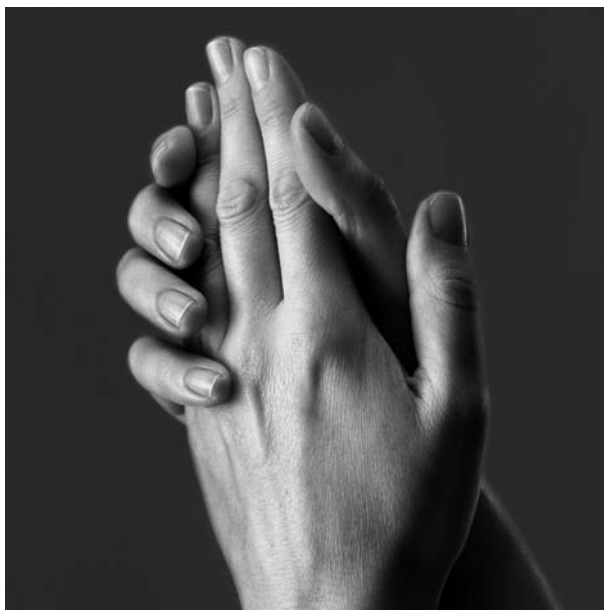




Multi-resistant *Staphylococcus aureus*  
– MRSA

**Clinical importance, pathogenic profile,  
hygiene management**

# Background



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Methicillin-resistant *Staphylococcus aureus* (MRSA) poses an increasing challenge to the infection control community due to several reasons: the spread of nosocomial multi-resistant strains and the emergence of less resistant PVL-positive strains in the community which will eventually also affect hospitalised patients. The major problem of nosocomial MRSA is the restriction of therapeutic options – the major problem of community-acquired MRSA the increased invasiveness. Any preventable infection triggered by MRSA causes unnecessary, potentially severe personal suffering and increases treatment costs dramatically.

Hence, whenever possible the transfer of these emerging pathogens in healthcare facilities should be avoided. But what is necessary to control the spread of MRSA?

Appropriate hand hygiene using alcohol-based hand rubs is probably the most important measure to control the spread of MRSA. Any initiative to improve compliance with hand hygiene practices will also help reduce the transmission of MRSA between patients and consequently the incidence of MRSA infection in hospitals. And – as outlined in this brochure – there are many other measures that can contribute to control the spread of MRSA.

Less transmission of MRSA in hospitals will help preserve the valuable antibiotics for a little bit longer – antibiotics that are desperately needed for all the unpreventable bacterial infections. With efficient infection control strategies all of us can have a share in maintaining antibiotics as long as possible. In this respect MRSA is a good example.

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# MRSA – on the rise

The prevalence of infections with antibiotic-resistant microorganisms in healthcare facilities is assuming alarming proportions worldwide. MRSA, short for methicillin- or multi-resistant *Staphylococcus aureus*, plays the most important role.

The Scottish surgeon Sir Alexander Ogden was the first to prove the link between pyogenic infections and a certain bacterium he identified as *Staphylococcus aureus*. But at that time, in 1880, he could not foresee the worldwide risk that once would emanate from this spherical, gram-positive bacterium.

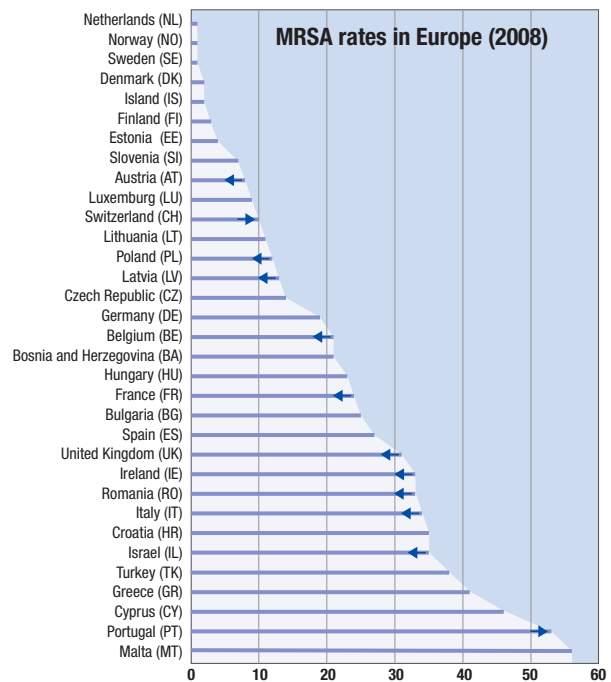
### Rates of more than 60 %

But not only Europe is concerned: today, a good 125 years after its discovery by the Aberdeen physician, MRSA is the most common elicitor of pyogenic infection in- and outside the hospital and the reason why the World Health Organisation (WHO) talks about a global health crisis.

#### Literature

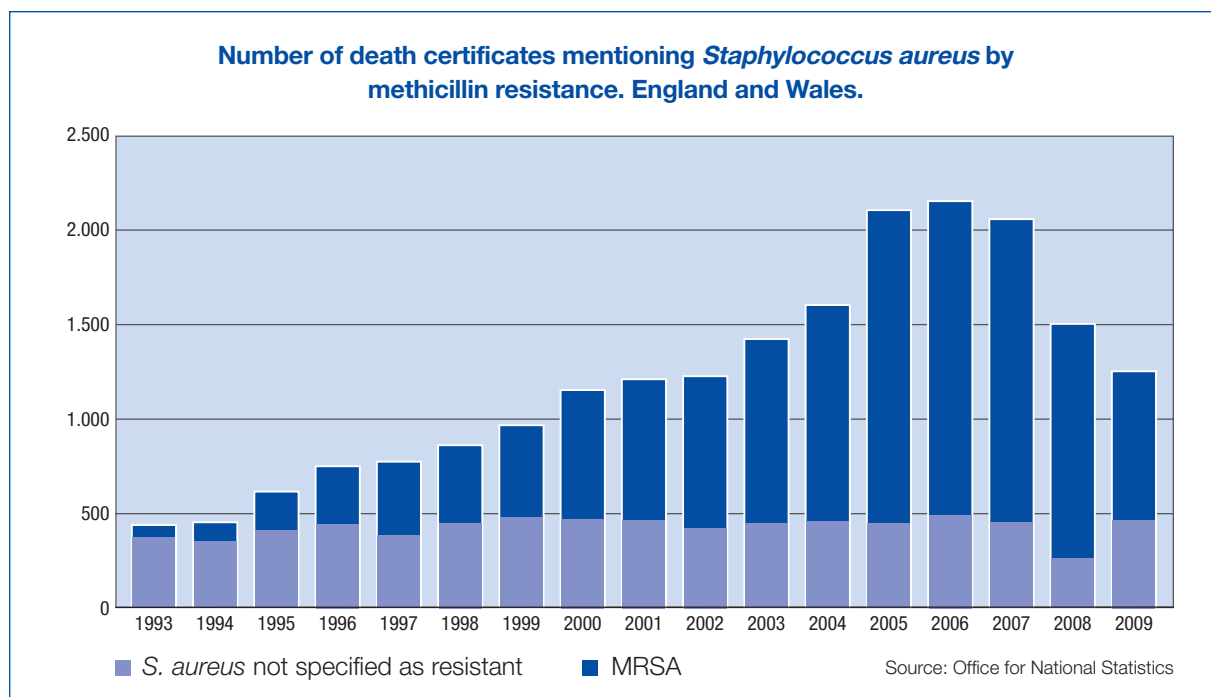
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MRSA proportions of countries reporting to EARSS. Arrows indicate significant trends.

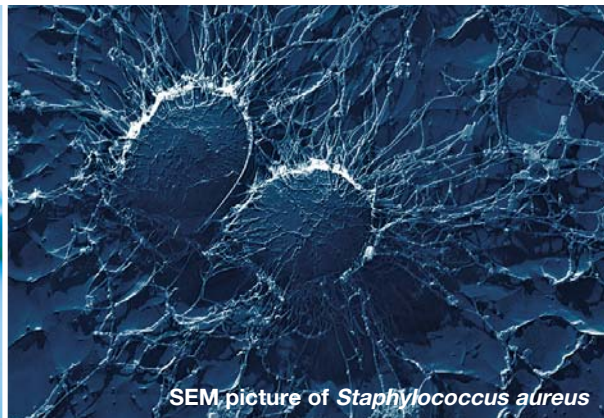
Source: EARSS Annual Report 2008



Source: Office for National Statistics



# Economic Consequences



SEM picture of *Staphylococcus aureus*

## Excessive costs and potential savings

**Hospital-acquired infection (HAI) including MRSA is linked to organisational efforts and is very staff-intensive. Moreover, HAI costs the UK health service around £ 1 billion per year.**

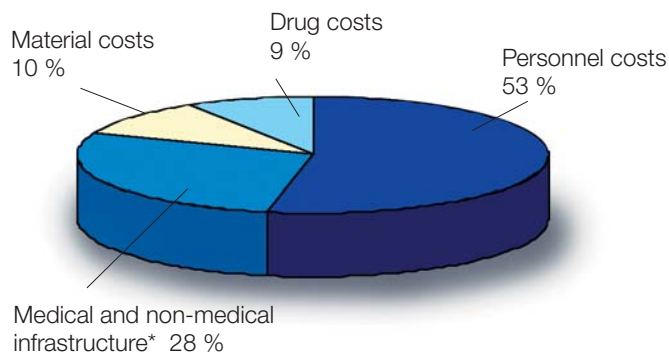
A variety of attempts have been made to document the excessive costs associated with MRSA. But separating the true costs of MRSA infection and the costs of the actual interventions to control and prevent MRSA from the consequences of colonisation and infection is very difficult. However, the trend is clear: Compared with MSSA (methicillin-susceptible *S. aureus*) the expenses for MRSA infection are approximately twice as high.

Even a MRSA colonisation alone increases costs due to the additional measures that have to be taken. In case a MRSA infection occurs these costs quickly rise three and a half times and higher. Essential cost drivers are:

- Prolonged hospital stays
- Additional surgeries
- Stays on intensive care unit
- Additional diagnostics, e.g. x-ray and computer tomography
- Systemic antibiotic therapies
- Additional pharmaceuticals

Each HAI infection – this includes MRSA infection – costs between £4,000 and £10,000.

So, HAI considerably impacts on a hospital's financial position. Under Payment by Results (PbR), the defined tariff will not take account of additional costs incurred by the treatment of HAI, including MRSA. This means, if a hospital has 40 cases of MRSA bacteraemia per year, these will incur additional costs of between £160,000 and £400,000 in excess of tariff



*A good portion of the expenses for MRSA infection is spent for personnel and infrastructures.*

Source: Wilke MH, Fink C, Maerz A, Resch A., Berlin, 2007

\* Costs of medical infrastructure: e.g., for central bed unit, medical typing. Costs of non-medical infrastructure: e.g., for power and water supply, cleaning services.

income. This of course does not take other HAIs into account – this figure could quickly increase tenfold.

### Major savings

In order to reduce MRSA, one of England's largest NHS foundation trusts – Guy's and St. Thomas' – implemented a trust-wide infection control programme: It updated its infection control policies and monitored compliance through audit, feedback and performance management.

Although the number of patients admitted with MRSA rose from around 40 % in 2003 to around 70 % in 2005, the trust very successfully decreased the num-



ber of patients acquiring MRSA at the trust, the number of patients giving positive MRSA results from wound swabs and the MRSA bacteraemia rate – moving from having one of the worst MRSA bacteraemia rates for specialist trusts to one of the best.

But what is more:

The reduction of MRSA infections from 2003 to 2006 resulted in the following annual savings:

- Prevention of 100 bacteraemias and 360 surgical site infections
- Savings of approx. 4,000 bed days and £1.4 million in hospital costs

## Glossary

### ■ Antibiotic resistance

Ability to withstand the effect of certain antibiotics. The serum levels reached by the patients do not suffice to kill the pathogen. Bacteria apply different strategies to inactivate antibiotics.

### ■ cMRSA

MRSA that is called community-acquired due to a missing link to medical facilities. cMRSA can trigger skin and soft tissue infections without a route of entry (intact skin).

### ■ Compliance

In general, compliance describes the adherence to regulations, recommendations or rules of action. In connection with hand disinfection, compliance comprises two aspects: Performing hand disinfection when indicated and using the correct rub-in method.

### ■ Device-associated care

Patient care using devices, such as catheters, probes, ventilation tubes. The associated routes of entry increase the risk of pathogens reaching the patient's body and eliciting infections.

### ■ MRSA/ORSA

Multi-resistant *Staphylococcus aureus* strains: Originally, 'MRSA' means methicillin-resistant *S. aureus*. Methicillin was the first penicillinase-resistant staphylococci penicillin and was replaced by Oxacillin (ORSA) later on. MRSA became increasingly resistant to other antibiotic classes, too. Hence, the term is primarily used for multi-resistant *S. aureus* today.

### ■ MRSA bacteraemia

Bacteraemia occurs when bacteria get into the bloodstream. Bloodstream infection is also sometimes called septicaemia, which implies greater severity/clinical significance. A wide variety of bacteria can cause bacteraemias, the two most common being *Staphylococcus aureus* and *Escherichia coli*.

### ■ MRSA colonisation

After the colonisation, MRSA proliferates in different body areas without eliciting symptoms or immune reactions.

### ■ MRSA infection

After entering the body, MRSA divides and proliferates. The infection manifests itself for example through fever and pus formation or other clinical signs of infection.

### ■ MSSA

Methicillin-susceptible or -sensitive *Staphylococcus aureus* strains.

### ■ Nosocomial infection

Following a definition of the Centers for Disease Control and Prevention (CDC), patients suffer from a nosocomial infection, when they do not show any visible indication of infection at the moment of hospital admission, but 48 hours later, and when the incubation period does not clearly indicate that this infection was not obtained during hospital stay.

### ■ PbR (Payment by Results)

New funding system for the NHS in England. Payment will be linked to activity and adjusted for case mix. The implementation of this system began in 2003/2004.

### ■ PVL (Panton-Valentin leukocidin)

PVL is a toxin which is produced by certain strains of MRSA or MSSA. It is not a variation of MRSA and can be produced by both methicillin-resistant *S. aureus* (MRSA) and methicillin-susceptible *S. aureus* (MSSA). PVL-producing MRSA is more virulent than other types of MRSA, it can cause more serious infections, e.g. necrotising pneumonia.

### ■ Screening

Examination involving swabs taken from the anterior nares, the throat, skin lesions and other (clinically suspicious) sites.

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Going further faster:  
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# Pathogenic Profile

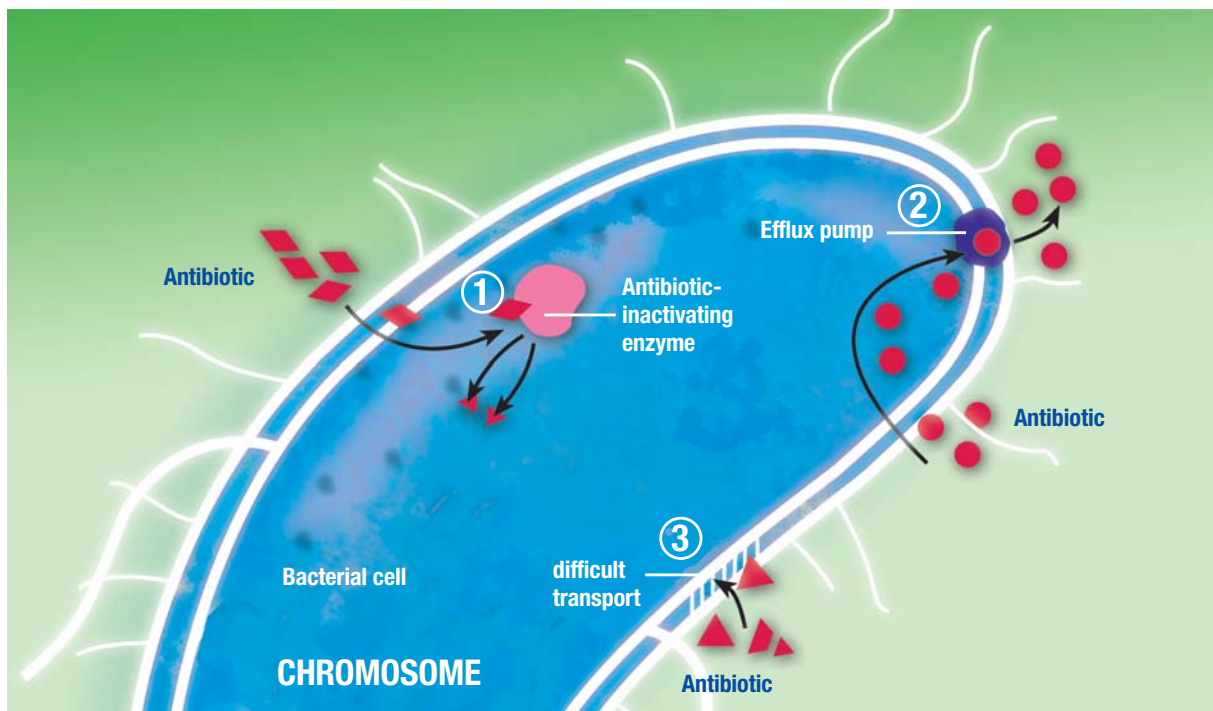
## Resistance mechanisms

**Inappropriate use of antibiotics has gradually increased the resistance of *Staphylococcus aureus*. Meanwhile the bacteria react to the antibiotics using a variety of strategies.**

Inappropriate or excessive antibiotic therapies set off *S.aureus* resistance. Experts estimate that approximately one third of all hospitalised patients receive antibiotics and that some of these are unnecessary.

The common practice of antibiotic therapy and prophylaxis results in so-called selection pressure. Frequently prescribed broad-spectrum antibiotics modify the patient's normal flora, which then cannot sufficiently compete against the resistant *S. aureus* strains. Only the most robust, antibiotic-resistant

bacteria survive and pass their resistances on as genetic information that is stored in the genes (DNA). These resistance genes cannot only be found in chromosomal DNA, but also in so-called plasmids – a small ring-like fragment of DNA, which can be exchanged between different bacteria species relatively easily and quickly. This gene transfer can cause a transmission of resistances. The plasmids act as a genetic information pool and jump back and forth between the individual isolates of *S. aureus* and also other species – antibiotic resistance spreads.



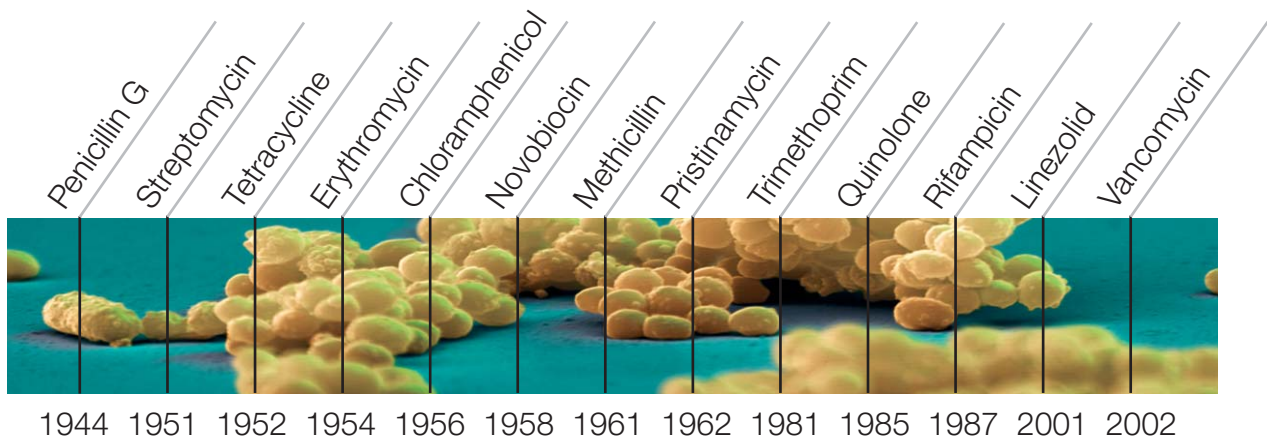
### Resistance mechanisms

Bacteria develop different strategies for warding antibiotics off:

1. An enzyme (penicillinase) decomposes the antibiotic and thus destroys it.
2. A membrane pump of the bacterium is altered so that the antibiotic can be channelled out immediately.
3. Modifications in the cell wall considerably impede the transport of the antibiotic inside the bacterium.



## Development of *S. aureus* resistances



Source: Janata O. Staphylokokken – heute ein Problem? Wien, 2005, Antibiotika Monitor XXI, 6/2005: 121-123.

### Multiple resistance mechanisms

The development of resistances is by no means a new phenomenon. When Sir Alexander Fleming heralded the era of antibiotics by discovering penicillin in 1928, he already knew that penicillin could not cure all diseases and that there was the risk that bacteria could develop resistance to this drug.

As early as 1944, the first resistance to penicillin developed. *Staphylococcus aureus* indeed was the first bacterium that was killed by the new drug, but it was also the first pathogen that successfully defended itself against the drug. And already Fleming described its strategy: The staphylococci formed an enzyme – the penicillinase – which decomposed the penicillin ring of the antibiotic. Without this ring the antibiotic is ineffective.

*Staphylococcus aureus* that take action against beta-lactam antibiotics with the beta-lactamase enzyme use the same principle, which is the most known of three resistance mechanisms resulting in the so-called methicillin-resistance.

### Methicillin- and multi-resistance

Conventionally, the abbreviation 'MRSA' stands for methicillin-resistant *Staphylococcus aureus*; by definition it stands for a resistance to all antibiotics with beta-lactam structure, for example penicillins, cephalosporins, carbapenems and monobactams. Where the resistance includes different additional antibiotic classes one speaks about multi-resistance. As most MRSA in the meanwhile are resistant to up to 20 different antibiotics, multi- and methicillin-resistance are used synonymously. In many cases glycopeptides such as vancomycin are the only effective therapeutic agents – but also here resistance has already emerged.

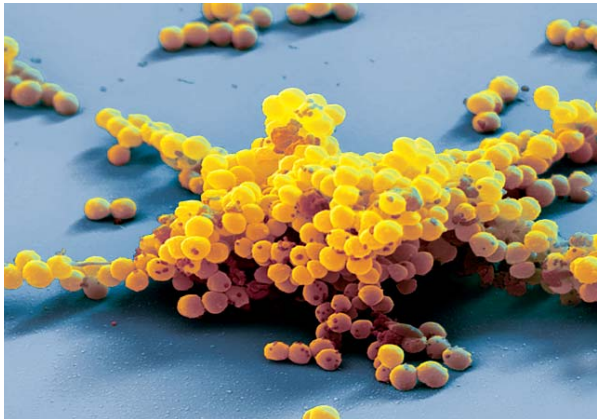
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# Pathogenic Profile



## Manifold clinical outcomes

**Among all staphylococci *Staphylococcus aureus* possesses the strongest pathogenicity. Hence, this bacterium is a very persistent enemy that causes diseases with manifold clinical outcomes.**

The pathogenic characteristics of resistant *Staphylococcus aureus* do not differ from the ones of antibiotic-susceptible *S. aureus*. However, a recent meta-analysis on bacteraemias showed that the risk of dying from a MRSA sepsis is 42 percent higher in comparison to a sepsis with susceptible *Staphylococcus aureus* strains. Diseases triggered by *S. aureus* are divided into pyogenic, invasive infections and diseases caused by toxins.

### ■ Pyogenic, invasive infection

Pyogenic, invasive infection (inflammation with pus formation) can occur as local (superficial), deep and systematic infection. In the majority of cases, local infections affect the skin and its adnexa, for example in the form of furuncles, carbuncles and abscesses. Deep infections include acute parotitis (inflammation of the parotid gland) and osteomyelitis (bacterial inflammation of bone) of exogenous or hematogenic origin. Emanating from a local infection *S. aureus* can colonise other organ systems and cause empyema. If the bacteria pass into the bloodstream, there is the risk of endocarditis (inflammation of the inner layer of the heart) or life-threatening sepsis.

### ■ Toxin-mediated diseases

*S. aureus* strains can form certain cytotoxins, the exfoliative toxins A and B (ETA and ETB). The toxins result in so-called staphylococcal scalded skin syndrome (SSSS) and staphylococcal toxic epidermal necrolysis (TEN) respectively. SSSS can occur locally or systemically: widespread erythemas with epidermal peeling develop. This syndrome predominantly affects infants and adults over 80 years.

Toxic shock syndrome (TSS) is a life-threatening infection that can result in multiple organ failure. For a diagnosis of TSS three or more of the following organ systems have to be involved: gastrointestinal tract (vomiting, nausea or diarrhoea), muscular system (strong myalgias), mucous membranes (hyperaemia), kidneys (increase of urea or creatinine in the serum), liver (e.g., increase of transaminases), CNS (disorientation, impaired consciousness).

### PVL-induced skin and soft-tissue infections

cMRSA (community acquired MRSA) is particularly dangerous. It forms the Pantone-Valentine leukocidin (PVL) toxin. Although there is no evidence that PVL-producing MRSA is more virulent than other types of MRSA it can cause more serious infections and usually affects previously healthy young children and young adults. PVL generates pores in the membrane of white blood cells which are part of the immune system defending the body and thus causes the release of inflammation messengers. The clinical picture is a deep, recurrent and necrotising skin and soft-tissue infection, which can be life-threatening, for example by resulting in necrotising pneumonia. The Health Protection Agency (HPA) is aware of 7 deaths related to this organism in England and Wales in 2005 and 2006.

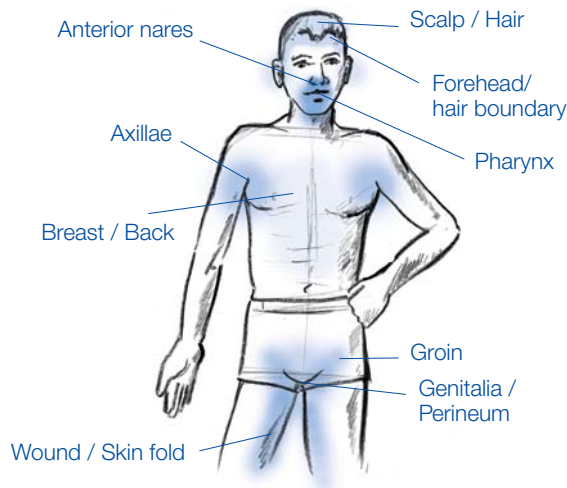
### Food intoxications

Food intoxications caused by *S. aureus* are elicited by the intake of enterotoxin. After the contamination of food the staphylococci must proliferate. As *S. aureus* enterotoxin is highly heat-resistant, it is not killed during food preparation.



## The human as reservoir

Today, *Staphylococcus aureus* is not only one, but the most common elicitor of pyogenic infection. Independent from antibiotic-sensitivity or –resistance, one of its natural reservoirs is the human.



*S. aureus* particularly colonises the anterior nares. Approximately 60 percent of all individuals in the developed countries are colonised occasionally by the bacterium, about 20 percent are colonised permanently and 20 percent never.

### Risk area ICU

The MRSA colonisation itself does not possess a harmful character – but vulnerable patients, particularly those in intensive care units (ICUs), might be at risk of getting a MRSA infection. It has been known for a long time that a weak immune system, continuous use of antibiotics and invasive therapies promote the spread of antibiotic-resistant pathogens. Intensive device-associated care, e.g. central venous catheters (CVC), mechanical ventilation and urinary catheters, provides pathogens with routes of entry. In addition, the numerous necessary contacts with the employees' hands increase the risk of spreading microorganisms.

Hence, it is no wonder that MRSA prevalence rates are high on ICUs: in 27 out of 30 countries reporting data to EARSS the 2006 MRSA proportions in ICU were higher than the overall MRSA proportions, in thirteen countries this difference was significant, including UK. In some countries – Croatia, Greece, Ireland, Malta and Turkey – the proportion of MRSA found among ICU patients was even over 60%.

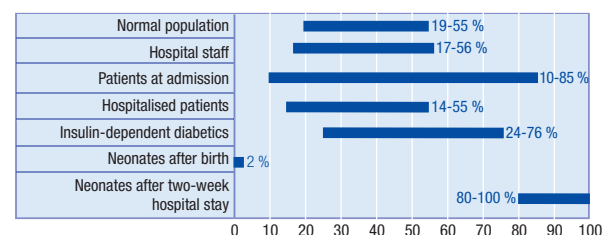
### Risk factor antibiosis

Broad spectrum antibiotics and drug classes that are not effective play a decisive role in the spread of MRSA. Current or past systemic antibiotic therapy creates one of the most important risk factors for susceptibility to MRSA. The authors of a study with 12,072 newly admitted patients identified the following 9 independent risk factors:

- Male gender
- Age > 75 years
- Fluoroquinolones within the past 6 months
- Cephalosporins within the past 6 months
- Carbapenems within the past 6 months
- Hospital stay within the past 12 months
- IV therapy within the past 12 months
- Urinary drainage at hospital admission
- Transfer within the hospital

Affected patients can be colonised by MRSA for a longer time and repeatedly. The medical personnel can also be colonised. The normal flora of healthy people usually protects against a colonisation. The MRSA rate among medical personnel can increase during outbreaks and is dependent on the characteristics of the individual MRSA isolates.

### *S. aureus*-colonisation rates



Source: Kappstein I. Prävention von MRSA-Übertragungen. Krankenhaushygiene up to date, Georg Thieme Verlag, Stuttgart, 2006, 1: 9-20.

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# Transmission Paths

## Most important origins of infection

***Staphylococcus aureus* is extremely resistant to environmental impacts and can survive for a long time – even on inanimate surfaces. So, the medical personnel's hands play a major role.**

Among all staphylococci, *S. aureus* not only possesses the strongest pathogenicity, it is also characterized by a particular durability:

*S. aureus*

- grows in nearly all simple culture media at temperatures between 18 °C and 40 °C – best at temperatures between 30 °C and 37 °C
- can persist on inanimate surfaces (e.g. bedside tables, doorknobs, etc.) for up to 7 months
- survives contact with up to 10 percent NaCl solution
- survives in dust and can be passed on from there
- dies only after 1 hour in dry heat at a temperature of 80 °C
- is able to survive in ice for 66 days
- possesses an affinity to hydrophobic materials such as synthetics and stainless steel

### Transmission paths

MRSA colonisation alone does not have a clinical significance. Normally, *Staphylococcus aureus* needs routes of entry to trigger an infection. In this connection, the bacteria are relocated from the patient's colonised skin or mucous membrane to usually microorganism-free body areas or to wounds. MRSA can be transmitted endogenously (patient-own flora) or exogenously by employees, inanimate surfaces or other patients.

#### ■ Endogenous patient flora

The nose is a common origin of infection – in fact via the patients themselves. This self-infection can occur surreptitiously e.g. by touching the nose, or more directly via a wound or catheter insertion.

#### ■ Hands

Transmission of microorganisms from patient to patient is relatively rare, but the hands of the medical staff play a decisive role in spreading MRSA – they can become contaminated when they come into contact with nasopharynx/secretions or colonised/infected wounds. If the hands are not disinfected, e.g. when leaving the room, it is possible that MRSA is passed on to other patients.

#### ■ Inanimate surfaces

Its high survivability of up to 7 months suggests that MRSA is also transmitted through contaminated objects. It has been shown, for instance, that MRSA remains capable of surviving on a sterile package for more than 38 weeks. And hands can be contaminated over and over by inanimate surfaces: A study demonstrated that during one single direct contact between hand and inanimate surface approximately 4 to 16 percent of the hand touches the surface – after 12 contacts even around 40 percent.

#### ■ Airborne

In principle, airborne transmission of MRSA is possible, e.g. through large droplets in case of very close contact. But it only plays a minor role. Airborne transmission can rarely be clearly identified as transmission path, because direct or indirect contact (staff, contaminated objects) during patient care cannot be ruled out completely.

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# Basic Hygiene

## The measure of choice

**Adherence to basic hygiene is of major importance in MRSA prevention. In particular, correct hand disinfection is the most effective measure to prevent transmission.**

### ■ Hand disinfection

Hygienic hand disinfection is generally carried out when entering a patient room, when moving from a contaminated to a clean body site, after removing disposable gloves and before leaving the patient room. Also visitors should be informed of accurately performing hand disinfection after leaving the patient room.

### ■ Disposable gloves

Disposable gloves serve as protection against contaminated materials, objects, devices and instruments. They are to be donned while entering the patient room after having performed hygienic hand disinfection. After glove removal in the room, the hands are always disinfected.

To prevent a contamination there are additional measures that have to be carried out when entering the room of a MRSA colonised/infected patient. If applicable, these have to be explained to staff from other wards.

### ■ Protective gowns

When entering the patient room a protective gown is put on and closed at the back. Disposable gowns are thrown into the hospital trash. Reusable gowns (one per patient) remain in the room and are disposed in a closed laundry bag after shift.

### ■ Mouth/nose protection

Donning a mouth/nose protection when entering the patient room keeps medical and caregiving personnel from becoming colonised by MRSA. The mouth/nose protection is thrown into the hospital trash before leaving the room. In residential and nursing homes mouth/nose protections are always necessary, when there is a risk of contamination via aerosols – e.g. when suctioning tracheostomies.

### ■ Surface disinfection

MRSA and MSSA can remain infectious on inanimate surfaces for up to 7 months. Hence, in case of MRSA, the Robert Koch-Institute recommends

- disinfecting surfaces (wipe disinfection) close to patients (bedframes, bedside tables, wet areas, doorknobs, etc.). If necessary, surface disinfection is to be extended to additional surfaces that are at risk of contamination.
- disinfecting surfaces of all contact areas of devices used on the patient (e.g. ultrasound heads, ECG electrodes and cables) – after each use and before removal from room.
- dedicating stethoscopes, thermometers and the like for use by only one patient and disinfecting them immediately after use.

## Basic hygiene





# Hand Disinfection

## The key factor

**It is generally accepted that hand disinfection is the most important preventive measure, even against antibiotic-resistant microorganisms. However, hand disinfection remains a challenge, as compliance rates average only 40%.**

Hygienic hand disinfection is a key factor in preventing nosocomial infection – also with MRSA. Experts estimate that up to 90 percent of all hospital-acquired infections are transmitted by hands. One third of these is considered to be avoidable. This fact is sufficiently known. Nevertheless, only one in two indicated hand disinfections is carried out.

As an essential part of standard hygiene, it is vital to perform hand disinfection before and after each direct patient contact.

This means in detail:

- when entering the patient room
- after handling blood and body fluids and items contaminated with blood and body fluids
- prior to aseptic technique
- before donning and after removing protective clothing/gloves
- before handling invasive devices
- prior to and following bed making
- before handling food
- before leaving the patient room

### Efficacy in case of MRSA

Hand disinfectants that possess a proven bactericidal activity in accordance with the European standards should be used to reliably inactivate MRSA.

But besides using an effective product when indicated, this product should also be used properly. Gaps in coverage have to be avoided by paying particular attention to fingertips, nail folds and the thumbs.

In addition, the basic principles of hand hygiene should be followed: Well-groomed hands (regular moisturising), short, clean, polish-free natural nails and no jewellery including wedding ring and watch.

### Training promotes compliance

Studies have shown that compliance with hand disinfection increases in case of a MRSA outbreak. As it is important to prevent a spread of pathogens before the occurrence of outbreaks, raising the compliance

rate is of major importance in hand hygiene. In this connection, staff training is a crucial measure. But also skin compatibility plays a major role: Hand disinfectants applied should possess a good skin tolerability to support compliance.

Better accessibility of hand disinfectants through good availability of disinfectant dispensers or by providing employees with pocket bottles also results in an increase in compliance with hand disinfection – and a decrease in the rate of nosocomial infection.

### Typical weak points

Knowing typical weak points of hand disinfection is a vital aspect of compliance: non-compliance is higher when employees wear gowns and gloves, perform activities with increased risk of cross contamination and when they are entrusted with tasks that require frequent hand disinfection during patient care. All these facts apply to the care of MRSA colonised/infected patients.

And there is an additional aspect when caring for MRSA carriers: The unconscious hand-face contact. As MRSA often colonises the anterior nares, employees, who unconsciously touch their face with the contaminated hand, are at risk of being colonised or transmitting MRSA. In addition to hand disinfection, the mouth/nose protection is therefore a reasonable barrier.

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# Screening

## Identifying at risk patients

**In addition to basic hygiene, so-called screening can help define adequate risk-related measures to prevent the spread of MRSA in medical facilities.**

Screening serves as early identification of patients who are colonized with MRSA either before or on admission. This swab test is not a control measure in itself. Hence, its results need to be linked to a targeted approach to the appropriate measures (see pages 14 and 15).

### Patient screening

Experts have repeatedly called for widespread MRSA screening to reduce the high MRSA rates in hospitals, but whether endemic MRSA can be reduced through universal screenings remains subject to great controversy.

As the local epidemiology of MRSA greatly differs from one healthcare facility to the next, the fine detail regarding which patients are screened should be determined by the infection control team and needs to be discussed with the clinical teams and endorsed by the hospital management. However, certain high-risk patients should be screened routinely, this includes those who are:

- known to have been infected or colonised with MRSA in the past
- frequent re-admissions to any healthcare facility
- recent inpatients at hospitals abroad or hospitals in the UK which are known or likely to have a high prevalence of MRSA, and
- residents of residential care facilities where there is a known or likely high prevalence of MRSA carriage.

In addition, patients on certain high-risk units – including intensive care, neonatal intensive care, burns, transplantation, cardiothoracic, orthopaedic, trauma,

vascular surgery, renal, regional, national and international referral centres – may be screened at least intermittently as the patients on these units are often seriously ill and particularly susceptible to an MRSA infection.

When screening patients without clinical signs of infection, the following sites should be considered for sampling: anterior nares and throat, groin, perineum, wounds, catheter insertion sites, and tracheostomy.

### Staff screening

In terms of type and extent, screening of staff should be aligned with already established patient screening policies. However, as a general rule it should be carried out in outbreak situations. In these cases it may be advantageous to limit the group of employees to be screened, e.g. to persons with allergies, skin or respiratory diseases. Appropriate sampling sites for staff screening are: anterior nares, throat and any areas of abnormal or broken skin.

#### Literature

Coia JE, Duckwoth GJ, Edwards DJ et al. Guidelines for the control and prevention of methicillin-resistant *Staphylococcus aureus* (MRSA) in healthcare facilities. *J Hosp Infect* 2006; 63S:1-44

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# MRSA Hygiene Management

## Decolonisation

**A decrease of MRSA carriage can reduce the risk of transmission in healthcare settings and of inoculation to the patient's own surgical wound during surgery. The so-called decolonisation mainly refers to the use of topical agents.**

MRSA colonisation increases the risk of spread and infection. To suppress MRSA carriage a decolonisation regimen should be carried out – under the advice and supervision of the hospital infection control team. The Guidelines for the Control and Prevention of MRSA in Healthcare Facilities recommend the following approach:

### ■ Nasal decolonisation

In an outbreak situation and as prophylaxis for an operative procedure, patients should undergo nasal decolonisation by applying a nasal ointment (mupirocin 2 %) to the anterior nares three times daily for five days. Mupirocin should not be used for prolonged periods or repeatedly as this might encourage resistance.

### ■ Oral hygiene

Systemic treatment of throat carriage should only be considered in exceptional circumstances, e.g. when there is evidence for a transmission from a throat carrier, and if required, be restricted to one course.

For oral hygiene single-use toothbrushes and antiseptic mouth rinses are recommended. The tooth mug should be disinfected daily.

### ■ Skin decolonisation

Colonised patients should be decolonised daily for five days with an antiseptic detergent. After moistening hair and skin the antiseptic body wash is thoroughly applied to all areas including hair. In doing so, special attention has to be paid to known carriage sites, for example the axilla, groin and perineal area. Afterwards the detergent is rinsed off. The antiseptic body wash should be also used for bed bathing of immobile patients.

To prevent re-colonisation clean clothing, bedding and towels should be provided after each bath and hair wash. Any further equipment for personal use, e.g. comb, glasses, drinking vessel, should be replaced or disinfected in the meantime while the patient is decolonised.

Skin decolonisation with an antiseptic body wash/shampoo is useful in eradicating or suppressing skin colonisation for short times.

Wash lotions that possess good skin tolerability even with long-term use and are effective within short exposure times, e.g. 30 seconds, increase the comfort for the patient and thus the willingness to carry out decolonising measures consistently.

**Decolonisation**

**Daily fresh bed linen**

**Nasal decolonisation**

**Single use or disinfected equipment for personal hygiene**

**Skin decolonisation including hair wash**

**Skin decolonisation immobile patient**



# Risk-related measures

**The proper management and placement of patients is one of the fundamentals of minimising the impact and potential transmission of any infectious condition, including MRSA.**

Based on the known routes and risks of transmission, hygiene experts and commissions develop concepts for the prevention and decolonisation of MRSA in hospitals and other healthcare settings. In addition to basic hygiene (see page 11), the following procedures are recommended in case MRSA screening results are positive:

## ■ Duty of notification

In case vancomycin-intermediate and -resistant *S. aureus* (VISA and VRSA) are identified, the relevant national surveillance organisation, e.g. Health Protection Agency (HPA) in England and Wales, should be notified. In addition, all cases of MRSA bacteraemia need to be reported to the HPA as part of Mandatory Surveillance directed by the Department of Health.

## ■ Single-room/cohort isolation

Patient isolation for those infected or colonised depends on the facilities available and the associated level of risk. The most effective form of isolation is a single-room and should be the first choice of placement. However, rooms, bays and areas used for isolated patients should have dedicated hand hygiene and toileting facilities.

## ■ Cleaning and decontamination

Management of the patient environment and equipment (occupied facility and after discharge of the patient) is important in minimising the risk of spread.

- Equipment should preferably be single-patient use. Multiple-patient use items must be decontaminated before use on another patient.
- All waste should be categorised as hazardous waste and disposed according to local policy.
- All linen, including bedding and adjacent curtain, should be treated as infected in line with hospital policy.

## ■ Patient movement

Transfer and movement should be kept to a minimum to reduce the risk of infection spreading. If a transfer is necessary, the following should be observed:

- The receiving area/facility must be informed so that effective infection control measures can be put into place.
- Hand hygiene and personal protective equipment (gloves, gown, etc.) procedures should be closely followed. Gloves and gowns should be disposed as clinical waste after contact with the patient.
- Lesions should be covered with an impermeable dressing.
- Equipment used to transport the patient (e.g., trolley, chair) should be decontaminated in accordance with local policy.
- Staff should decontaminate their hands thoroughly after dealing with the patient and cleaning the trolley or chair.

## ■ Surgical/invasive procedures

Prior to any planned invasive procedure, efforts should be made to decrease the risk of infection. Good infection control practices that should be in place between all patients should reduce the risk of cross-transmission.

## ■ Discharge

Generally, MRSA-colonised patients do not need to continue with extended eradication protocols after discharge. However, patients, their relatives and carers should be fully informed about MRSA.

### Literature

Coia JE, Duckwoth GJ, Edwards DJ et al. Guidelines for the control and prevention of methicillin-resistant *Staphylococcus aureus* (MRSA) in healthcare facilities. *J Hosp Infect* 2006; 63S:1-44

The Health Act 2006: Code of Practice for the Prevention and Control of Healthcare Associated Infections. Revised January 2008. Department of Health. Available at: [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_081927](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_081927). Accessed on June 21, 2008.

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# MRSA Hygiene Management

## Care plan immobile patient

Who	When	With what	Please notice	What
Nursing staff	Before entering patient room	Sterillium® Sterillium® Gel	30 sec exposure time, hygienic hand disinfection.	<b>Basic hygiene</b>
Nursing staff	As ordered			<b>Swabs</b>
Nursing staff			Cover wound with impermeable dressing.	<b>Change of dressing, if applicable</b>
Nursing staff / Patient	Daily		Ensure that enough single-use toothbrushes are available. Disinfect tooth mug.	<b>Oral hygiene</b>
Nursing staff / Patient	Daily for five days in line with decolonisation	Stellisept® med foam Stellisept® med tissues	Dispose hospital linen in laundry bag. Apply foam on dry single-use washcloth or use ready made soaked tissues. Thoroughly spread on respective body part. No rinsing required, let product dry naturally.  In case rinsing with wet cloth is desired the exposure time of minimum 60 seconds must be adhered to.	<b>Antiseptic whole-body wash</b>
Nursing staff	Daily		Leave unused bedding in room.	<b>Change of bedding Part I</b>
Nursing staff	Daily	Stellisept® med foam Stellisept® med tissues	Leave-on products! No washing up, please let air dry.	<b>Continuation of whole-body wash</b>
Nursing staff	Daily	Sterillium® Sterillium® Gel	Leave unused bedding in room.  (30 sec) (30 sec)	<b>Change of bedding Part II</b>
Nursing staff	Daily			<b>Skin care, clean clothes, if applicable</b>
Staff	Daily		Don disposable gloves. Perform hygienic hand disinfection after removal and disposal.	<b>Change of dressing, if applicable</b>
Staff	3 times daily for 5 days in line with decolonisation	Mupirocin, in case of resistance alternative	Don disposable gloves. Perform hygienic hand disinfection after removal and disposal.	<b>Application of nasal ointment</b>
Nursing staff	Before leaving patient room	Sterillium® Sterillium® Gel	Observe 30 sec exposure time (hygienic hand disinfection).	<b>Basic hygiene before leaving the room</b>
Cleaning staff	Daily	Mikrobac® forte BODE X-Wipes	5ml/l – 0.5 % – 1h	<b>Disinfection of environment and floor near to patient</b>





## How

- Hygienic hand disinfection
- Don mouth/nose protection
- Don protective gown
- Don disposable gloves

Take necessary swabs (anterior nares, throat, skin lesions, wounds, sites, sputum in acc. with local policy).

Prior to whole-body wash in case of strong secretion.

Oral hygiene with single-use toothbrush and antiseptic mouth rinse.

Use clean washcloth after each step and in between to assure hair and skin is moistened throughout the whole wash procedure.

### 1. Step:

- Hair
- Place head on clean towel
- Forehead
- Face
- Closed eyes
- Ears
- Neck: front and sides

### 2. Step:

- Upper part of body, front
- Upper extremities
- Axillae
- Lower extremities, front
- Groin / Genitalia

### 3. Step:

- Turn patient to the side, use clean washcloth.
- Neck: nape and sides
  - Back
  - Flank facing staff
  - Lower extremities, back
  - Anal area

Beware! Area near eyes apply with care and make sure, no product gets into the eyes.

- Spread clean bed sheet, roll up lengthwise to centre and put on mattress
- Lay patient on the other side (over sheet role)
- Immediately dispose used bedding in laundry bag

### 4. Step:

- Don disposable gloves
- Use clean washcloth and wash flank

- Remove disposable gloves
- Perform hygienic hand disinfection
- Put clean pillow sheet on

After whole-body wash in case of dry, not infected wounds.

Apply ointment to both anterior nares with cotton swab.

- Remove disposable gloves and throw into trash
- Dispose mouth/nose protection
- Reusable gowns are left in the room and disposed in laundry bag after shift; dispose immediately, if visibly soiled
- Perform hygienic hand disinfection
- Remove disposable protective gown and dispose it



# MRSA Hygiene Management

## Care plan mobile patient

Who	When	With what	Please notice	What
Nursing staff	Before entering patient room	Sterillium® Sterillium® Gel	30 sec Exposure time, hygienic hand disinfection.	<b>Basic hygiene</b>
Nursing staff	As ordered			<b>Swabs</b>
Nursing staff	Daily	Mikrobac® forte Bacillo® AF	Immediately dispose bedding in laundry bag.  5 ml - 0.5% - 1 h Conc. - 30 sec	<ul style="list-style-type: none"> <li>■ <b>Change bedding</b></li> <li>■ <b>Disinfection of mattress cover</b></li> <li>■ <b>Disinfection of furniture and contact surfaces</b></li> </ul>
Nursing staff / Patient	Daily	Bacillo® AF Bacillo® Tissues Mikrobac® Tissues	Use single-use materials, e.g. toothbrush, comb, nailbrush.  Conc. - 30 sec Conc. - 30 sec Conc. - 60 sec	<b>Disinfection of personal objects of patient.</b>  <b>Afterwards: discard disposable gloves and perform hand disinfection.</b>
Nursing staff	Daily		Leave unused bedding in room.	<b>Put on clean bed sheets</b>
Nursing staff	When necessary		Cover wound with impermeable dressing.	<b>Change of dressing, if applicable</b>
Nursing staff	Daily		Ensure that enough single-use toothbrushes are available. Disinfect tooth mug.	<b>Oral hygiene</b>
Nursing staff / Patient	Daily for five days in line with decolonisation	Stellisept® med	<ul style="list-style-type: none"> <li>■ Dispose hospital linen in laundry bag</li> <li>■ Use single-use washcloth</li> <li>■ Exposure time: at least 30 sec</li> </ul>	<b>Antiseptic whole-body wash</b>
Patient	Daily			<b>Skin care, clean clothes, if applicable</b>
Staff	Daily		Don disposable gloves. Perform hygienic hand disinfection after removal and disposal.	<b>Change of dressing, if applicable</b>
Staff	3 times daily for 5 days in line with decolonisation	Mupirocin, in case of resistance alternative	Don disposable gloves. Perform hygienic hand disinfection after removal and disposal.	<b>Application of nasal ointment</b>
Nursing staff	Before leaving patient room	Sterillium® Sterillium® Gel	Observe 30 sec exposure time (hygienic hand disinfection).	<b>Basic hygiene before leaving the room</b>
Cleaning staff	Daily	Mikrobac® forte BODE X-Wipes	5 ml/l - 0.5% - 1h	<b>Disinfection of environment and floor near to patient</b>





## How

- Hygienic hand disinfection
- Don mouth/nose protection
- Don protective gown
- Don disposable gloves

Take necessary swabs (anterior nares, throat, skin lesions, wounds, sites, sputum in acc. with local policy).

- Strip off bedding

- Wipe disinfection

e.g. table, bedside table, bed-frame, chair surfaces, handles, doorknobs, handrails, light switches, trapeze bar

- Wipe disinfection

e.g. visual aids, hearing aid, jewellery, thermometer, hairbrush, hairdryer

Prior to whole-body wash in case of strong secretion.

Oral hygiene with single-use toothbrush and antiseptic mouth rinse.

- Shower: Wet hair and body, apply wash lotion to washcloth (switch off shower)

Order of washing:

- Hair
- Forehead, face, ears, neck
- Upper part of body, upper extremities, axillae
- Back
- Groin, genitalia, anal area

Wet clean washcloth and apply antiseptic detergent:

- Lower extremities
- Shower hair and body after exposure time

After whole-body wash in case of dry, not infected wounds.

Apply ointment to both anterior nares with cotton swab.

- Remove disposable gloves and throw into trash

- Dispose mouth/nose protection
- Remove disposable protective gown and dispose it

- Reusable gowns are left in the room and disposed in laundry bag after shift; dispose immediately, if visibly soiled

- Perform hygienic hand disinfection





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