



Impact of surface hygiene on transmission of infections

22 April, 2021

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Ways of transmissions

Germs are everywhere:

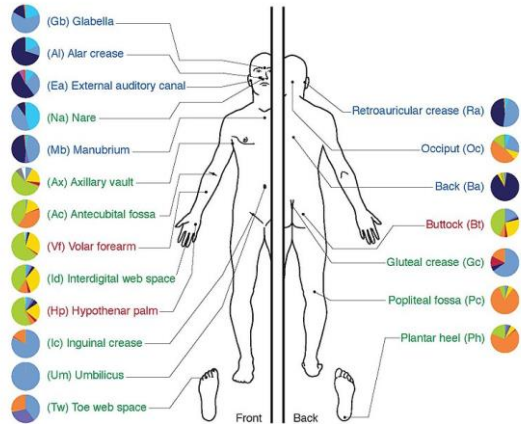
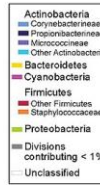
- In us – eg gastrointestinal tract (gut)
- On us – eg skin
- In air
- In water
- On surfaces

Germs can be

- pathogenic, eg *Staphylococcus aureus*
- not pathogenic, eg *Staphylococcus epidermidis*
- but not pathogenic ones can be pathogenic in case of immunodeficiencies, eg *Aspergillus* spp.

Mikrobiom

All germs in and on us:
bacteria and fungus (not virus)
Estimated 39 trillions
Mostly gastrointestinal tract
Also skin, mouth, nose, vagina

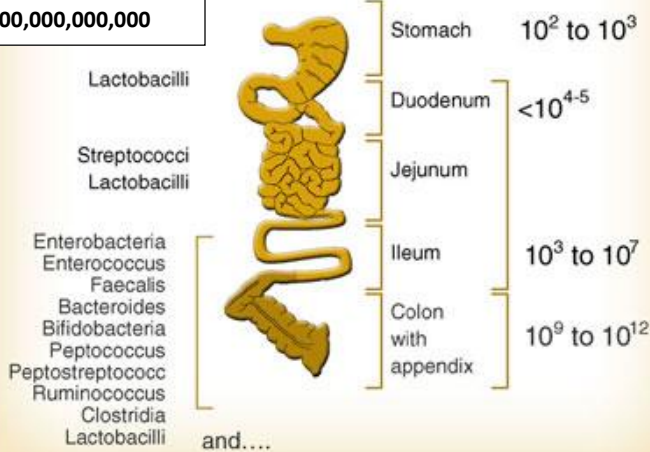


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INTESTINAL MICROFLORA

10^{14} micro-organisms, >500 differentes species

$10^{14} = 100,000,000,000,000$

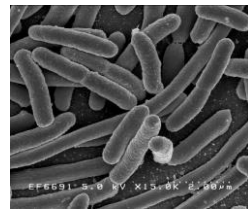


Germs

Bacteria, virus, fungus/mold

Bacteria – examples:

- Escherichia coli:
 - In colon
 - Often bladder infection
- Staphylococcus aureus:
 - 30 % in nose and pharynx
 - Often surgical site infections
- Pseudomonas aeruginosa:
 - Environment: in water
 - Often pneumonia in ventilated patients



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Perioperative Antibiotikaprophylaxe bei Haut- und Weichteileingriffen

Tab. 1 Normalflora der Haut an verschiedenen Lokalisationen (kulturelle Anzucht). (Mod. nach [15])							
	Obere Extremität	Untere Extremität	Kopfhaut	Stirn	Axilla (apokrin)	Normales Perineum	Interdigitalfalte
Keimdichte (pro cm ²)	1,7×10 ³	4,4×10 ³	1×10 ⁶	4,4×10 ⁶	1,3×10 ⁶	4,3×10 ⁷	1,4×10 ⁷
<i>Zusammensetzung (in %)</i>							
– Kokken	93,1	87,8	23,1	7,2	25,7	14,2	22,7
– <i>Corynebacterium</i> spp.	3,9	12,1	2,3	0,02	71,6	84,4	77,2
– Propriobakterien	3,0	0,01	27,5	83,5	2,4	0	0
– Gram-Stäbchen	n.d.	n.d.	0,002	0	0,3	7,7	0,05
– <i>Pityrosporum</i>	n.d.	n.d.	46,7	9,2	n.d.	n.d.	n.d.
– <i>Candida</i> spp.	n.d.	n.d.	n.d.	n.d.	0	0,06	0,02
<i>n.d.</i> nicht spezifiziert.							

Ways of transmissions

Direct

Person A to person B
Example: Covid-19

Indirect

Person A to person X to person B
Person A to surface/toilet... to person B
Example: MRSA by surface and not good cleaning

Higher risk of indirect transmission if environmental persistence is high:
Eg Noro-, Rota-, RS-virus, Staphylococcus aureus, Acinetobacter baumannii,
Clostridium difficile
Infectious dose: Salmonella > 100.000, Norovirus 10-100, SARS-CoV-2 1.000?

Surface: eg furniture, door knob, light switch, stethoscope, working clothes, blood pressure cuff

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HyKoMed

Bacterium persistence on dry surfaces

Bacterium	Duration of persistence
Campylobacter jejuni	Up to 6 days
Clostridium difficile (spores)	5 months
Escherichia coli	1,5 hours – 16 months
Enterococcus spp. including VRE	5 days – 4 months
Klebsiella spp.	2 hours – 30 months
Salmonella typhi	6 hours – 4 weeks

Kramer, BMC Infect Dis 2006, 6, 130

Ways of transmissions

Droplets and aerosols – via air mostly, indirect via surface possible for some germs
Eg measles, diphtheria, varicella, Covid-19

Parenteral – via damaged skin or mucosa – eg injections, infusions, blood transfusion
Eg hepatitis B, C, HIV

Vector associated – mostly insects
Eg plague by fleas from animal, malaria, yellow fever

Contaminated surfaces
Eg MRSA, MRGN (ESBL)

Food and water
Eg salmonella, legionella

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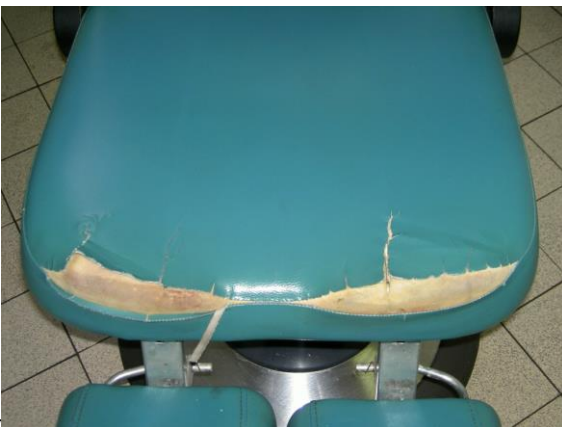
	Germ reduction
Cleaning	factor 10 to 100. 1-2 lg step. KRINKO: Germ reduction 50-80 %
Disinfection	factor 1,000 to 100,000. 3-5 lg step. KRINKO: Germ reduction 85-99 % Hand disinfection: 2 lg step realistic.
Sterilisation	No living germs left.



Example		
Start	1,000,000 germs	10,000 germs
After best cleaning	10,000 germs	100 germs
After best disinfection	10 germs	0 germs
After sterilisation	0 germs	0 germs



Surfaces should withstand cleaning agents (disinfectants).
Cleaning must be possible.





Fortbildung -1/2011



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German ICU 40-50 years ago

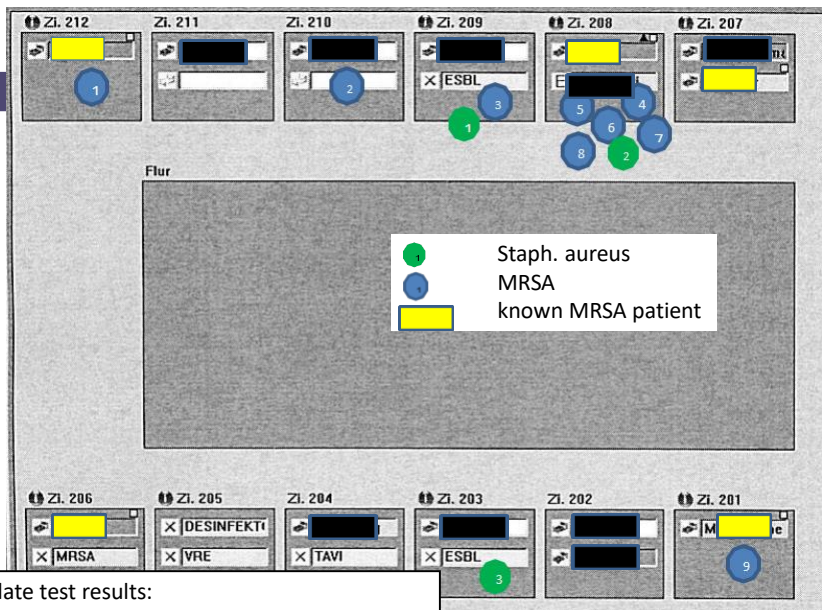


Plate test results:
 9 x MRSA
 3 x Staph. aureus



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Surfaces in cars

Hard surfaces: eg cockpit, steering wheel

Soft surfaces – textiles – hard to clean

Air conditioning – problem if wet inside

Problems:

Eating

Children

Animals

Carsharing



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