hygiene in practice

REVIEW

Issue 3

DISPOSABLE DRAPES –
reducing contamination

SURGICAL SCRUBS –
helping to prevent infections

SURFACES –
trends in disinfection

Dear hygiene professionals,

We are all having the fortune of getting older – life expectancy has doubled between 1950 and 2017[1]. But with increasing age, the risk of disease and injury grows, and therefore so does the number of surgeries any of us might experience. Unfortunately, surgical site infections (SSI) are currently the second most common cause of hospital-acquired infections (HAIs) in Europe[2]. With effective measures in the pre-, intra- and postoperative phase, patients can be better protected from SSI. The graphic on the right shows a selection of interventions recommended by the Robert Koch Institute, Germany. We invite you to learn more about preventing SSI in this issue of *review*.

Before performing surgery, establishing hygiene guidelines and choosing the right surgical scrubs for the personnel transfer area are important steps in reducing the incidence of SSI. In our first article, you will read more about the bacteria found on surgical scrubs and the advantages of disposable scrubs to prevent SSI.

Sterile materials are also the topic of the next story in this *review*, "Disposable draping materials: Reducing the contamination of surgical wounds." What kind of surgical drapes do you use in your OR? Find relevant studies and more information on page 8.

It is because of curious and ambitious experts, researchers and scientists that our understanding of infection prevention is constantly growing – as is product safety. In our third story, you will meet Dr Juergen Gebel, who established a European standard for testing the effectiveness of ready-to-use wipes systems and wipe dispenser systems – his contribution to keeping patients safer.

We hope you enjoy reading our articles.
Your *hygiene in practice* team

PS: You can also find further interesting facts and articles about SSI on our website, ***hygiene-in-practice.com***
Become part of our movement for infection prevention!

For references, see page 16.

Phase 1
preoperative

Use of **antibiotics** only when recommended

Wear **examination gloves** where recommended. **Change OR area clothing**, surgical shoes, surgical cap, surgical mask, mouth and nose protection (MNS) before each operation & in case of visible soiling

Hand disinfection
Hand **wash**

Bathing before surgery
No shaving but clipping;
Decolonisation of *S. aureus* (intranasal mupirocin)

Phase 2
intraoperative

Hand disinfection

Sterile gowns (standard and high performance), **protective shield** in the OR where aerosol or secretions are present

Devices for patient **body warming**

Double gloving in the OR (sterile gloves)

Patient's skin **disinfection**

Sterile drapes, Equipment cover, Custom procedure trays

Sterile instruments, Antiseptic **sutures**

Phase 3
postoperative

CNP: Prophylactic negative pressure wound therapy may be used on primarily closed surgical incisions in high-risk wounds and for the purpose of preventing SSI

48 h

Wound dressing: Check wound dressing after 48 hours and perform hygienic dressing change

SI

Of course, all requirements for hygiene remain important while caring for the patient's wounds and working at the Point of Care!

Surgical scrubs: Choosing the right clothing improves patients' safety

Surgical scrubs can aid in containing the shedding and dispersal of skin-resident microorganisms into the environment and lower the incidence of surgical site infections. Choosing the right clothing for the personnel transfer area and establishing guidelines are important steps in limiting microbial spread and promoting patient safety.

Until the middle of the nineteenth century, most patients undergoing surgery would not survive the procedure. Death rates of nearly 80% were usual in hospitals in London. Surgeons operated with bare hands, using non-sterile instruments, wearing dark, unwashed frock coats. Dried blood stains were regarded as a sign of experience. Nobody knew at that time that bacteria and other microorganisms were the main cause for the high mortality rates. Reports commonly stated that "operation was successful, but the patient died". This changed in the following decades as the relationships between microorganisms and infections became clearer, and surgeons started cleaning their hands, sterilising their instruments and wearing gowns over their street clothes.

Today, very detailed hygiene guidelines regulate clothing in the OR and in the restricted surgery area. Clean surgical scrubs, sterile surgical gowns and headgear are worn to protect the perioperative personnel as well as to decrease microbial contamination of surgical wounds. Nevertheless, surgical site infections (SSI) are still among the most common healthcare-associated infections (HAIs) and are linked with a high financial burden (Badia JM et al., 2017).

SSI occur after surgery mostly in the operated body part and can be either superficial or involve organs, tissues or implants, often causing longer postoperative hospital stays, additional surgical procedures, treatment in intensive care units and higher mortality. They can originate from the OR staff or from the operating room environment. Reports from the European Centre for Disease Prevention and Control (ECDC) estimate

that every year half a million patients suffer SSI, which could be avoided by enhancing infection control and monitoring hygiene measures. As the skin of OR personnel harbours microorganisms that represent a potential source of cross-contamination, surgical scrubs play a key role in keeping patients free from infections and lowering SSI rates. In Europe, surgical scrubs are worn in the surgical area by many healthcare providers such as surgeons, anaesthesiologists, nurses and laboratory technicians. Sterile gowns are then worn over the surgical scrubs to ensure sterile conditions when performing surgery.

The missing link between surgical scrubs and SSI

Determining the contamination of surgical scrubs is essential information for designing infection control guidelines for the personnel transfer area. A study by Hee HI et al., 2014, observed a significant increase over time in bacterial burden on scrubs worn by medical professionals. Other studies also reported similar findings, underlining the importance of regularly changing scrubs during the day, for example after toilet visits, after surgeries with visible soiling of the surgical scrubs or after leaving the surgical department to prevent the transfer of microbes to the patients. (Sivanandan I et al., 2011). The most common bacteria found on worn scrubs were coagulase-negative *Staphylococci, Staphylococcus aureus*, coliform bacteria and gram-positive rods (Nordstrom JM et al., 2012).

Based on this data, it is difficult to establish a direct relationship between contaminated scrubs and SSI incidence. Many risk factors such as number and type of microbes, or the patients' immune defences, can favour the incidence of SSI. Yet the continuous shedding of skin-harboured microorganisms throughout the day leads to an increase in scrubs colonisation and could enhance the contamination risk in the OR environment. This is why changing scrubs and gowns before each surgical procedure is crucial, not only when performing procedures with high infection risk, such as heart or implant surgery. As an alternative to reusable scrubs that need to be washed frequently to remove contamination, disposable scrubs provide numerous advantages. Freshly unpacked, the risk of contamination by clothing particles is significantly lower; it provides an effective barrier against germs and thus reduces the frequency of SSI. With conventional reusable surgical scrubs, the user cannot be sure that all contaminants have been removed after washing. After all, the performance of the material is influenced by the quality and number of washes. Although the use of

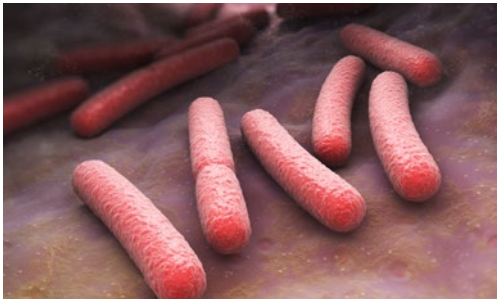
disposable materials can raise environmental concerns and can be associated with a lack of comfort, the possible reduction of infection rates and costs associated with SSI are surely key factors that need to be considered before choosing surgical clothing.

Establishing a medical dress code

The medical community is taking an increased interest in professional medical dress codes. Many local or national associations as the National Institute for Health and Care Excellence in the UK or the Working Group "Hospital and Practice Hygiene" of the AWMF (Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften) in Germany have released guidelines for personnel entering restricted areas of the operating department. They recommend wearing specific colour-coded, non-sterile surgical scrubs in all areas where operations are undertaken. Moreover, they recommend not wearing surgical scrubs in the hospital outside of the OR area without an appropriate cover over them. They also underline the importance of a daily change of scrubs.

OR clothing should have some key features: Scrubs should provide an effective barrier for pathogens, reduce the risk of infection, be lint-free and comfortable to wear. A multi-centre study conducted by Loison G et al. in France assessed compliance of OR staff with clothing regulations during a large number of procedures. Just 56% of the examined surgical attire showed full compliance with the guidelines, suggesting that there is still room for improvement.

The development and implementation of guidelines and standardised procedures for surgical scrubs in the perioperative setting is crucial for increasing staff compliance and for promoting patients' safety. Reducing the number of resident microorganisms on surgical scrubs to a minimum and preventing the transfer of microorganisms from personnel to the patients would result in a lower incidence of SSI and ultimately save lives.



Together with Staphylococci and gram-positive rods, coliform bacteria such as E. coli are the most common bacteria found on worn scrubs a study says.

Disposable draping materials: Reducing the contamination of surgical wounds

Surgical drapes isolate the surgical site from non-sterile areas of the patient's body and the operating table. They reduce the risk of surgical site infections (SSI). Optimising their barrier function can help to prevent microbial contamination and to improve patients' safety.

Surgeries are life-saving interventions that are successfully used to treat many conditions such as injuries, cancer, heart diseases and mobility restrictions. Their number rises worldwide every year. According to the German Federal Statistical Office (Statistisches Bundesamt), more than 16.8 million surgeries were performed in Germany in 2017 compared to 13 million a decade earlier. However, along with the increasing number of surgeries, the need for better infection control also rises. Patients need to be protected from surgical site infections (SSI), which account for 22% of healthcare-associated infections (HAIs) and are among the most frequent types of HAIs in German acute-care hospitals. The European Centre for Disease Prevention and Control (ECDC) defines SSI as "postoperative infections occurring within 30 days of a surgical procedure (or within a year for permanent implants)". Minimising the risk of contamination for patients is imperative, as SSI can have severe consequences. Pain, re-admission to the hospital, loss of income, reduced quality of life and, in some cases, death are the human costs suffered by the affected patients. In addition, longer hospitalisation, additional diagnostics measures and treatments substantially increase the financial burden of surgery (Badia JM et al., 2017). The treatment of SSI can also contribute to the spread of antibiotic resistance, one of the biggest threats for healthcare today.

Surgical drapes create a barrier to microbes during surgeries

Bacteria such as *Staphylococcus aureus*, *Escherichia coli*, coagulase-negative staphylococci and the *Enterococcus* species are the most commonly isolated organisms related to SSI. Methicillin-resistant *S. aureus* is a relevant source of infection and presents a growing number of challenges for SSI therapy due to multiple antibiotic

resistances. As microorganisms on the patients' skin are a major source of contamination, using draping materials plays a pivotal role in reducing infections and improving patient outcomes. Surgical drapes create an effective physical barrier for preventing microbial transfer from both the patient and the environment to the wound.

After antiseptic skin preparation, surgical drapes are placed over the surgical site to maintain a sterile field and to prevent contact with untreated surfaces. One of their most important features is fluid containment. This is because during surgery, body fluids and irrigating solutions come into contact with the drapes, and the risk for pathogen transmission increases when the materials become moist or wet. Draping material must also be low-lint, as lint can transport microbes and introduce them into the surgical wounds, increasing the risk of infection. Other requirements for sterile surgical drapes include resistance to microbial penetration (dry and wet), the absorption capacity, the resistance to liquid penetration and the tensile strength (according to EN 13795).

To find further evidence for clear benefits of disposable versus reusable drapes, more prospective large-scale studies with higher number of patients are needed. In addition, functional requirements, economic aspects and environmental impact need to be taken into account when selecting appropriate drapes for surgery.

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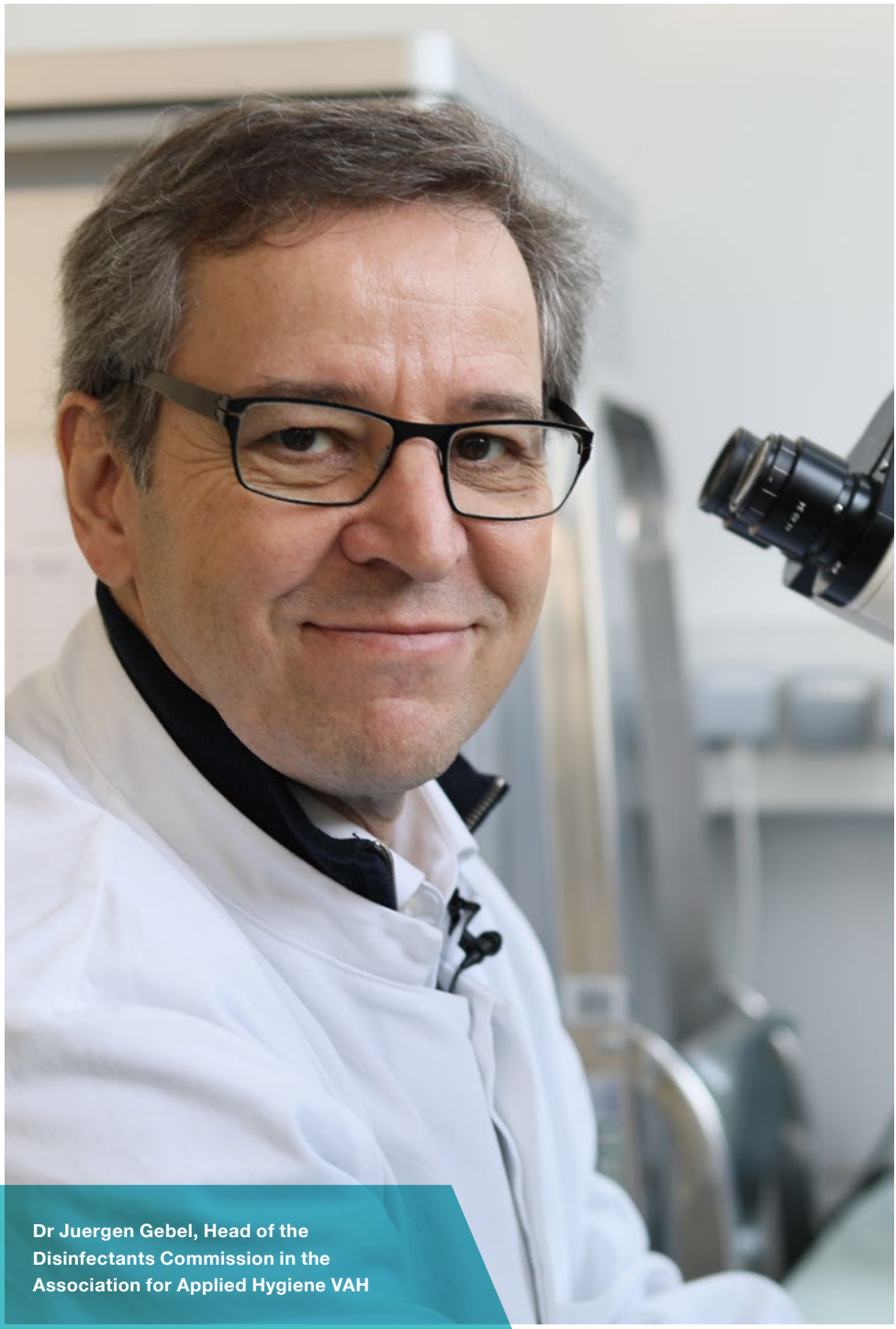
Find the complete online version of this article together with useful further links here: bit.ly/surgical_drapes



Dr Juergen Gebel, Head of the Disinfectants Commission in the Association for Applied Hygiene VAH

Surface disinfection: You should know these trends

In recent years, ready-to-use wipes have become increasingly popular for surface disinfection. They are easy to work with and safe to use. But how do experts test the effectiveness of such wipes? Learn about the role of the 4-field test and why the number of moist wipes in flowpacks matters – and how institutions such as Germany's VAH with its disinfectant experts are working to improve products.

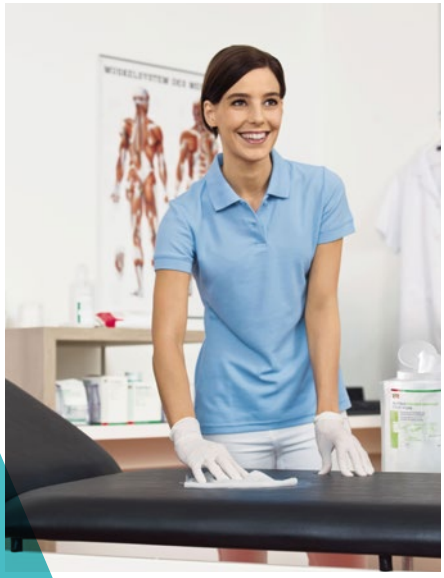
Bacteria and viruses are invisible to the human eye. The effectiveness of surface disinfectants cannot be seen with the naked eye, either. However, safe products are essential for daily clinical use or in an outpatient setting. This is why reliable test methods and binding standards are crucial. By 2013, at the European level, the proof of efficacy for surface disinfection in the human medical sector was carried out exclusively on active ingredient solutions. At the same time, more and more ready-to-use systems came onto the market that offered wipes and disinfectants as a unit. Both at the European level and in Germany, the practical efficacy tests used not only ignored the interaction of the wipe and disinfectant solution, but these were also partly unintended for human medicine. Dr Juergen Gebel, who heads the Office of the Disinfectants Commission in the Association for Applied Hygiene, explains a further aspect: "In contrast to ready-to-use methods, in previous tests, we always used a surplus of liquid. The wipe was dipped in a bucket, soaked with disinfectant, and the surfaces were then disinfected." However, this test method led to a number of problems. It was not possible to determine whether the amount of active substances actually released by a wipe in ready-to-use procedures was sufficient to inactivate microorganisms on a surface. Wiping can also lead to cross-contamination – which was also not detectable in the test. In practice, these weak points can lead to an infection risk for users and patients.

From Bonn to the European Union: The success story of the 4-field test

"Disinfectants are used to reduce the risk of infection for patients," Gebel adds. "Users must be able to rely on the direct benefit of the agent because they cannot see it directly. This is why you have to use appropriate test methods for testing the efficacy

of the product beforehand," continues Gebel. It was very important for Gebel and his team at the Institute for Hygiene and Public Health at the University Clinics in Bonn, Germany to eliminate these weak points and to test the effectiveness of disinfectant wipes in practice. So they developed the 4-field test. This is a quantitative test method for assessing the bactericidal, levurocidal, fungicidal, mycobactericidal and sporicidal effects of disinfectant wipes for the medical field.

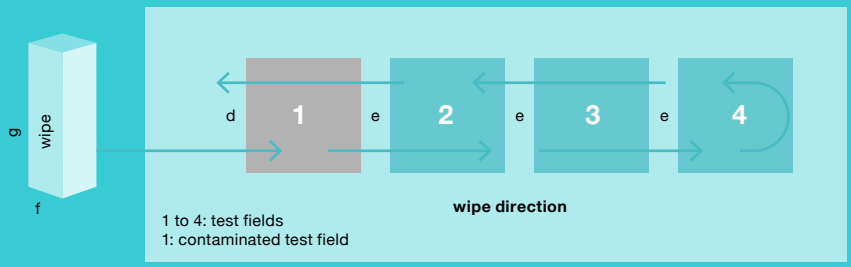
The wipe is moved across a non-porous surface (mostly PVC floor covering or PVC foam board ("FOREX ®") over four marked fields by means of a granite block (see infographic). The first field is contaminated with test organisms, whereas there are no test organisms on the other three fields. The new method is a closer representation of real-life situations and treats the disinfectant solution and wiping activity as a unit, rather than evaluating the solution alone. "The advantage of the test is that it represents not only the reduction of the test organisms on the test field itself, but also a possible spread of the test organisms to other test fields," Gebel explains. "The test makes it possible to confirm the effectiveness during the entire period that the wipe is used."



To ensure effectiveness and safety for users, surface disinfectants must be tested with EN16615.

In 2013, Dr Gebel and his team submitted the procedure as a pre-standard in the European standards group. Their motivation was clear, says Gebel. "There is one Europe, and its borders are very open. There is no way that Germany could use a border to protect itself from infections or the transfer of pathogens. And that is why our efforts must be directed at establishing high quality standards in all European countries. For this reason, the VAH also takes a great interest in implementing uniform and standardised test procedures at the European level." And this has been

Schematic representation of the 4-field test



test area (a x b = 50 x 20 cm) with 4 test fields (5 x 5 cm) and defined wipe direction of the wipe. c = 5, d = 10 cm, e = 5cm, f and g = dimension of the unit weight + protective cap (minimum 8,6 x 12,1 cm); Source: VAH

successful, because in 2015, the process became recognised as Standard EN 16615 in the European Union. “Yes, that does make one proud,” adds Gebel.

In addition to the development and establishment of new testing methods, the VAH has another important function. The association continually compiles and updates the disinfectants list, another responsibility that Dr Gebel carries out. The VAH list is the list of disinfectants and procedures tested by the VAH. For example, surface disinfection products are divided into three categories: “surface disinfection” (without specified wipes) and surface disinfection as “pre-soaked wipe systems” or “ready-to-use wipe systems”. “Since 2016, all surface disinfectants have had to prove their effectiveness by means of the 4-field test in at least one expert appraisal,” explains Gebel. Last year, however, the transitional period ended. Since 2019, both expert appraisals that are required for listing must have been conducted according to this test procedure. The VAH updates the list on a monthly basis and makes it available online. Under the heading “surface disinfection”, products with the word “cloth” or “wipe” in the name (without specified wipes) are still listed, but these are specially labelled. This is because here only the effectiveness of the wetting solution is tested with a standard wipe. The situation is different with the categories “pre-soaked wipe systems” or

“ready-to-use wipe systems”. “The user can trust that the pre-soaked wipe system or ready-to-use system has been tested and found to be an effective product. It ensures compatibility between the wipe and the disinfectant,” says Gebel.

Is time relative? Contact times are continually adjusted by the VAH

In addition to the subdivision into the three categories, contact time also plays a role. The VAH currently lists products with a contact time of five to 60 minutes. However, when certifying for five minutes, a contact time of one minute must also be tested. Gebel explains the necessity for this. “We want to be sure that the effective area is safely separated from the ineffective area. Since it is not possible to modify the concentration in ready-to-use systems, we try to set the limit of the process via the contact time.” This methodology could soon lead to a further update of the VAH list for disinfectants, as there are products that work within one minute. “There is a growing discussion about whether to introduce contact times shorter than five minutes. The VAH is considering listing products with a contact time of one minute.”

The reaction time not only plays a role in the effectiveness of products, but also has an influence on the microorganisms themselves. Often, long contact times are synonymous with low concentrations of active ingredients. “If the pathogens are not immediately inactivated, they can develop certain protective mechanisms. This effect is called tolerance – not to be confused with resistance. Tolerances are time-limited, adapted properties that are subsequently lost,” Gebel explains. Nevertheless, they raise the risk of infection for patients and users. This is why more and more disinfectant formulations

Advantages of the 4-field test:

- a quantitative test method
- a closer representation of real-life situations
- confirming the effectiveness during the entire period that a wipe is used

are approved under biocide laws. Last year, the European Chemicals Agency ECHA published a document that included guidelines for the use of surface disinfectants in healthcare. According to the Biocidal Products Regulation, the maximum contact time of “high-touch-surfaces”, i.e. frequently touched surfaces in the patient environment, is five minutes. “With regard to the risk of infection, we at the VAH recommend very short contact times – this is the case with these highly frequented areas. When, however, surfaces only have to be disinfected once a day where there is no visible contamination. Thus longer contact times are justified,” Gebel explains.

The ECHA prescribes a maximum of 60 minutes for the latter areas – in Germany, a contact time of four hours has been established, especially for floors. “The tendency is for people to deviate from this following observed development of tolerances in microorganisms. The VAH now also follows the guidelines of a maximum of 60 minutes, which is regarded as a consensus at European level.” The contact times recommended by ECHA are based on the European Standard EN 14885. Here, too, the contact times are five and 60 minutes respectively. “The VAH accepts the concentrations and contact times specified by biocide legislation. However, this does not mean that the VAH does not impose additional quality requirements for verifying the specified values. In future, the VAH list will become a positive list of biocides approved by ECHA,” Gebel concludes.

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Find the complete version of the article and more information on the decisive ratio of liquid to wipe, as well as a new study finding, here: bit.ly/surface_disinfection

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Sources: 1: Global, regional, and national age-sex-specific mortality and life expectancy, 1950–2017: a systematic analysis for the Global Burden of Disease Study 2017; The Lancet
2: Global guidelines for the prevention of surgical site infection: An introduction; WHO
References can be found online under the respective article.

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