Background

Our most important points of contact with the outside world – our hands – are the main carriers of many of these infectious diseases.

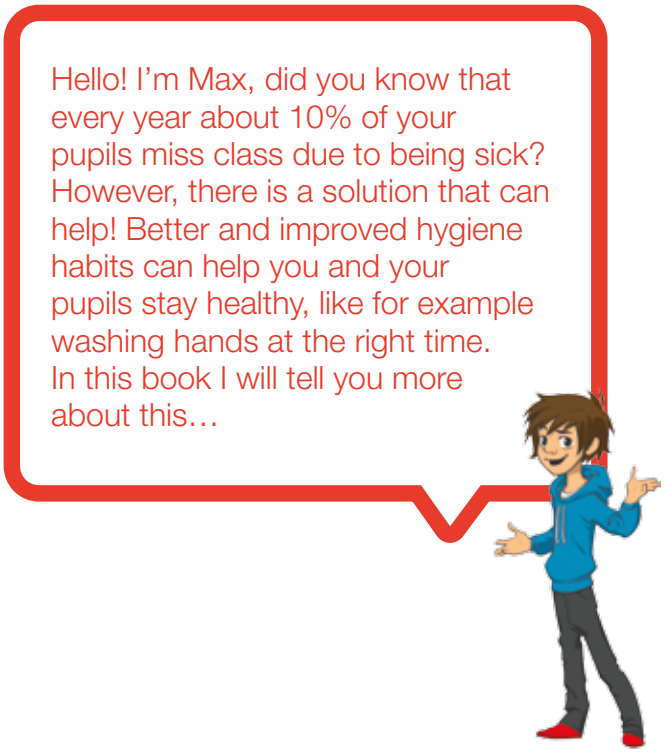
Infectious diseases spread quickly, particularly in places where many people come together, such as in kindergartens, schools and at workplaces (Talaat *et al.*, 2011). Diseases such as influenza and diarrhoea as well as measles and mumps break out frequently, particularly in primary schools (Neuzil *et al.*, 2002). Our most important points of contact with the outside world – our hands – are the main carriers of many of these infectious diseases.

Consequently, the World Health Organisation (WHO) describes regular and thorough hand washing as the most important hygienic measure for preventing the spread of such diseases (WHO, 2009).

Numerous studies support and document that proper hand washing prevents the spread of infections (Mathur, 2011 & Smith, 2009). Moreover, it is particularly sensible, even during childhood, to learn the necessary routines of hand hygiene (Gebel *et al.*, 2008), since hand washing is primarily promoted through positive behavioural support (Savolainen-Kopra *et al.*, 2012).

Despite these scientific facts, there is a lack of information and exercises regarding proper hand washing at primary schools (Apisarnthanarak *et al.*, 2009). Proper hand washing should be learned and practiced! Several million bacteria can be found alone under one fingernail, under a ring even several hundred million, and even billions of bacteria can romp around on an incised wound! Many of them are part of the skin's own flora and are harmless, but some cause serious diseases.

For years we have been involved in efforts for improved hand hygiene as one of the leading European providers of hygiene products for toilets and lavatories.



"Don't forget to wash your hands after going to the toilet and before eating!"

As this universally known jingle clarifies, providing information about the effect of thoroughly washed hands cannot be started early enough, in our opinion.

That is why we have decided to support primary schools and to give their protégés a healthy awareness of hygiene with tips provided by Max and his friends. Children will playfully learn how a person thoroughly washes their hands, dries them, what microbes are and much more with the existing teaching materials. They should think up stories, tricky arithmetic problems, write dictation exercises and also perform experiments. The tasks are conceived for children in the third and fourth academic year, and have different skill requirements. Max will lead the children through the documents and give helpful tips.

And now we wish you lots of fun!

Apisarnthanarak, A., Apisarnthanarak, P., Cheevakumjorn, B. & Mundy, L.M. (2009): Intervention with an infection control bundle to reduce transmission of influenza-like illnesses in a Thai preschool. Infect Control Hosp Epidemiol, 30 (9): 817 - 822.

Gebel, J., Teichert-Barthel, U., Hornbach-Beckers, S., Vogt, A., Kehr, B., Littmann, M., Kupfernagel, F., Ilschner, C., Simon, A. & Exner, M. (2008): Hygiene tips for kids. Concept and examples of realisation. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz, 51 (11): 1304 - 1313.

Neuzil, K.M., Hohlbein, C. & Zhu, Y. (2002): Illness among schoolchildren during influenza season: effect on school absenteeism, parental absenteeism from work, and secondary illness in families. Arch Pediatr Adolesc Med, 156 (10): 986 - 991.

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Savolainen-Kopra, C., Haapakoski, J., Peltola, P., Ziegler, T., Korpela, T., Anttila, P., Amiryousefi, A., Huovinen, P., Huvinen, M., Noronen, H., Riikkala, P., Roivainen, M., Ruutu, P., Teirila, J., Vartiainen, E. & Hovi, T. (2012): Hand washing with soap and water together with behavioural recommendations prevents infections in common work environment: an open cluster randomized trial. BioMed Central Trials, 13: 10.

Smith, S.M. (2009): A review of hand-washing techniques in primary care and community settings. J Clin Nurs, 18 (6): 786 - 790.

Talaat, M., Afifi, S., Dueger, E., El-Ashry, N., Marfin, A., Kandeel, A., Mohareb, E. & El-Sayed, N. (2011): Effects of hand hygiene campaigns on incidence of laboratory-confirmed influenza and absenteeism in schoolchildren, Cairo, Egypt. Emerg Infect Dis, 17 (4): 619 - 625.

WHO World Health Organisation (2009): Guide to Implementation. Available at www.who.int/gpsc/5may/Guide_to_Implementation.pdf

WHO World Health Organisation (2012): World Health Statistics 2011. WHO Press, Geneva, Switzerland.

1

Introduction

1 The importance of hand hygiene

1

The importance of hand hygiene

Transmission of these influenza viruses occurs via droplet infection, i.e. a virus can be transmitted when a person is speaking, sneezing or coughing, but also via objects which have been touched with infected hands. Via the mucous membranes of the mouth or nose the virus can then enter the organism.

Particularly children are quickly infected, because in everyday school life they come into contact with other children and public sanitary facilities.

Clean hands are the best way to reduce an infection or the spread of bacteria and viruses. Hand washing and drying hands substantially reduces infectious bacteria and viruses on the skin (Centers for Disease Control and Prevention, 2008). Learning and practicing correct hand hygiene is possible at any school.

Hygiene is not only important in cases of an influenza epidemic, but at any time a wide variety of pathogens can be dangerous. For example, increasing infections with the norovirus are recorded every year. This virus – which causes severe diarrhoea and vomiting, but also nausea and general indisposition – occurs over and over again in hospitals, elderly people's homes, schools and the like. Since here a person can be infected very quickly by touching a toilet seat or using the same water tap that an ill person has used beforehand, transmission is hard to avoid except through very hygienic conditions and extremely thorough hand washing.

A majority of viruses and bacteria can be removed from the hands through proper technique and adequate thoroughness so that they are not even able to penetrate the organism via the mucous membranes or wounds.

Another germ that hardly anything can counter is MRSA (methicillin-resistant Staphylococcus aureus). These are bacteria that belong to the normal skin flora in humans, but have formed a resistance to antibiotics.

An infection normally occurs via the hands and is one of the most common hospital-acquired infections. Antibiotics are increasingly used in clinics, and that is why resistant strains become established. Treatment is extremely difficult and expensive due to the pronounced resistance.

Footnote: Centers for Disease Control and Prevention (2008): An Ounce of Prevention Keeps the Germs Away. Available at: www.cdc.gov/ounceofprevention

"But while these infections and the increase of antibiotic resistant microorganisms in a hospital are awarded a relatively high health policy importance in terms of general perception, the risk of infection outside the hospital is not rated as relevant or as threatening to health. Consequently, the importance of hygiene measures in everyday life is also underestimated."[1]

In particular, the hands are the number one carriers of germs. Hand hygiene is therefore urgently necessary and also the simplest and most effective individual measure for reduction of transmissible infections (Bloomfield *et al.*, 2007, Luby *et al,* 2005 & Ponka *et al.*, 2004).

These kinds of infections are the most common illnesses among children under 15 years of age. Therefore, it is necessary to take or to strengthen preventive measures for children and students.

Also **short-cut fingernails**, i.e. fingernails end at the fingertips, contribute to effective hand hygiene. A large number of germs which can be transmitted during contact gather under the fingernails.

Drying hands is also of elementary importance to reduce transmission.

Paper towels are ideally suited for hygienic drying of hands after washing. The mechanical exposure additionally frees the skin of skin particles and germs which are not part of the natural skin flora. These are disposed of with the paper towel and therefore do not find their way back to the human skin via air turbulence or contaminated surfaces. Naturally the quality of the paper towel, which is expressed among other things in the paper's suction power, plays an important role.

That is why whoever uses disposable paper towels is on the safe side.

"After drying I initially keep my paper towel, push the door open with it and only then dispose of it in the next waste container."[3]

Measures to prevent infection

short-cut fingernails

drying hands

paper towels

"Particularly simple hygiene measures have a considerable preventive potential that should not be wasted in our healthcare system."[2]

1-3 Martin Exner, Direktor des Instituts für Hygiene und Öffentliche Gesundheit und geschäftsführender Direktor des Zentrums für Infektiologie und Infektionsschutz der Universität Bonn. In 2008: (Exner, 2008).

2

Activities

2.1 Introduction
2.2 When hands need to be washed
2.3 Right or wrong
2.4 Why using soap
2.5 The meaning of hygiene
2.6 Dictation exercises
2.7 Make your soap
2.8 Why do you need to dry your hands
2.9 What are microbes
2.10 The importance of the skin
2.11 Multiplication of bacteria
2.12 How do you wash your hands
2.13 Search for microbes
2.14 How do microbes spread
2.15 Conclusion

2.1

Introduction

The existing teaching materials on the subject of hand hygiene have been conceived so that they can be used in a different way in the classroom. They can be used in the form of learning stations, implemented in a project week or simply as individual worksheets as part of the regular lesson.

The individual stations were deliberately not numbered. So it is up to the teacher to decide which stations he or she would like to use.

A guiding map is helpful. For one thing, the children have a good overview of all stations offered and can check off which stations have already been worked on. For another thing, the teacher has control of the work performed.

Some stations are more important than others. This is why it is at the teacher's discretion to mark stations which they consider especially important as mandatory stations (e.g. by means of an exclamation mark on the map or on the station itself). Other stations which the children can additionally work on, but do not have to, can be declared an optional station. In addition, a "reading corner" can also be set up with books on the subject of hygiene.

Should there be a museum or an exhibition around the school`s approximate neighbourhood, an excursion there can be planned as an extracurricular place of learning.

Introduction to hand hygiene
As an introduction to the subject of "hand hygiene", it is suggested to set up some objects in the learning circle which can be associated with hand washing, such as:

- Soap, soap dispenser
- Hand or paper towels
- Possibly water

And the teacher can simple allow the children to react, i.e. they themselves determine which subject will be handled in the future, before the series of lessons are presented.

Objects associated with hand washing

Soap, soap dispenser

Hand or paper towels

Water

Brainstorming is another possibility. First of all, the teacher gathers what comes to the children's mind on the subject of hygiene in general and "hand hygiene" in particular, and records it as a 'cluster' in the form of a panel. In this way the teacher also gets an impression of the children's level of knowledge on the subject. Following that, the teacher can then introduce and briefly explain the subject/term "hand hygiene".

A series of information sheets and tasks will be presented on this subject. Depending on the proficiency level of the students, the teacher can select which worksheets they want to use. The working materials are intended to be station work, i.e. the children should come to terms with the subject on their own and the teacher should function as reference person. The knowledge acquired should be deepened afterwards in the learning circle.

Handling materials
For learning in stations, the individual stations are set up in the class with the required materials. The subject should be prepared independently by the children. The children should be able to perform the work assignments of the individual stations alone. The teacher can provide assistance, but otherwise remains in the background.

Reflection
The results of the independent work on the stations should be presented in the learning circle at the end of every hour and the knowledge acquired should be deepened. Here the children can repeat what has been learned once again, and also present, reflect on and clarify questions if necessary.

The working method should be clarified with the children before you start with the teaching unit.

- A few mandatory stations should be worked on first. But apart from that a specific sequence does not have to be maintained, i.e. the children can start at any station.
- The stations are not all identically structured: some consist of only one work assignment, while others consist of a reading card and a work assignment. It can also occur that help sheets are to be added. This should be explained to the children beforehand.
- The stations can also be provided with small reference cards on which the children can read what they are required to work on for this station (see templates and materials in the following overview of stations).
- It is advisable to laminate the reading cards in 3-4 copies or put them in transparent folders so that the children realise that these cards should be put back again. However, work assignments and help sheets can be kept.
- With the help a control folder the children themselves can check whether they have performed the work assignment correctly.
- This control folder can also exist in several versions so that several children can check their work assignments at the same time.

2.2

When hands need to be washed

Objective
It should be made clear in which situations it is particularly important to clean the hands so that no microbes can find their way into the body and cause diseases.

The children write down in which situations hand washing is particularly important and think about other examples.

Templates
Reading card, work assignment, help sheet; if necessary, some worksheets should be copied and laid out to be cut out.

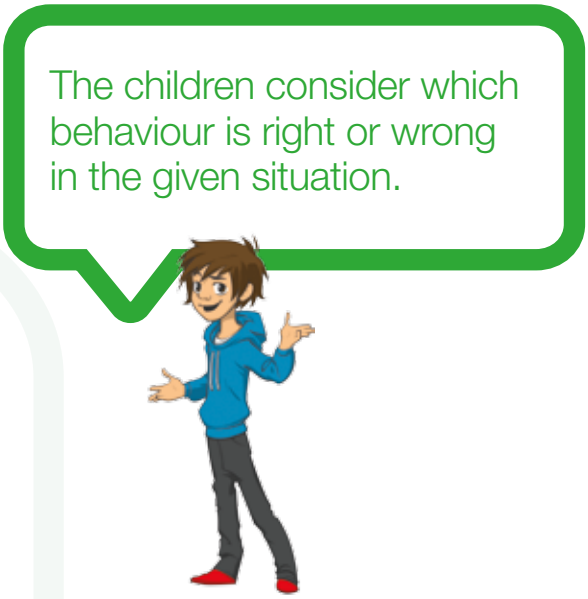
Note
Exactly why hand washing is particularly important in these situations should be deepened in the learning circle.

Suitable from the 1st to 4th school year

2.3

Are the kids behaving right or wrong?

Objective
The children should learn to judge which behaviour is right or wrong with regard to hand hygiene, and why.



Templates
Work assignment.

Note
The results should be discussed once again and clarified in the learning circle.

Suitable from the 1st to 4th school year

2.4

Why should hands be washed with soap?

Objective
It will not really be clean without soap. It should be made clear to the children that many things that can only be removed with soap can take hold in the finger grooves as well as on rough surfaces.

The children wash a rough surface once without and once with soap. They look at their skin under a magnifying glass and realise that is it not simply smooth.

Materials
A dirty tile or the like, water, soap, hand towel, stamp pads, magnifying glass.

Note
Exactly why hand washing is particularly important in these situations should be deepened in the learning circle.

Suitable from the 1st to 4th school year

2.5

What does hygiene mean?

Objective
The children should be aware that hygiene means more than just cleanliness. They also learn how to deal with dictionaries and are thus able to inform themselves about unknown terminology.

The children consider what comes to mind with regard to the term hygiene. After that they check by means of a dictionary whether their assumptions are correct.

Materials
A dictionary. Please make sure that a dictionary which explains the term “hygiene” is available in the classroom.

Templates
Work assignment, information sheet.

Suitable for the 3rd and 4th school year

2.6

Dictation exercise: Why are clean hands important?

Objective
The reading card shall inform the children that diseases can be prevented with simple measures such as hand washing, and that not all microbes are harmful.

The children read the text regarding “Why are clean hands important?”, and then memorise a few words and write them down.

Templates
Reading card, work assignment.

Note
For this dictation the check sheet for the dictation exercise “Why are clean hands important?” must be duplicated and hung up at various spots in the classroom.

Suitable for the 3rd and 4th school year

2.7

Make your own foam soap!

Objective
The children shall concentrate their attention soap or foam soap.

The children make their own foam soap with the teacher's help.

Templates
Work assignment

Materials
Hotplate, pot (enamelled), glass with screw top, wooden spoon, tablespoon, warm water, salad oil, sodium bicarbonate.

Note
Liquids are heated up during this experiment. Attentive care is absolutely necessary in this regard.

2.8

Why should you always dry your hands well?

Objective
This work assignment shall make it clear that more microbes can take hold on wet surfaces, i.e. hands that are not properly dried.

The children wash their hands and notice that sand remains stuck on hands that are still moist, but no on dry hands.

Templates
Work assignment

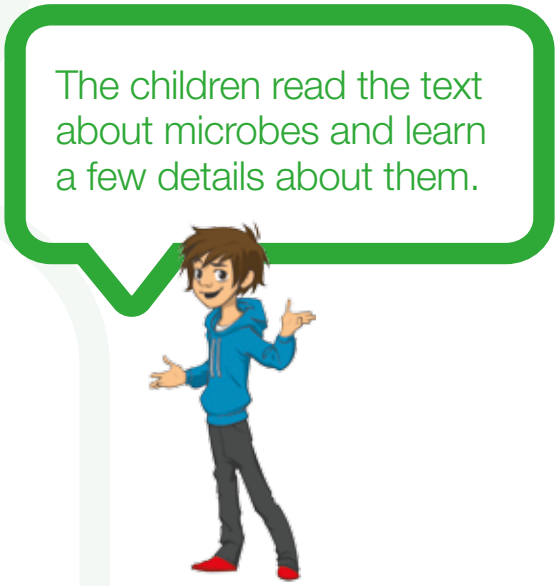
Note
Make sure that the sand is really dry, because moist sand also remains stuck on dry hands.

Suitable from the 1st to 4th school year.

2.9

What are microbes?

Objective
The children shall be familiarised with the term “microbes” and learn that not all microbes make a person sick. Knowledge shall be deepened by asking own questions.



Templates
Reading card, work assignment.

Note
Partner work.

Suitable for the 3rd and 4th school year

2.10

The skin as protection against microbes

Objective
The children insert the words in the corresponding gaps indicated below in the work assignment

The children read the text regarding “Why are clean hands important?”, and then memorise a few words and write them down.

Templates
Work assignment, control text.

Note
Review by means of answer sheet in the control folder.

Suitable for the 3rd and 4th school year

2.11

Where are microbes found?

Objective
There are quite a few microbes on objects which are used by many people. But the risk of an illness is considerably reduced by hand washing.

The children learn on which spots quite a few microbes are to be found, and why.

Materials
Possibly coloured pencils.

Templates
Reading card, work card.

Suitable for the 2rd and 4th school year

2.12

How and when do bacteria multiply?

Objective
The idea of how quickly microbes can multiply under moist and warm conditions shall be conveyed to the children through arithmetic problems. Retain knowledge by recording the results in a table.

The children figure out how quickly microbes (“bacteria” in student version) multiply under favourable conditions.

Materials
Exercise book, 3 glasses or the like, paper.

Templates
Reading card, work assignment 1, check sheet 1, work assignment 2, check sheet 2.

Note
Review by means of answer sheet in the control folder.

Suitable for the 3rd and 4th school year

2.13

Do you also wash your hands properly?

Objective
The children shall be made sensitive to thorough hand washing of all hand areas.

The children recognise which hand areas that are not cleaned with the help of fluorescent washing lotion under black light.

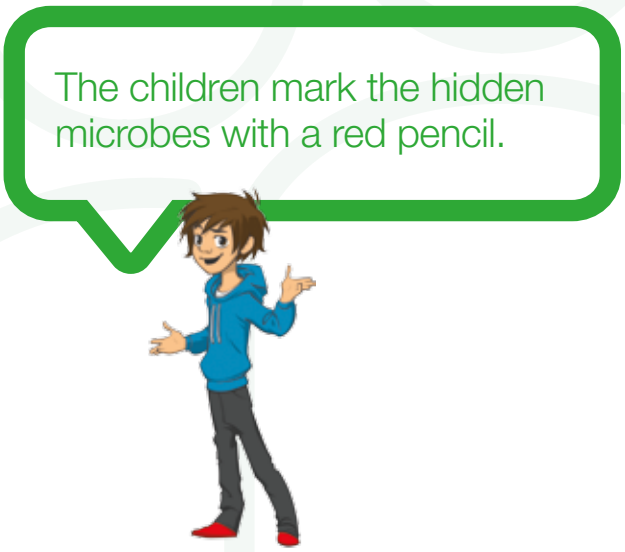
Materials
Washbasin, soap, paper towels, tube with washing lotion, black light box (1).

Templates
Work assignment.

2.14

Search for microbes

Objective
The children shall deepen their knowledge of which spots quite a few microbes are to be found in their living environment.



Materials
Red pencil.

Templates
Work assignment 1, work assignment 2.

Note
Review by means of answer sheet in the control folder.

Suitable from the 2nd to 4th school year.

2.15

How do microbes spread?

Objective
The children shall recognise how quickly microbes (the powder) spread in the environment, and that these microbes are to be found on virtually all objects.

The children transmit invisible fluorescent powder which becomes visible under black light by means of a role-playing game.

Materials
Rubber chicken, plastic food items, play money, black light box, fluorescent lotion (2).

Templates
Work assignment.

Note
The teacher must prepare the materials before this experiment. Either only selected materials, or otherwise all materials are coated with the invisible marking powder. In this way the students spread the “bacteria” in the environment in the course of the role-playing game.

2.16

Conclusion poster

Objective
While preparing a presentation, the children shall reflect on the knowledge learned and present the result to the other children.

Materials
Scissors, glue, coloured pencils, tracing paper, possibly pictures and reports from magazines on the subject of hands and hygiene.

Templates
Work assignment

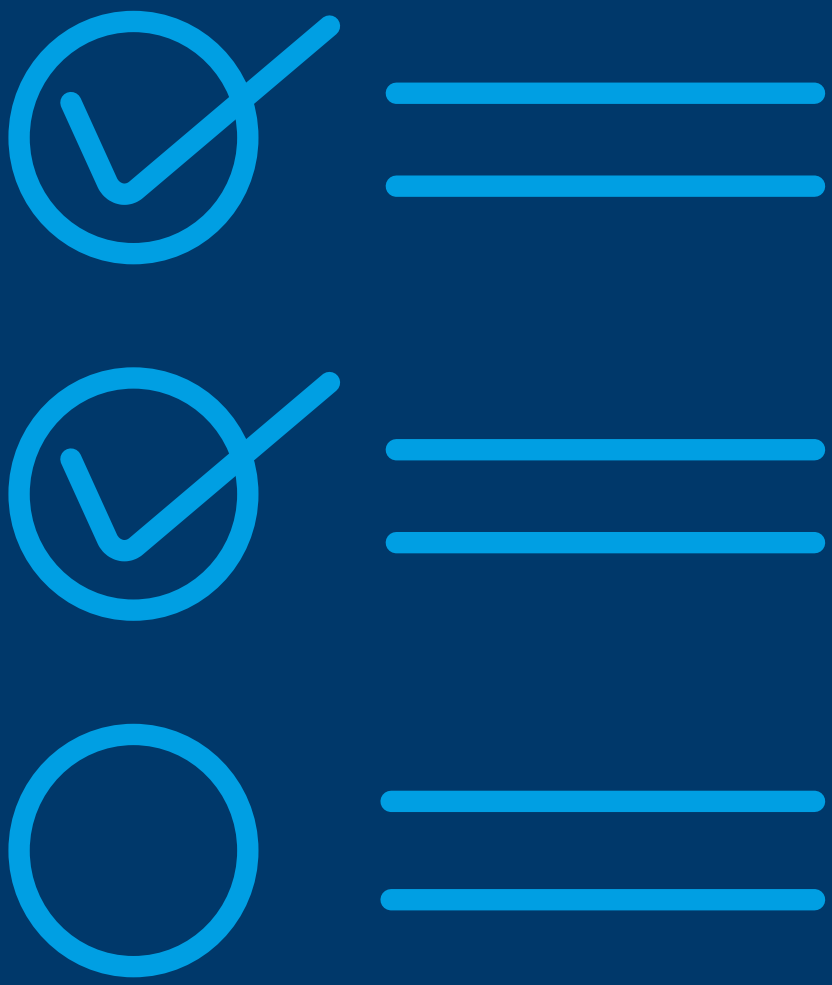
Note
Review by means of answer sheet in the control folder.

Suitable from the 1st to 4th school year.

3

Exercises

3.1 What does hygiene mean?
3.2 Dictation exercise
3.3 The skin as protection against microbes
3.4 How and when do bacteria multiply



3.1

What does hygiene mean?

Hygiene not only means cleanliness. It means much more:

The word “hygiene” stems from the Greek *hygienios*. When translated, this means beneficial to health. Hygiene is the doctrine of the preservation and promotion of health.[1] Hygiene means measures for preserving a person’s health and prevention of diseases.[2]

Footnote 1-2: Der Brockhaus Gesundheit. Schulmedizin und Naturheilkunde, Arzneimittel, Kinderheilkunde und Zahnmedizin. Wissenmedia, 2006.

3.2

Dictation exercise:

“Why are clean hands important?”

- Thorough hand washing is very important, because you can remove microbes from your hands with water and soap. Microbes or germs are tiny living organisms which can cause diseases. You cannot even see them with the naked eye.
- Microbes are everywhere in your environment. This can be bacteria, fungi or viruses. Especially on the hands there can be many microbes, since you touch everything with your hands. Microbes are transmitted through contact with objects. If they find their way into the body via the mouth, nose, small scratches or wounds, they can make you sick. But don’t be afraid! Not all microbes are harmful and cause diseases.
- You can very easily protect yourself against becoming sick by thoroughly washing and drying your hands! Then microbes don’t have a chance.

3.3

The skin as protection against microbes

This is how the fill-in-the-blank text has to be correctly completed:

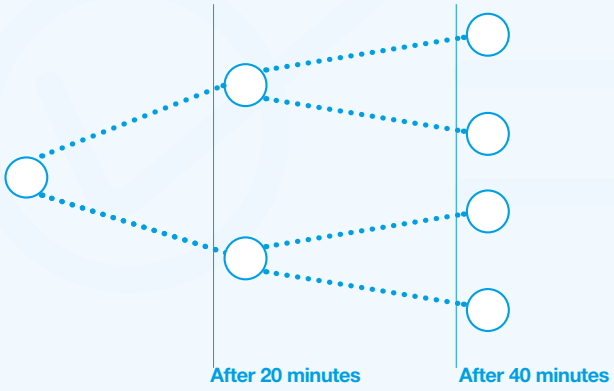
The skin serves as the **body's** protective cover. It prevents microbes from finding their way into the body and making you **sick**. You cannot get sick as long as the microbes remain outside the body on the skin. You also have help in the body known as "body defences", which **combat** microbes when they find their way into the body. But if you have a **wound**, microbes can enter. That's why you have to clean the wound and carefully put a **plaster** on it. Microbes can also find their way into the body through the **mouth**. That's why you should not eat with dirty hands or **chew** on pens or pencils. Lots of microbes can also be **transmitted** when someone sneezes. It is best to sneeze in a handkerchief, if need be you can also sneeze on your shoulder or elbow. Because when you **sneeze** in your hands and you shake hands with someone later, you still have many microbes on your hands which can then be passed on to the other person.

3.4

How and when do bacteria multiply?

What are the ideal conditions for the rapid multiplication of bacteria?

Bacteria need a moist and warm environment in order to be able to rapidly multiply.



Draw the family tree and continue it in your booklet.
(Draw circles instead of bacteria!)

How many bacteria are there
a) After 60 minutes? **8 bacteria**
b) After 80 minutes? **16 bacteria**

Figure out:
How many bacteria are there
a) After 2 hours? **64 bacteria**
b) After 3 hours? **512 bacteria**
(Think beforehand: How many minutes are 2 and 3 hours?
So how often do the bacteria double?)

This is a particularly tricky task: 128 microbes are already on the toilet seat. How many are there
a) After the third doubling? **1,024 bacteria**
b) After 2 hours? **8,192 bacteria**

3.5

How and when do bacteria multiply?

Bacteria multiply incredibly quickly when it is moist and warm. So it happens that there are already quite a few more bacteria after a short time.

You can get a better idea if you do the following experiment:

1. Make a small pellet of paper and put it in a glass.
2. After 20 minutes there are 2, so throw another pellet of paper in the glass.
3. After another 20 minutes there are 4, so double the number once again, and so on.
4. Note down your results in the following table:

How quickly bacteria multiply and their number increases

Doubling	After…minutes = …hours	Number of bacteria
		1
1st doubling	After 20 minutes	**2**
2nd doubling	After 40 minutes	**4**
3rd doubling	After 60 minutes = 1 hour	**8**
4th doubling	After 80 minutes	**16**
5th doubling	After 100 minutes	**32**
6th doubling	After 120 minutes = 2 hours	**64**
7th doubling	After 140 minutes	**128**
8th doubling	After 160 minutes	**256**
9th doubling	After 180 minutes = 3 hours	**512**
10th doubling	After 200 minutes	**1,024**

After the 10th doubling, one bacterium has become 1,024 bacteria.

4

Technical information

4.1 Technical information
4.2 Bacteria, viruses and fungi
4.3 What effect do microbes have on humans?
4.4 How does hand hygiene work?

4.1

Technical information

The history of hand hygiene is closely linked with the name Ignaz Semmelweis (1818–1865), who discovered the connection between smear infection (by smearing germ-laden material, pathogenic germs can enter the body) and childbed fever in 1847. As a consequence, physicians had to wash their hands in a chlorine solution before treating a pregnant woman. The mortality rate of about 9% could be lowered to below 2% with this discovery. As a result, hand hygiene obtained great importance in medicine (Nuland, 2006).

Cleaning hands also plays an important role in everyday life, because the hands serve us as an organ of communication and “tool” so that they are in constant contact with the environment.

We touch objects, surfaces, people, plants, animals, etc. with them, whereby many microbes gather on the hands. These microbes spread particularly fast among children and can cause diseases. Cross-contamination, i.e. a transmission of germs from one spot (e.g. a toilet) to another (e.g. a blackboard eraser) or otherwise transmission of microbes by shaking hands, plays an important role in this context.

“Training for hand washing” was implemented in so-called “test classes” in several American schools. The result over a three-month test period was that well over 50% of students in the control group were more frequently absent than children who went through the training program. This shows the great importance of thorough hand hygiene in school.

As already mentioned above, many microbes gather on the hands because they are found virtually everywhere, such as in nature, in the air, on objects and on the human skin. A large number of microbes belong to the group of microbes.

In the following we would like to provide a brief list of these microbes.

The history of hand hygiene is closely linked with the name Ignaz Semmelweis that discovered the connection between smear infection and childbed fever in 1847

50%

of students in the control group frequently absent than children who went through the training program

Footnote: Nuland, S.B. (2006): Ignaz Semmelweiss. Arzt und großer Entdecker. Piper-Verlag, München.

4.2

Bacteria, viruses and fungi

Bacteria
Bacteria are single-celled living organisms which are between one and two micrometres in size. The chain-shaped genetic material of bacteria exists without partition in the cell. They multiply by means of binary fission, i.e. via growth and division.

The following calculation shows how quickly bacteria can multiply under optimal conditions: 128 bacteria become 1,024 within one hour, 8,192 in two hours and over 1 million bacteria in 4 hours and 20 minutes (They seldom grow this fast in real life. They also do not multiply indefinitely, sooner or later growth levels soft when some limiting factor is reached.)

Bacteria can be classified according to mobility, shape, size, metabolic properties, and their behaviour in the dyeing and growth on artificial culture media. Here we can make a distinction based on the criterion “shape”: spherical bacteria (so-called “cocci”) and rod-shaped or spiral-shaped bacteria are examples of shapes which are further subdivided depending on formation.

Viruses
Viruses can cause infectious diseases among humans, animals and plants, but also among bacteria. Viruses consist of a protein shell (capsid) and a nucleic acid, either DNA or RNA. They are between 0.03 and 0.3 micrometre in size.

Viruses can only multiply if they penetrate a cell which serves as the so-called “host” and re-programme their metabolism so that the cell forms new viruses. Consequently, viruses are cell parasites. Viruses are subdivided into DNA or RNA viruses, corresponding to the nucleic acid. Herpes simplex is an example of a DNA virus.

Fungi
Fungi are single-celled or multicellular organisms which are found in various sizes (10-100 micrometres).They can sometimes live in symbiosis with hosts or as parasites. The growth of fungi occurs through cell divisions, in which case they occur either as individual cells through budding with strobilation of respective daughter cells (yeast) or as multicellular, thread-like structures with formation of a weave (Schubert, 2000). There are flowing transitions between these two shapes.

Factors which also influence the mortality rate of microbes

Influence of light
Daylight causes a reduction of microbial growth on surfaces, in which case ultraviolet rays are most effective.

Furthermore, artificial light has basically the same effect, but the effect occurs slower. In contrast, all pathogenic bacteria survive best in the dark.

Surface
Germs can be eliminated very quickly on smooth, flat surfaces through the influence of daylight. By contrast, small grooves or furrows, scratches on table tops and the like, offer possibilities for germs to retreat.

Small moist niches, in which bacteria have a greater chance of survival due to shading against daylight and due to moisture, can be created through wiping off the respective surface.

Cleaning measures
Cleaning measures decisively counteract germs. That is why daily cleaning of special “sources of danger” is sensible in order to prevent a multiplication of germs. During daily cleaning a person also recognises that there are hardly any germs on the surface after cleaning, but they resettle there in the course of the day.

A person should also take note that frequently used objects are also more strongly populated with germs.

So-called “microorganisms” are found virtually everywhere. A particularly large number of microorganisms can be found in soil.

For example, microorganisms reach the surface by means of wind erosion and are carried away by the wind so that the air’s germ content depends on the degree of dust content. But normally this is relatively minor. Dust always contains bacteria, and consequently the germs linked to it also contaminate objects in rooms.

In addition to germs from the air, the dust in a building also consists of two other sources – skin scales and bacteria which are excreted through a person’s upper respiratory tract (coughing, sneezing, etc.). If a person is ill, pathogenic germs can be detected in the living areas.

As soon as germs are transmitted onto objects, they lose their ability to multiply, regardless of whether they got there by means of dust, dirt or a person’s respiratory tract.

That is why dust particles are merely a vehicle for the transport of germs. But under which conditions do germs multiply? The basic requirement for microbial growth is moisture. This is why increased germ content must be anticipated on moist surfaces such as a washbasin, blackboard eraser, etc.

In addition to moisture, the temperature is an essential factor, since any type of germ grows in a specific temperature range.

Germs generally multiply between 4°C and 63°C, whereby every type of germ prefers a different temperature range. Many germs feel most comfortable in a moist, warm environment.

This is why they are very frequently found in showers, toilet facilities and the like.

Footnote: Schubert, F. (2000): Fachkunde für Arzthelferinnen. Cornelsen-Verlag, Berlin.

What effect do microbes have on humans?
As already mentioned, there are harmless microbes which are used e.g. for cheese making, but there are also pathogenic microbes.

In contrast, children are much more susceptible than adults because their immune system is not yet fully developed. It has been shown that a large number of illnesses which affect children are transmitted via the hands. So hands are regarded as the main carriers of infectious diseases.

That is why adequate preventive measures such as hand hygiene are highly recommendable.

It is even more alarming that people often do not wash their hands. Studies revealed that over 90% of adults indicate having washed their hands after using a toilet. But only about 63% actually also did this.

Only about 50% of secondary school students even wash their hands after using a toilet. Not more than 7.5% of students used soap (Minnesota Department of Health, 2006).

7.5%
of students wash their hands after using a toilet with soap

Microbes and diseases

Several important microbes which are transmitted via the hands can cause the following diseases:

Rubella virus – German measles

Salmonella typhimurium – salmonellae

Bacillus cereus – foodborne illnesses which are expressed with vomiting or diarrhoea

Streptococcus – sinusitis, middle ear inflammation, tonsillitis and scarlet fever

Rhinovirus – colds

Staphylococcus aureus – skin infections and muscular diseases, pneumonia, endocarditis, toxic shock syndrome and sepsis

Influenza viruses A and B – influenza illnesses and swine influenza

Human noroviruses – vomiting and diarrhoea, gastroenteritis

4.3

How does hand hygiene work?

Hand washing is such a regular and routine procedure for most people that it can quickly become careless. This particularly applies to children and adolescents, since they do not pay the necessary degree of importance to this procedure. This is why we want to establish a few important ground rules for hand washing here.

Where do microbes accumulate on the body?
Microbes are to be found on the entire human body. But there are certain spots where quite a few microbes accumulate.

Hands and fingernails
A large number of microbes can be particularly found on the hands and fingernails (approximately 104 to 108 microbes per cm^2), because we do many things with our hands and are in contact with our environment by means of our hands. Dirt tends to accumulate under long fingernails.

Moist, warm body sites
Pathogenic microbes feel most comfortable on moist, warm body sites, so they can be found in great number there. These sites are the spaces between the toes, armpits, groin area and other hairy spots, which means special importance has to be paid to hygiene here.

Mucous membrane
The mucous membrane is a tissue covering the inner surfaces of hollow organs. The mucus produced covers the surfaces like a film, lubricates them and protects against mechanical, chemical or enzymatic destruction Due to the constant mucus covering and the relatively warm temperature, the mucous membranes form an ideal breeding ground for microbes. There are various mucous membranes in the human body. The following are especially notable with respect to infectious diseases:

Oral mucous membrane
Over 100 species of microbes can be found on the oral mucous membrane, and there are about 108 species of microbes in the saliva itself. That is why this area constitutes a source of danger for infections.

Hand washing instructions

Moisten the hands under warm water and apply liquid soap afterwards. Use soap dispensers where possible.

Lather up on both sides of your hands, your wrists, between your fingers and around your nails. Wash for 20 seconds.

After that, rinse the hands under running water.

Finally dry hands, preferably with paper towels.

Nasal mucous membrane
A good many microbes – which are transmitted through sneezing onto the hands and are then able to spread further, e.g. by shaking hands – accumulate in the nasal mucous membrane. It makes sense to use a paper tissue when wiping the nose, because you can reduce the risk of a head cold infection. If no paper tissue is available, you should sneeze on the crook of your arm or on your shoulder.