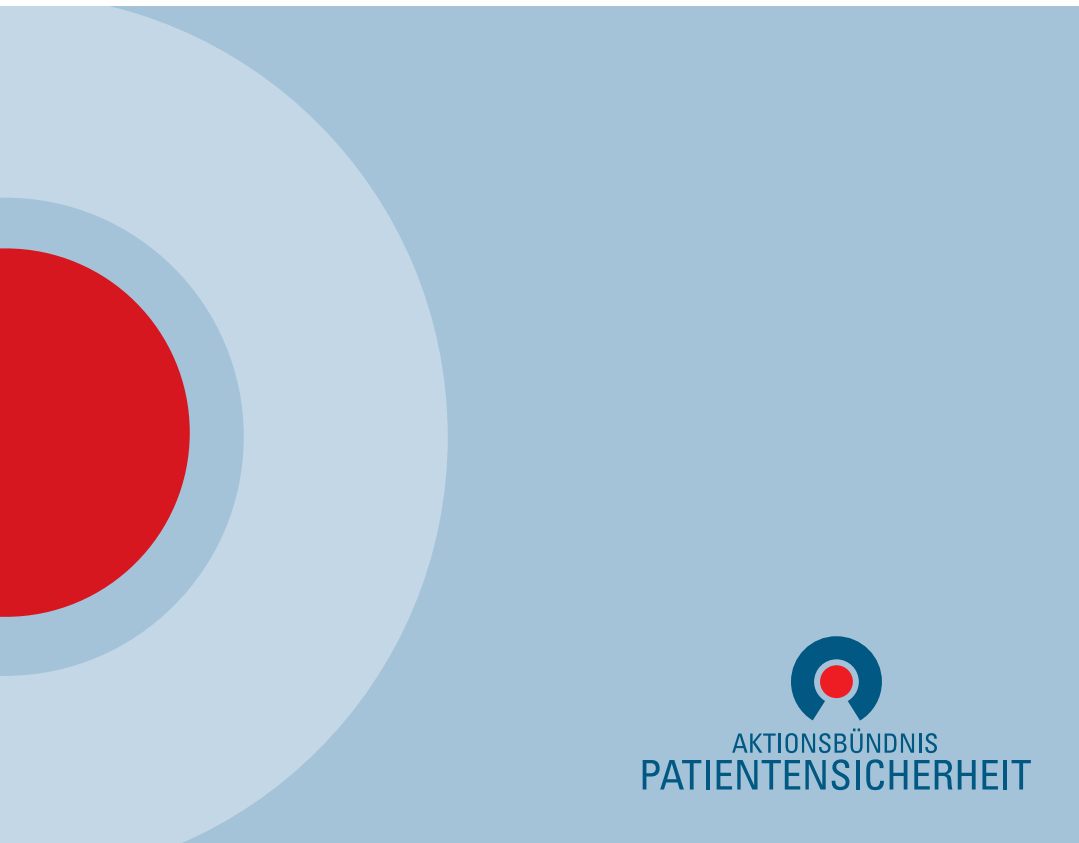




## Prevention of Hospital-Acquired and Multidrug-Resistant Infections



While there are many diverse patient-oriented education resources on multidrug-resistant germs (MDR-G), there is little information on hospital-acquired infections

- caused by susceptible or resistant germs
- that should be the focus of prevention approaches.

Based on recent research, this brochure gives you all the tips, information and background knowledge you need as a patient<sup>1</sup> or relative to help prevent hospital infections. Every year, an estimated 80,000 to 180,000 preventable infections occur in German hospitals, about 1,500 to 4,500 of which with fatal outcomes. While the bulk of the measures needed to prevent these infections are for the hospitals and doctors' surgeries to take, you and your relatives can effectively protect yourselves while staying at a hospital.

For the sake of medical and scientific accuracy, the authors of this brochure chose not to use very easy language. If you have any questions or there is something you do not understand, please feel free to contact the Geschäftsstelle des Aktionsbündnis Patientensicherheit. They will help you (contact data on the last page).

The authors thank Prof. Dr. Petra Gastmeier (Director of the National Reference Center (NRC) for Surveillance of Nosocomial Infections at the Institute for Hygiene and Environmental Medicine, Charité Universitätsmedizin Berlin, and initiator of the hand hygiene initiative "Aktion Saubere Hände") for her initiative that resulted in this brochure.

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<sup>1</sup> To enhance readability, the text only refers to patients, doctors, relatives, etc. as male. The female form is, of course, always subsumed.

## 1. What are hospital-acquired infections?

A hospital-acquired or nosocomial infection is an infection that was neither present nor incubating at the time of hospitalisation (i.e. the patient was not even infected).

Consequently, the only factor that makes an infection a hospital-acquired infection is timing, not any causal link to healthcare activities. In other words: it is called a hospital-acquired or healthcare-associated infection even if nobody has made a mistake, but the infection is temporally linked to the hospital stay.

In a broader sense, also infections that are linked to other points of care (doctor's surgery, rehabilitation clinic) are called hospital infections.

## 2. What causes hospital-acquired infections?

It is completely natural for the human skin and gut to be colonised by millions or even billions of bacteria. Most of them are perfectly harmless, indeed beneficial, for instance helping us maintain a healthy skin barrier or digest food. Problems only arise if they make their way to normally sterile body sites where they have no business being, such as the bloodstream, lungs, bladder or wounds. This leads to hospital infections such as sepsis, pneumonia, UTI or wound infections.

As diagnostic and therapeutic procedures become ever more sophisticated, they also become increasingly invasive, and catheters, probes and tubes more and more common. This gives germs easier access to normally sterile sites and the risk of hospital infection rises. Moreover, an increasing number of patients require immunosuppressive therapies that compromise the effectiveness of their body's immune system and so aid and abet the invasion by hospital infection bacteria.



Hospital infections can be distinguished as follows:

- Infections caused by the patient's own bacterial flora and/or by its movement from commonly colonised sites (such as skin, gut) to normally sterile sites (such as bloodstream, urinary tract, lower airways). These account for the majority of hospital acquired infections.
- Then there are hospital-acquired infections due germs spread from one patient to another (foreign microflora).
- While the latter group of hospital infections can and must always be prevented hospital infections that are caused by the

patient's own flora can only be prevented to a certain extent, e.g. by avoiding therapies that compromise the immune system, and most of all by critically scrutinising the need for devices such as venous lines or urinary catheters.

In Central Europe, hospital infections that are triggered by foreign flora account for some 10-30 per cent of the total number, allowing for a natural variation according to patient groups and care settings. In day-to-day hospital operation, these infections are hard to assign to either group, since it is not possible in most cases to reconstruct the infection chain and clearly identify the route of transmission.



### 3. What is the risk of getting a hospital-acquired infection?

About three to five in 100 patients get a hospital acquired infection during their hospital stay.

The risk is particularly high at ICUs, because of the large number of invasive diagnostic and treatment procedures carried out there and because patients with tumours often get immunosuppressive therapy as a part of their treatment. Another special risk group are new-born ICU patients. The longer the hospital treatment, the higher the risk of infection.

### 4. Which hospital-acquired infections are the most problematic?

The most common hospital acquired infections are infections of the urinary tract (cystitis), the airways (pneumonia, bronchitis), wound infections after surgery and sepsis (blood poisoning). Hospital infections also include diarrheal diseases, such as Clostridium difficile-associated diarrhoea (CDAD).

The majority of hospital acquired infections resolve without complications. In some cases, however, they may require further treatment or even surgery that can lead to more pain and longer hospital stays. Sometimes the infections are so serious that the patient's life is at risk, especially if sepsis develops.

### 5. What are multidrug-resistant germs?

In the meantime, approx. 10 % of hospital infections are caused by multidrug-resistant germs, i.e. germs that cannot be effectively controlled with many classes of antibiotics. This can lead to a situation where the first-

line antibiotics that doctors must resort to even before the results of microbiological testing in, no longer work. Then the patient must be changed to an antibiotic that is still effective (broad-spectrum or reserve antibiotic). This delay means that valuable time is lost that may have been essential for treatment. For some patients, for instance those with sepsis, it may even be too late for a good outcome by then.

### 6. Why do doctors even use broad-spectrum antibiotics?

This is precisely the dilemma that plagues modern medicine: The many trillions of bacteria that live in the human gut and on the human skin always include some that have become resistant to certain antibiotics, either through mutation or – more commonly – through exposure to other people, animals or plants. If you start a course of antibiotics, the susceptible microorganisms are usually killed off effectively, while those with resistance traits survive, which means that resistant microorganisms are selected for. That is the

reason why doctors must always critically scrutinise the need for antibiotic treatment

in each case. They must be even more careful to avoid any overuse of broad-spectrum antibiotics, for instance in case of infections that are not caused by bacteria but viruses.

This is the antibiotic dilemma - treating the individual patient versus preserving antibiotic effectiveness for the benefit of all people.

### 7. Why has this become such a big dilemma just now?

It used to be that the pharmaceutical industry kept bringing new innovative antibiotics to market, so that there was always some reserve antibiotic in the pipeline. The situation now is completely different, with next to no genuinely novel antibiotics in the last decade nor any game-changer on the horizon.



## 8. The major multidrug-resistant germs

### MRSA

MRSA (Methicillin-resistant *Staphylococcus aureus*) continue to be the superbugs that the public are most aware of. Like the “regular” *Staphylococcus aureus* (pus-forming bacteria that are commonly found on the skin or in the nose of healthy individuals), they mainly cause pneumonia, sepsis and wound infections that, however, effectively respond to treatment in most cases.

Methicillin is an antibiotic. Resistant means that the bacteria have become non-susceptible to this and other antibiotics and can therefore no longer be effectively controlled with them.

### VRE

Enterococci are bacteria that commonly live in the human gut and help us digest our food. Once in a while, they cause infections, such as UTI, wound infections or sepsis. In some cases, these bugs are non-susceptible (resistant) to the antibiotic Vancomycin; then they are called Vancomycin-resistant enterococci (VRE).

Already, approx. one to two per cent of the general population carry VRE in their gut.

### ESBL (Extended Spectrum Beta-Lactamase-forming bacteria)

These include *Escherichia coli* and *Klebsiella pneumoniae*. The antibiotic-susceptible strains of these bacteria also live in the human gut. If they find their way to the urinary tract or airways, they can trigger UTIs, airway or wound infections and even sepsis (blood poisoning). The prevalence of these germs has more than tripled since 2005. Frequently, patients infected with this gram-negative bacterium can only be treated with antibiotics of the carbapenem class. As a result, carbapenem use has more than doubled in recent years. In several regions of the world (India, Pakistan), carbapenem-resistant bacteria are already found in the environment. In an effort to fight these pathogens, and because there are no alternatives, doctors have resorted to an antibiotic that has been around for a very long time, but which had been discarded on account of its adverse effects - colistin.

Already, approx. three to ten per cent of the general population carry ESBL in their gut.

Even when MDR superbugs are detected, we must distinguish between colonisation and infection. Colonisation means that this agent is present in or on the human body, but has not yet made its host ill. Infection means that this agent has caused an infection in the patient tested, i.e. the patient shows the typical symptoms of infection.

The presence of germs on the body (or colonisation) is not treated with antibiotics, in

some cases (with MRSA), attempts may be made to eliminate colonisation by appropriate medicines or washings (lavage).

What ultimately matters is to prevent the colonisation from developing into an infection, since the latter has the potential to seriously harm the patient, mainly because not all of the usually effective antibiotics can be used to treat these superbugs.

## 9. How can I tell if a given hospital-acquired infection might have been prevented?

This is hard to do in the concrete case. The fewer underlying conditions a patient had on admission, and the less invasive or immunocompromising a treatment regimen was, the higher the odds that the infection might have been prevented.

Since patients are not screened on admission for pathogen carriage (e.g. on the skin, in the nose or gut), it is usually hard to prove whether the pathogen implicated in a hospital infection came from the patient's own body or from outside sources.

If several patients are found to be infected with the same agent at the same time, it is highly likely that it is a cluster of preventable hospital acquired infections.

## 10. How do hospital-acquired infections even spread between patients?

The vast majority of germs that cause hospital acquired infections (also called multi-drug-resistant germs) spread through contact, i.e. by touch. Since patients are unlikely to touch each other, transmission is mainly through healthcare providers treating several patients in a row without disinfecting their hands between patients.

Of course, transmission can also occur if several persons share the same items. However, pieces of hospital equipment are usually patient-dedicated or single-use. If that is not possible (e.g. surgical instruments, endoscopes, crockery) they are processed using soundly validated disinfection and sterilisation methods. Only a few pathogens can be transmitted through the air, among them most of the bugs that cause respiratory infections. Coughing or sneezing can spread them as far as roughly one metre away from the infection source.

Therefore, you can avoid the risk of getting these infections if you keep a proper distance from the infected patient or wear a mask covering your mouth and nose. For very few infections, (pulmonary tuberculosis, chickenpox, measles) the agents are found further away from the infection source or stay air-borne even after the infectious patient has left the room. This is why these patients must always be placed in single rooms and may only have contact with persons wearing well-fitting masks over mouth and nose, or protected thanks to prior exposure to the disease or immunisation.

An infection is also hospital-acquired if the agents spread through blood. This can be the case with various types of hepatitis (Hepatitis B and C) as well as HIV. Generally, however, the level of safety in German health settings is sufficiently high to prevent this theoretical form of infection transmission.

## 11. What can I do as a patient or relative?

- The single most important thing you can do is practise good hand hygiene
- Just like your healthcare providers, you should make it a regular habit to wash or disinfect your hands after any contact with potentially contaminated objects and after using the bathroom. .
- If you notice that your healthcare providers forget to practise hand hygiene, ask them to do so. Also remind your family and friends when they come visiting you
- Healthcare providers usually prefer to disinfect their hands with an alcohol-based hand rub, because it is faster and more effective than washing with water and soap, does not require a sink and because disinfection is easier on the skin given the many times they have to clean their hands each day. However, even hand-washing clearly lowers the number of germs on

your hands, so that in most cases you can decide for yourself whether to wash or disinfect your hands. What matters is that you do not forget it.

- Venous catheters and urinary catheters should be removed as soon as they are no longer needed. If necessary, ask the doctors or nurses whether you still need the catheter.
- If you have been fitted with a venous, urinary or other catheter or undergone other invasive procedures, please take care not to manipulate them. Frequent handling raises the risk of bacteria from the environment (e.g. your skin) taking advantage of these portals to invade normally sterile body sites (such as the bloodstream or bladder) where they can trigger infections.
- Do not take antibiotics unless medically prescribed. Overuse of antibiotics selects for multidrug-resistant pathogens and worsens the resistance problem.
- If you develop profuse diarrhoea, you should inform the doctors, since it might be a *Clostridium difficile*-associated diarrhoea that is commonly linked to antibiotic use.
- Look out for other symptoms of infection.
- If you belong to one of the risk groups, get vaccinated ahead of planned hospital stays (e.g. pneumococcal vaccination, influenza vaccination).
- If you have noticed any potential infection risks, you may want to alert your doctors to them.

## 12. Targeted measures to prevent the major hospital-acquired infections

### Post-operative wound infections

About one to three per cent of post-op patients develop an infection around the surgical wound (rates vary according to type of surgery). Symptoms are reddening of skin and pain in this area, discharge from the wound, fever. These infections can be treated with antibiotics, sometimes they require additional surgery.

#### *What are the measures healthcare providers take to prevent post-op wound infections?*

- » *Before surgery:* e.g. the patient's body hair is removed immediately before surgery and their skin disinfected.
- » *During surgery:* e.g. antibiotic prophylaxis starting 30-60 min. ahead of the OP, surgeons carefully disinfect their hands and wear sterile surgical gowns and sterile surgical gloves
- » *After surgery:* the wound is covered with sterile dressing

#### *What can you as a patient do to prevent infections?*

- » *Before surgery:* alert the doctors to potential problems, such as allergies, diabetes;

even overweight can add to the risk; you should stop smoking, ideally before surgery; and avoid any skin irritation near the surgical wound

- » *After surgery:* all healthcare providers should disinfect their hands before each examination; if you do not see them do so, ask them to; family and friends should also disinfect their hands before visiting, they should not touch the wound or dressings.

#### *What should you do when you go home from hospital?*

- » Have your healthcare providers explain to you everything you need to know about wound care at home
- » Always disinfect your hands before touching the wound
- » Ask where you can turn to in case of problems
- » Seek immediate medical attention if you develop symptoms such as reddening and pain around the surgical wound, discharge from the wound or fever.

## Catheter-associated bloodstream infections

Central venous catheters are placed in a large vein (in the neck, chest, arm or groin) to draw blood for testing or give medicines. They are a portal that microbes can use to enter the body.

Patients with a catheter-associated infection develop fever and chills or the skin around the insertion site gets painful and red.

These infections can be treated with antibiotics, the catheter will usually be removed.

### *What are the measures health care providers take to prevent these infections?*

- » Insertion of central venous catheters using sterile techniques (hand disinfection, sterile gloves, gowns, disinfection of the patient's skin and sterile draping of the insertion site).
- » Insertion of peripheral venous catheters after the patient's skin and the care provider's hands have been disinfected.
- » Daily check if the catheter is still necessary

- » Consistent hand disinfection before handling the catheter or infusion system.
- » Great care in handling any fluids given through a catheter.

### *What can you as a patient do to prevent infections?*

- » Ask your doctors or nurses to explain why they are putting in the catheter and how long it is going to remain in place.
- » Watch your doctors and nurses to check if they take the necessary prevention measures required for catheter care, especially if they always disinfect their hands before manipulating the catheter or infusion system.
- » If necessary, ask them to do so.
- » Alert the nurses if dressings have become wet or soiled at the insertion site.
- » Alert the nurses if the area around the insertion site is reddened or painful.
- » Family and friends should also disinfect their hands before visiting and should not touch the catheter or infusion lines.

### *What should you do when you go home from hospital?*

- » If the catheter cannot be removed before you leave, have doctors or nurses explain to you exactly how to care for the catheter; for instance, ask if you can take a shower and how to change the dressings.
- » Always disinfect your hands before manipulating the catheter.
- » Look out for symptoms such as pain and redness at the insertion site or fever and seek immediate medical attention if you notice any of these.





## Catheter-associated urinary tract infections

Urinary catheters are placed into the bladder (through the urethra or the skin of the abdomen) to drain urine or measure the quantities excreted. They are a portal through which microorganisms can enter the body. In the case of catheter-associated urinary tract infections, the patient develops a fever, burning and pain in the lower abdomen and there may be blood in their urine. However, some patients never experience these symptoms.

UTIs can be treated with antibiotics; if necessary, the catheter will be removed.

### *What are the measures health care providers take to prevent these infections?*

#### » *Insertion of the urinary catheter*

Urinary catheters are only put in if necessary and are removed as soon as possible; the patient's skin is disinfected prior to insertion, or sometimes alternative catheterisation methods are used (intermittent catheterisation, condom catheters).

#### » *Catheter care*

Hand disinfection prior to any catheter manipulation, minimising connections between catheter and urine collection bag, avoiding kinking and backflow, regularly draining the urine bag.

### *What can you as a patient do to prevent infections?*

- » Ask every day if you still need the catheter.
- » Watch your healthcare providers to check if they take the prevention measures required for catheter care, especially if they always disinfect their hands before manipulating the catheter or infusion system.
- » Make sure to follow these rules yourself
- » The urine bag should be kept lower than the bladder at all times.
- » Do not pull or tug at the catheter and do not twist the catheter tubing.

### *What should you do when you go home from hospital?*

- » If the catheter cannot be removed before you leave, have your healthcare providers explain to you exactly how to handle the catheter.
- » Look out for symptoms such as burning and pain, fever and increased urine excretion and seek immediate medical attention if you notice any of these.

## 13. Precautions around special groups of patients

### What are the rules for visiting a patient with a multidrug-resistant infection?

It is perfectly safe to visit a patient infected with multidrug-resistant bacteria, this patient needs care and affection, too. These bacteria only spread through direct contact and not through the air. Just remember to disinfect your hands as you leave the room!

### Special precautions around immunocompromised patients

Immunocompromised patients must be carefully shielded from environmental pathogens. Therefore, they are placed in a single room to prevent exposure to pathogens from the environment e.g. neighbouring patients or the air outside which could trigger infections that can be highly problematic in the immunosuppression phase.



## Information resources

### Robert Koch Institute:

[www.rki.de](http://www.rki.de) -> Infektionsschutz -> Krankenhaushygiene -> KRINKO-Empfehlungen  
The Robert Koch Institute coordinates the work of the KRINKO (Kommission für Krankenhaushygiene und Infektionsprävention - Commission for Hospital Hygiene and Infection Prevention). This Commission prepares national recommendations on infection control that can be accessed from the websites above (in German).

### National Reference Center for Surveillance of Nosocomial Infections:

[www.nrz-hygiene.de](http://www.nrz-hygiene.de) -> Surveillance -> Module für einzelne Risikogruppen, z.B. ITS-KISS für Intensivstationen  
Approx. 1400 acute hospitals in Germany are volunteering in this national surveillance system for hospital infections (Krankenhaus-Infektions- Surveillance-System -KISS), e.g. they regularly share their risk group-specific data on infections (separate modules) with KISS, using standardised definitions and methods. This allows the establishment of benchmarks regarding the infection rates in the various fields that are relevant for the hospitals' quality management.

The NRZ also supplies data to the “European Centre for Prevention and Control” (ECDC) that gathers comparative data on hospital-acquired infections from across Europe.

### Aktion saubere Hände:

[www.aktion-sauberehaende.de](http://www.aktion-sauberehaende.de)

Joint Action launched by the National Reference Center for Surveillance of Nosocomial Infections (NRZ) and the German Coalition for Patient Safety (APS) to improve hand hygiene practices in German healthcare facilities.

The Aktion saubere Hände was modelled on the WHO campaign “Clean care is safer care” and has meanwhile become one of the biggest campaigns in this field.

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10117 Berlin  
Tel. 030 3642 816 0  
Fax 030 3642 816 11  
info@aps-ev.de  
www.aps-ev.de

### Concept and text:

Prof. Dr. Petra Gastmeier  
Nationales Referenzzentrum (NRZ) für Surveillance von nosokomialen Infektionen am Institut für Hygiene und Umweltmedizin, Charité Universitätsmedizin, Berlin

### Picture credits:

Wiebke Peitz | Charité Universitätsmedizin Berlin

### Overall coordination and editing:

Conny Wiebe-Franzen

**This booklet was drafted in a language patients easily understand thanks to the help of:**

Dr. Barbara Keck, BAGSO  
Stefanie Kratzenstein, Universität Potsdam  
Hannelore Loskill, BAG Selbsthilfe  
Sabine Müller, patient

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