Clean Hospitals Day Special Lecture: The 6 Technical Domains of healthcare environmental hygiene

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Chair, Clean Hospitals

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Hosted by Paul Webber
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October 18, 2024

On the menu…

The role of the healthcare environment in transmission

Clean Hospitals Day 2024

- Theme & Campaign materials

The 6 Technical Domains of HEH

- Surfaces
- Air control
- Water control
- Device reprocessing & Sterilization
- Laundry
- Waste management

The HEHSAF

Partners and Stakeholders

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The role of hand hygiene and healthcare environmental hygiene in disease transmission

- Depends on the setting and estimates vary
- An estimated 40-70% of HAI are caused by contaminated hands
- An estimated 20-40% of HAI are spread through the healthcare environment
- Evidence-based IPC interventions have been shown to be effective in preventing at least 50% of HAIs*

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*Umscheid et al. *Infect Control Hosp Epidemiol*. 2011; 32: 101-114

Burden of the healthcare environment

According to a recent study, large-scale multi-center randomized controlled trial showed that:

- The environment accounted for at least 10-30% of MDRO acquisition, even though the intervention focused solely on strategies to enhance terminal room disinfection

- This indicates that the full impact of the healthcare environment on colonization and HAIs is possibly higher than expected

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Chen et al. "A prospective study of transmission of multidrug-resistant organisms (MDROs) between environmental". ICHE (2019)

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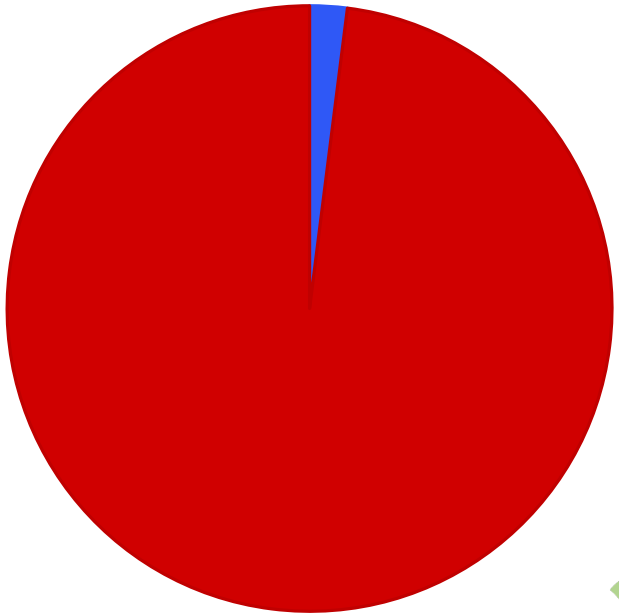
HEH programs are grossly insufficient across resource levels

From a group of 51 facilities in 35 countries:

98% of HCFs were majorly lacking in at least one of the five main components of HEH!



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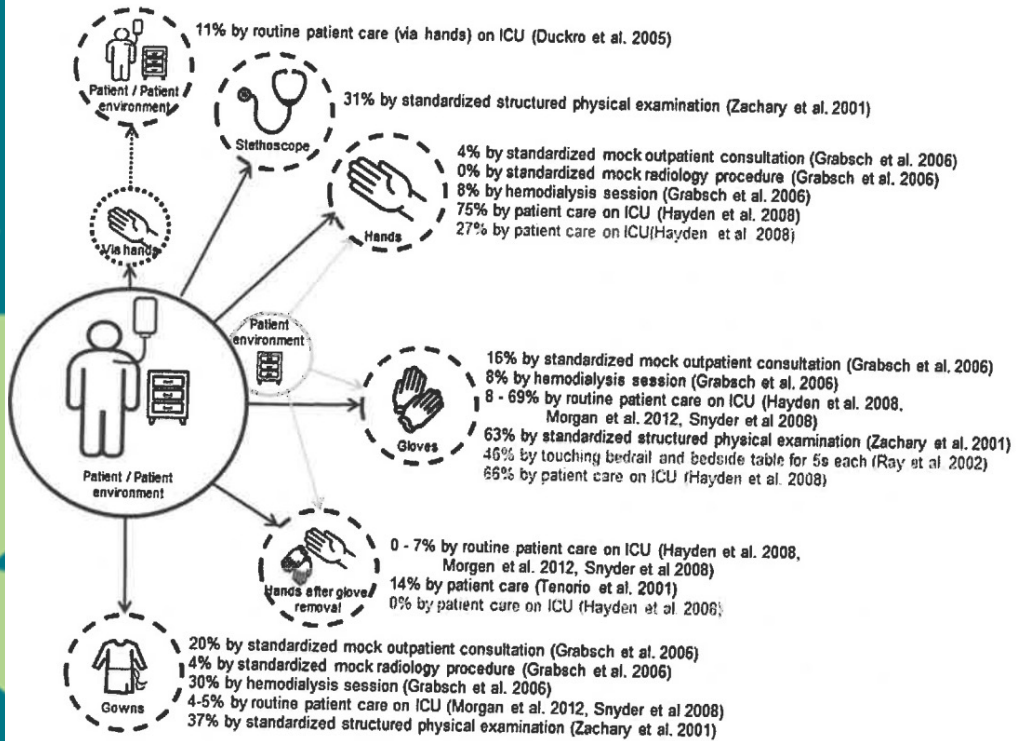
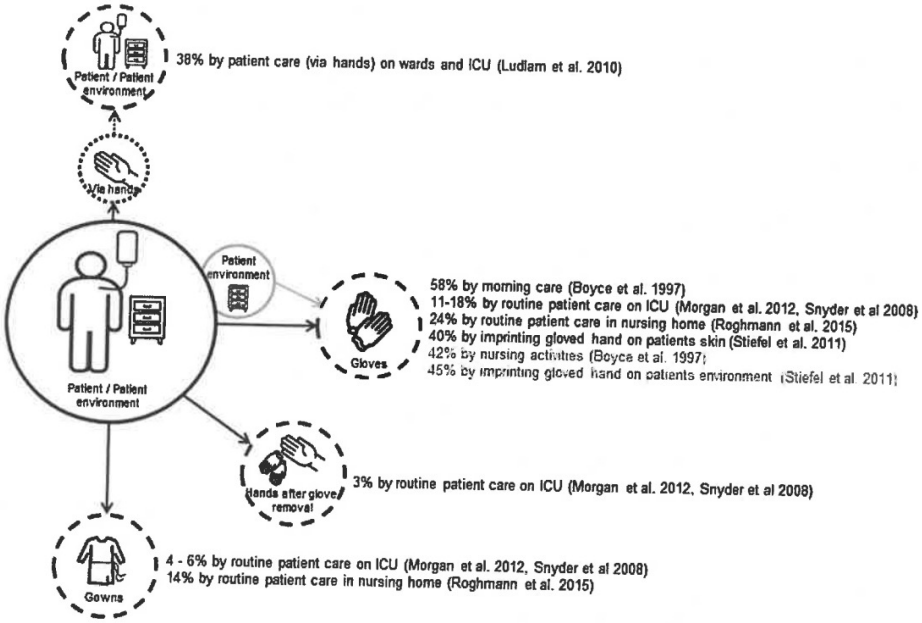
Peters A, et al. Am J Infect Control. 2022 Dec;50(12):1302-1310.

Transfer frequency of VRE and MRSA

VRE



MRSA



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Wolfenberger et al. “Transfer of pathogens to and from patients, healthcare providers, and medical devices during care activity-a systematic review and meta-analysis : Figure 2”. ICHE (2018)

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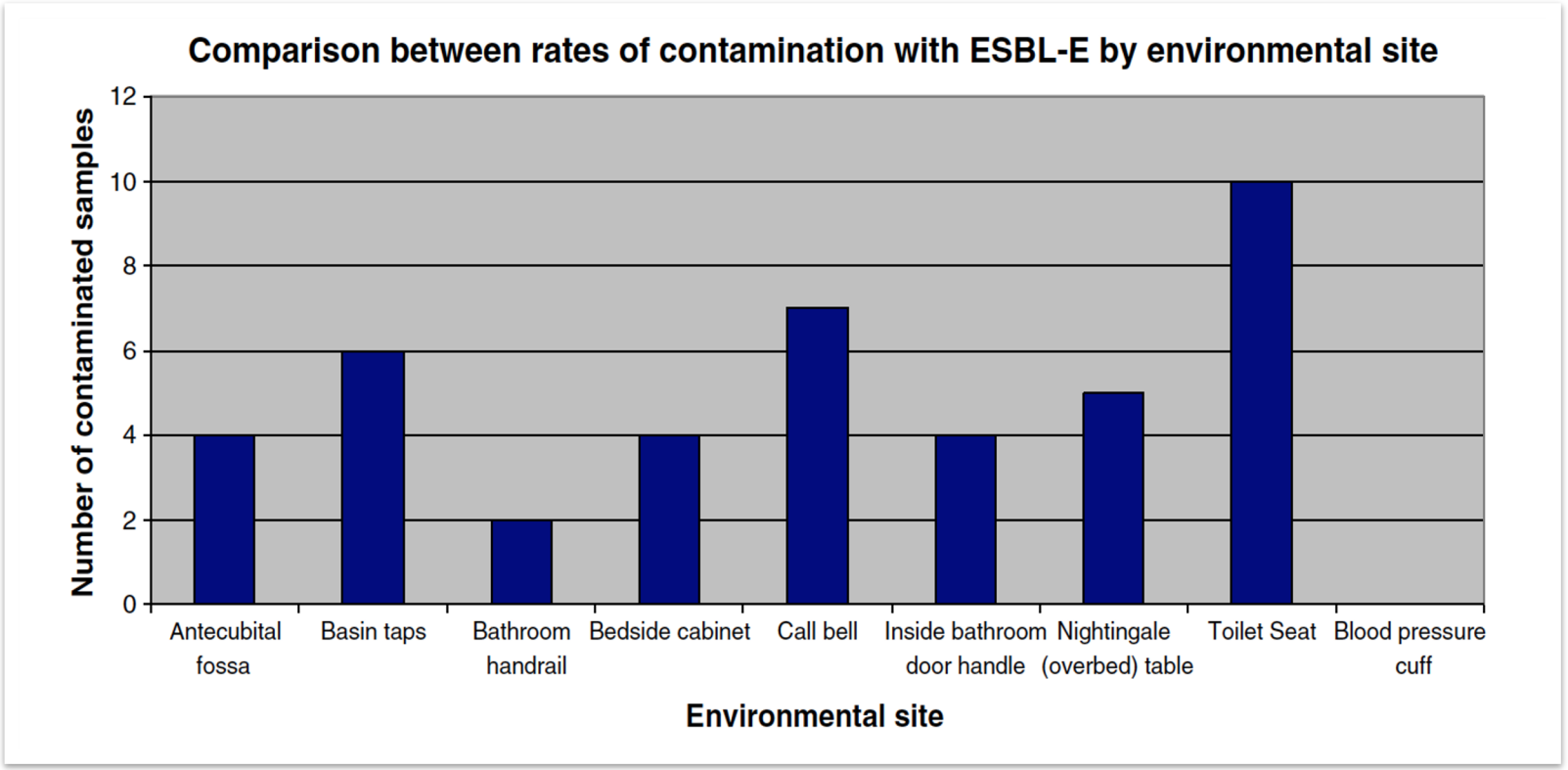
Relative Rates of Contamination Across the Different Sites



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Freeman et al. *Antimicrobial Resistance and Infection Control* 2014, 3:5

Adapted from a slide by Dr. Andreas Voss

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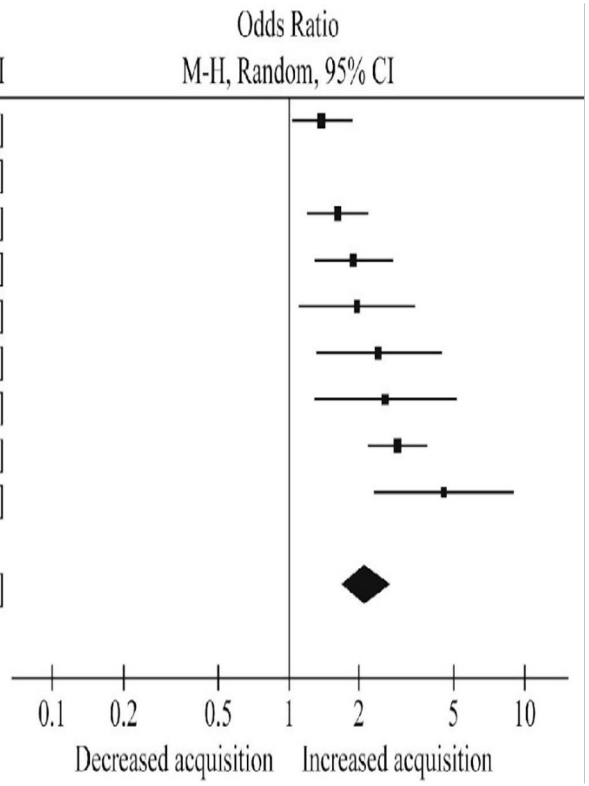
Risk of acquisition from prior room occupants by organism

Study or Subgroup	Decreased acquisition Events	Total	Control Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Huang (MRSA)	57	1454	248	8697	16.2%	1.39 [1.04, 1.86]
Nseir (ESBL producing Gram neg)	8	50	50	461	0.0%	1.57 [0.70, 3.52]
Huang (VRE)	58	1291	256	9058	16.2%	1.62 [1.21, 2.16]
Ajao (Klebsiella sp. or Escherichia coli)	32	648	235	8723	14.2%	1.88 [1.29, 2.74]
Nseir (Pseudomonas)	21	85	61	426	10.4%	1.96 [1.12, 3.45]
Drees (VRE)	19	138	31	500	9.7%	2.42 [1.32, 4.43]
Shaughnessy (Clostridium difficile)	10	91	77	1679	8.3%	2.57 [1.28, 5.15]
Mitchell (MRSA)	74	884	163	5344	16.4%	2.90 [2.18, 3.86]
Nseir (Acinetobacter)	16	52	41	459	8.6%	4.53 [2.32, 8.86]
Total (95% CI)		4643		34886	100.0%	2.14 [1.65, 2.77]
Total events	287		1112			

Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 21.32$, df = 7 (P = 0.003); $I^2 = 67\%$

Test for overall effect: Z = 5.74 (P < 0.00001)



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Mitchell, B. G., Dancer, S. J., Anderson, M. & Dehn, E. Risk of organism acquisition from prior room occupants: a systematic review and meta-analysis. *J. Hosp. Infect.* 91, 211–217 (2015).

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CH Day 2024:
Focus on the 6 Technical Domains of HEH

Surfaces

Reprocessing and Sterilization

Water Control

Air Control

Laundry

Waste Management

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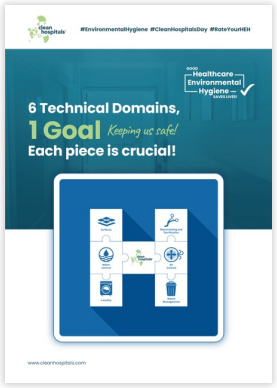
2024 Campaign materials

Main Poster



6x Domain focused posters

SoMe Tiles

Factsheet

Original Posters Rebranded risk zones in current style

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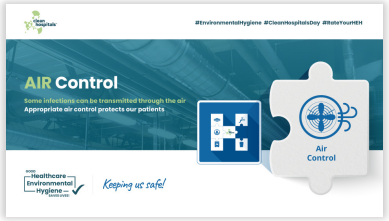
Screen Savers



https://cleanhospitals.com/promotional-toolkit-2024/

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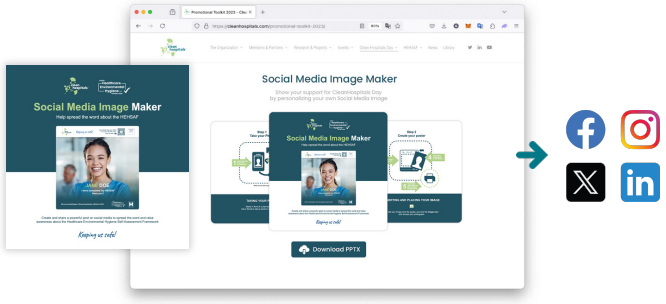
2024 Campaign Advocacy materials

Selfie Poster Maker (PPT)

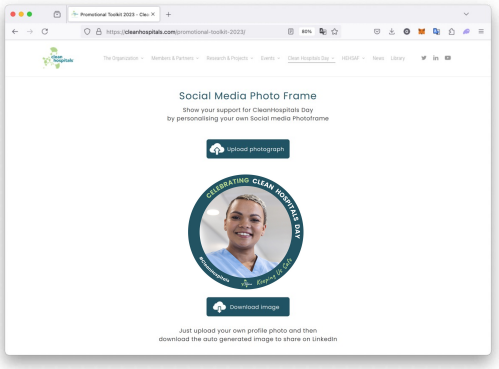
Post HEHSAF Campaign



Video Conferencing Background

Selfie Board

Social Photo Frame



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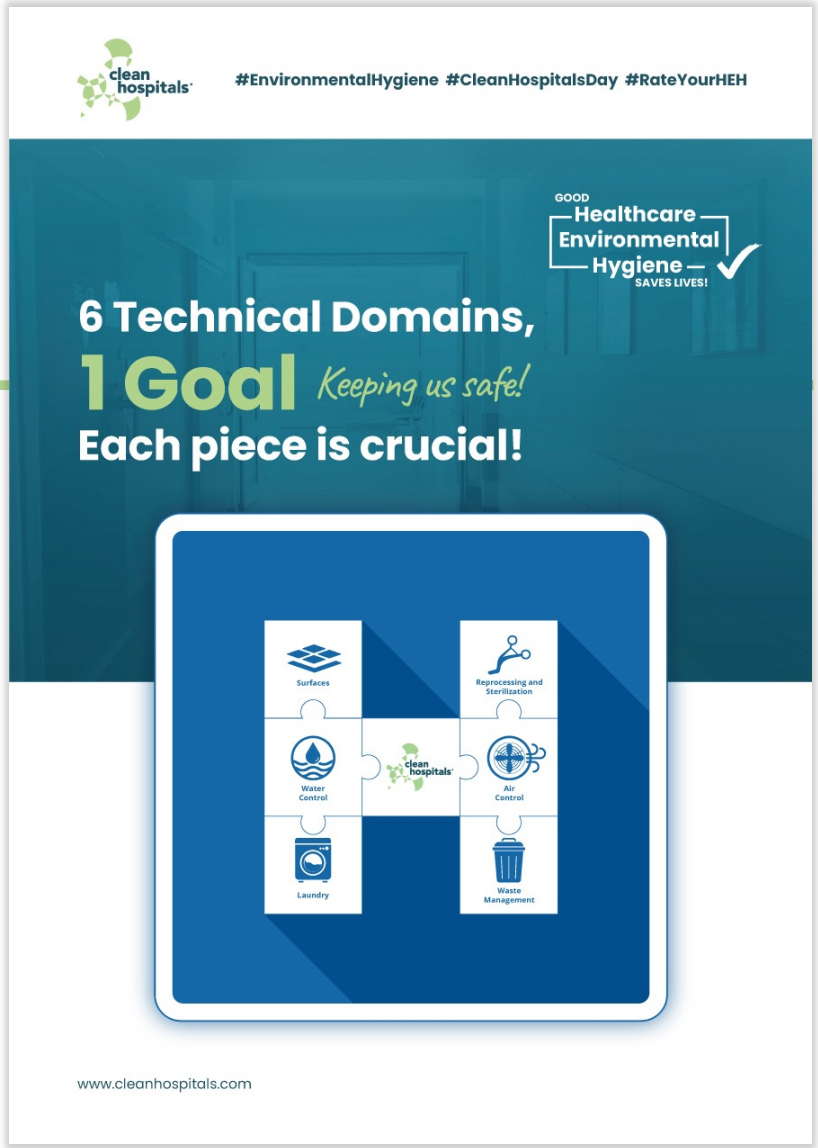
2024
Main campaign poster



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2024 Campaign Materials

3) Selfie Poster Maker (PowerPoint File)

Goal to encourage easy User Generated Content (UGC) to show support of HEHSAF on Social Media

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2024 Campaign Posters

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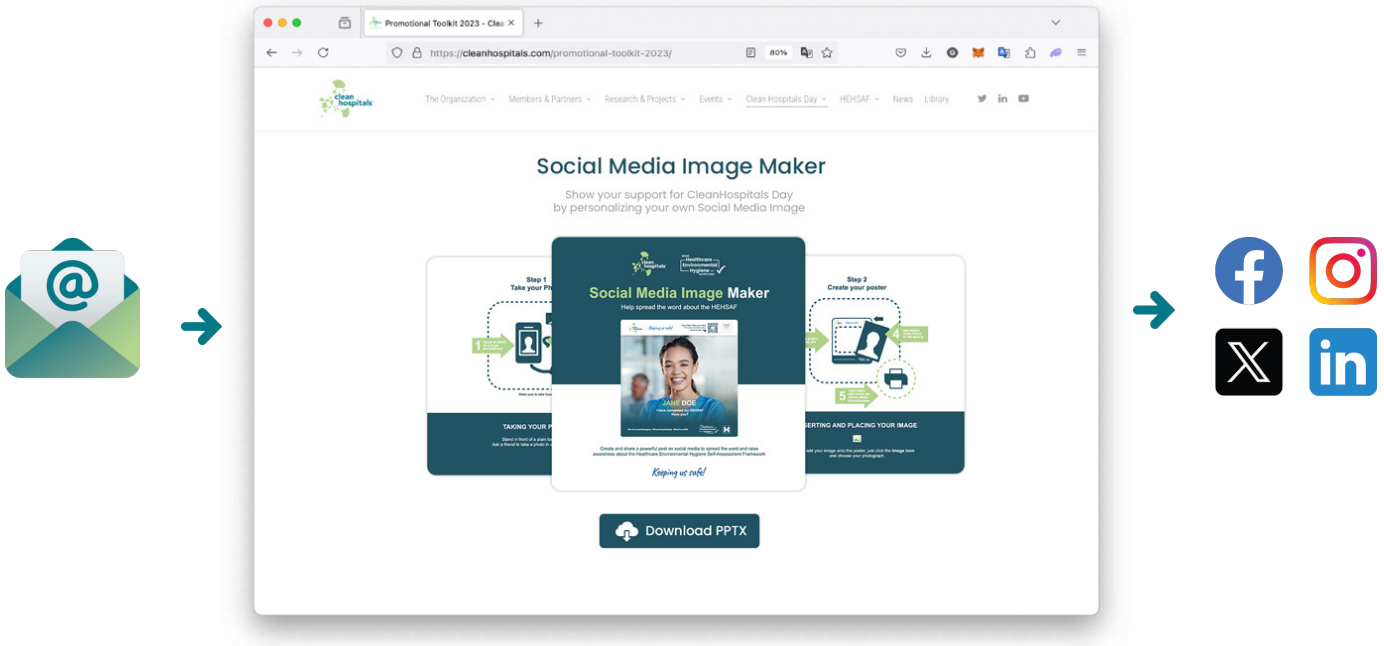
2024 Campaign Materials



Step 1:
People complete the HEHSAF

Step 2:
Send them thank you email with a link to their CH website for them to download a PPT SoMe image maker

Step 3:
Encourage people to share the image on social media

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Social Media Tiles

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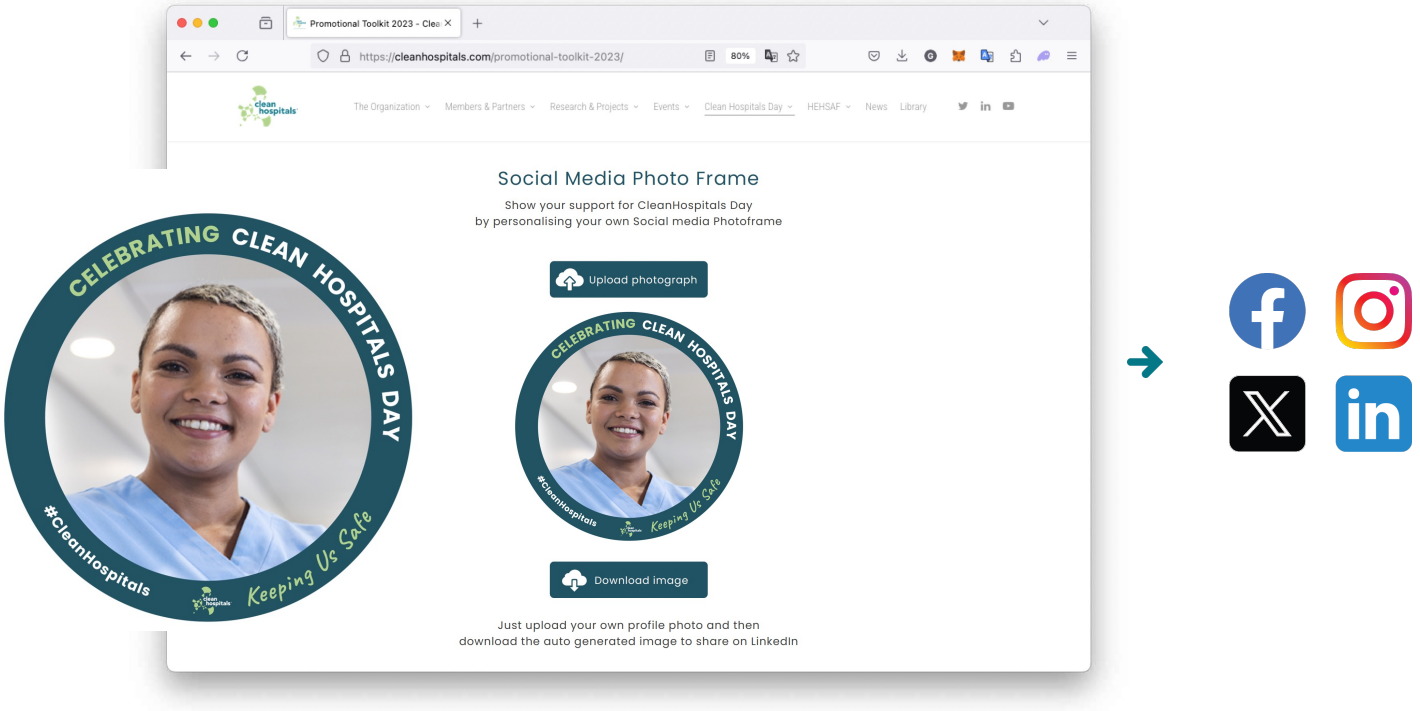
Social Media Photo Template Maker



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Screen Savers

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Video Conferencing Background

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Selfie board

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Selfie board

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Additional Campaign Materials from previous years

Rebranded 2022 Risk Zones

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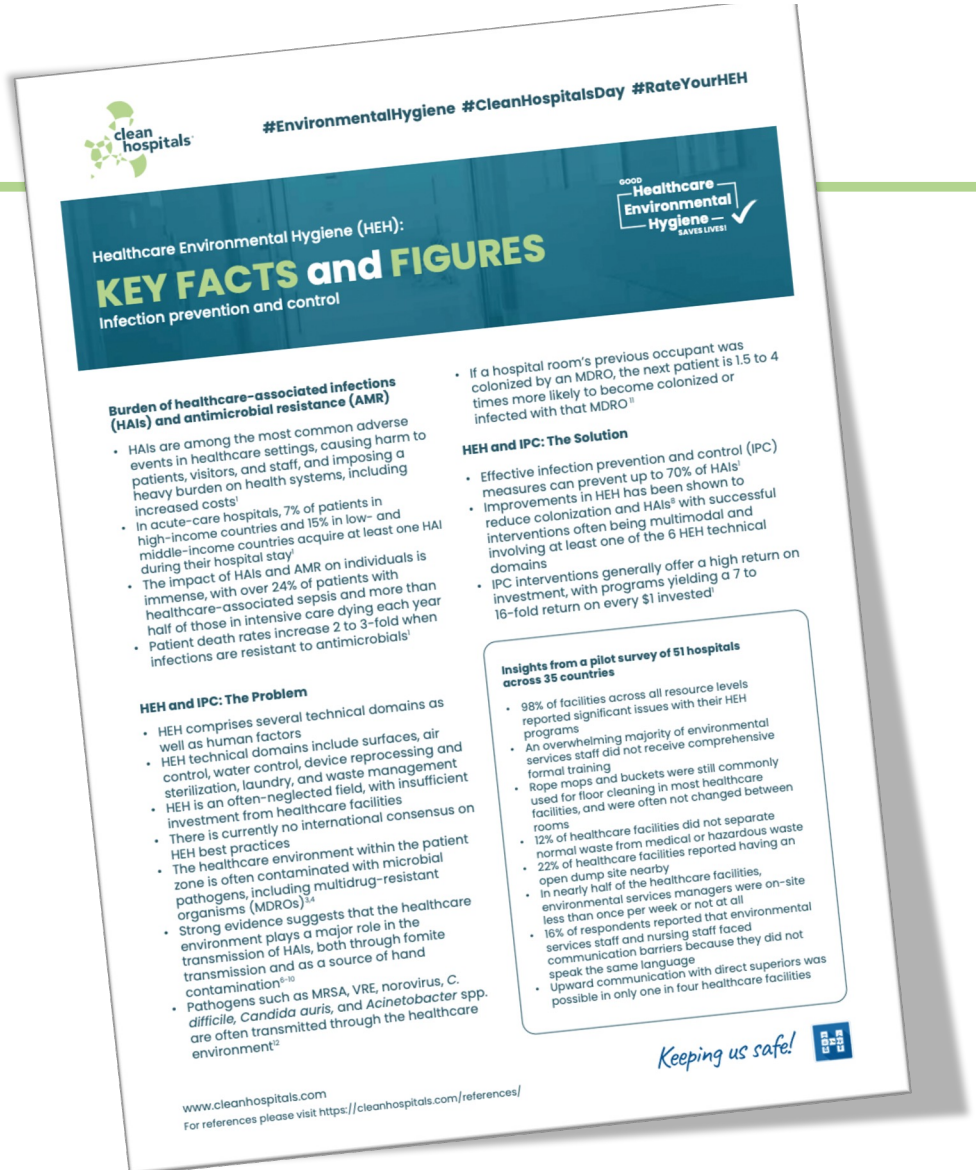
Fact Sheet



#EnvironmentalHygiene #CleanHospitalsDay #RateYourHEH

Healthcare Environmental Hygiene (HEH):

KEY FACTS and FIGURES

Infection prevention and control

GOOD Healthcare Environmental Hygiene SAVES LIVES!

Burden of healthcare-associated infections (HAIs) and antimicrobial resistance (AMR)

- HAIs are among the most common adverse events in healthcare settings, causing harm to patients, visitors, and staff, and imposing a heavy burden on health systems, including increased costs[1]
- In acute-care hospitals, 7% of patients in high-income countries and 15% in low- and middle-income countries acquire at least one HAI during their hospital stay[2]
- The impact of HAIs and AMR on individuals is immense, with over 24% of patients with healthcare-associated sepsis and more than half of those in intensive care dying each year
- Patient death rates increase 2 to 3-fold when infections are resistant to antimicrobials[1]

HEH and IPC: The Problem

- HEH comprises several technical domains as well as human factors
- HEH technical domains include surfaces, air control, water control, device reprocessing and sterilization, laundry, and waste management
- HEH is an often-neglected field, with insufficient investment from healthcare facilities
- There is currently no international consensus on HEH best practices
- The healthcare environment within the patient zone is often contaminated with microbial pathogens, including multidrug-resistant organisms (MDROs)[3,4]
- Strong evidence suggests that the healthcare environment plays a major role in the transmission of HAIs, both through fomite transmission and as a source of hand contamination[6-10]
- Pathogens such as MRSA, VRE, norovirus, *C. difficile*, *Candida auris*, and *Acinetobacter* spp. are often transmitted through the healthcare environment[12]
- If a hospital room's previous occupant was colonized by an MDRO, the next patient is 1.5 to 4 times more likely to become colonized or infected with that MDRO[11]

HEH and IPC: The Solution

- Effective infection prevention and control (IPC) measures can prevent up to 70% of HAIs[5]
- Improvements in HEH has been shown to reduce colonization and HAIs[8] with successful interventions often being multimodal and involving at least one of the 6 HEH technical domains
- IPC interventions generally offer a high return on investment, with programs yielding a 7 to 16-fold return on every $1 invested[1]

Insights from a pilot survey of 51 hospitals across 35 countries

- 98% of facilities across all resource levels reported significant issues with their HEH programs
- An overwhelming majority of environmental services staff did not receive comprehensive formal training
- Rope mops and buckets were still commonly used for floor cleaning in most healthcare facilities, and were often not changed between rooms
- 12% of healthcare facilities did not separate normal waste from medical or hazardous waste
- 22% of healthcare facilities reported having an open dump site nearby
- In nearly half of the healthcare facilities, environmental services managers were on-site less than once per week or not at all
- 16% of respondents reported that environmental services staff and nursing staff faced communication barriers because they did not speak the same language
- Upward communication with direct superiors was possible in only one in four healthcare facilities

Keeping us safe!

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For references please visit https://cleanhospitals.com/references/

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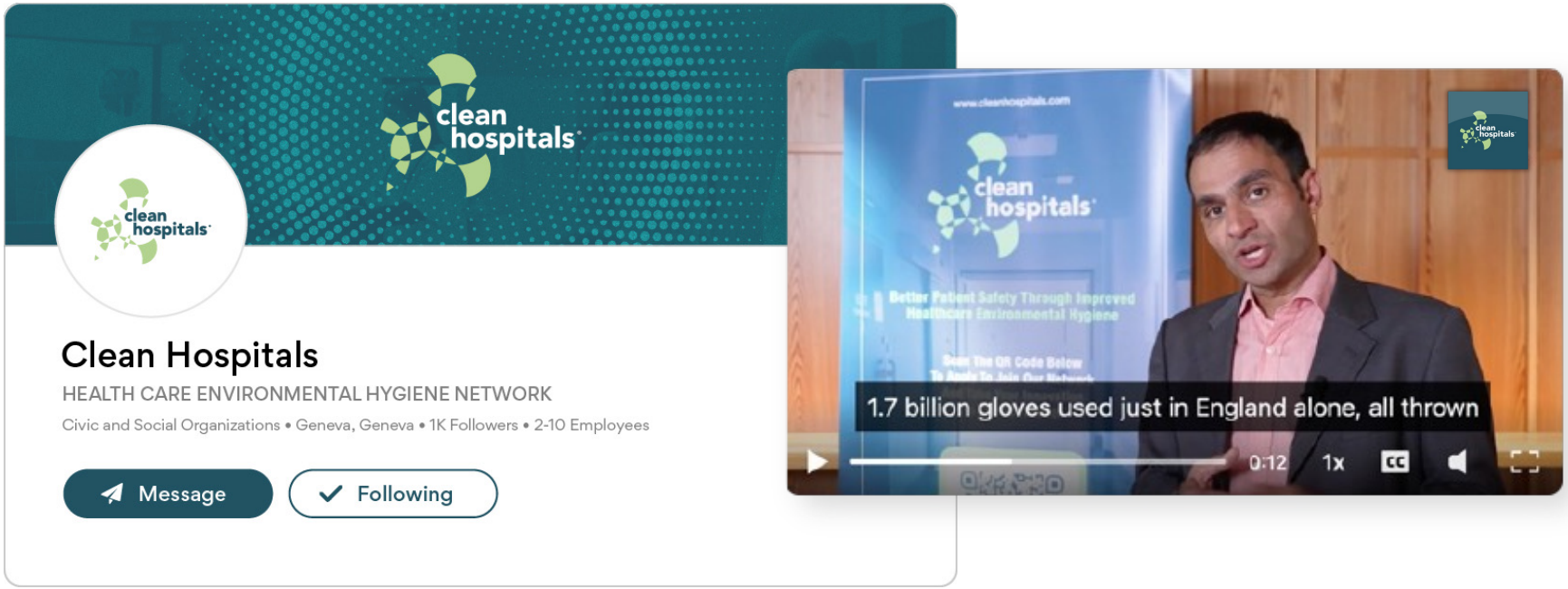
LinkedIn



Please promote and comment on the videos and encourage staff to do the same.
Not only on the day but throughout the year.

https://www.linkedin.com/company/cleanhospitals

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HEH human & technical elements

Technical Domains:

- Surface cleaning & disinfection
- Laundry
- Sterilization & device reprocessing
- Waste management
- Air control
- Water control

Human Components:

- Workforce
- Training
- Workflow
- Monitoring
- Career development
- Management
- Cost and value

Surfaces

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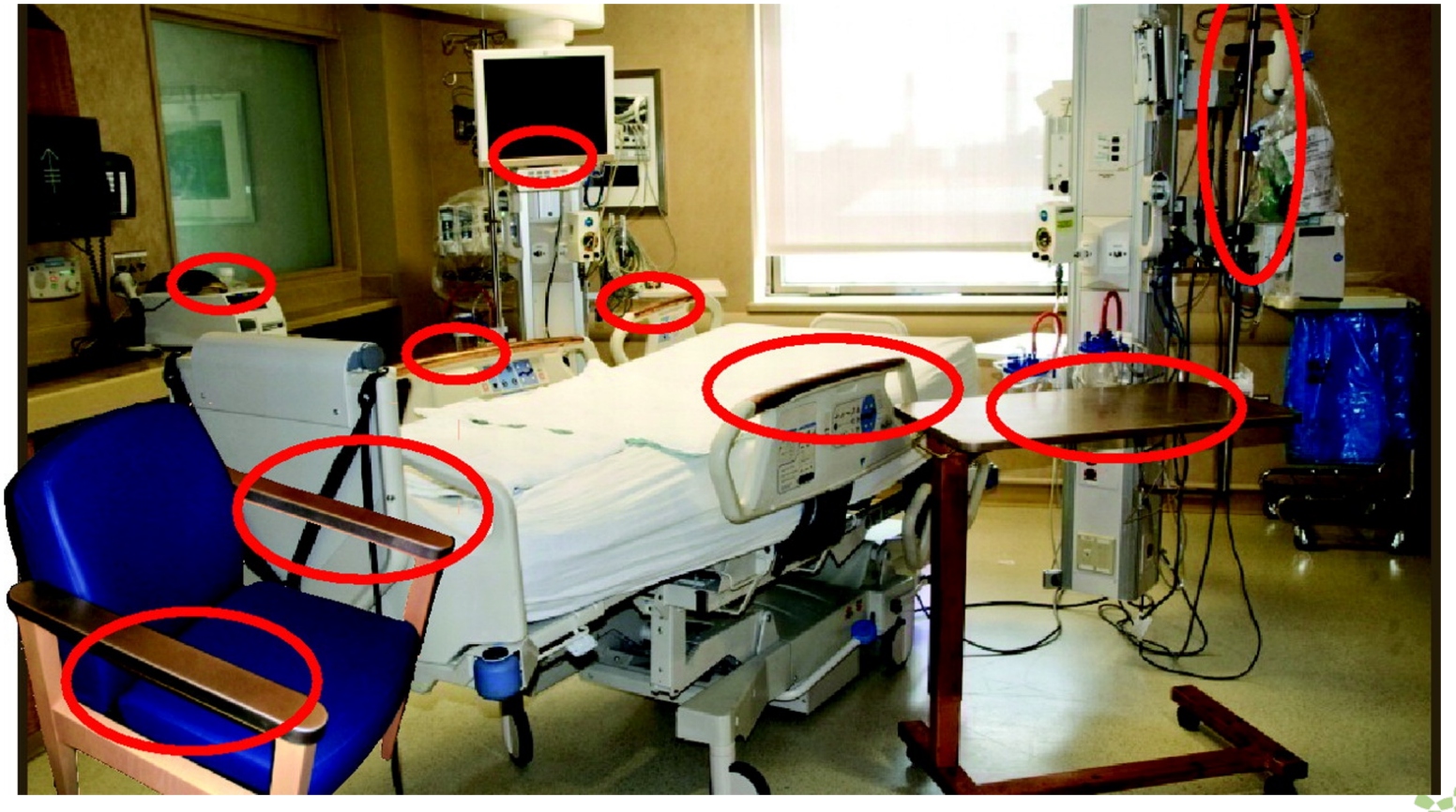
High touch areas in a hospital room



Journal of Clinical Microbiology DOI: 10.1128/JCM.01032-12

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Cleaning versus disinfection

- Both reduce bacterial contamination
- Difference in reduction

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Adapted from a slide by Prof. Andreas Voss

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Detergents and disinfectants: What is the difference?

- Detergents: CLEAN

  They have a chemical action to REMOVE SOIL

- Disinfectants: KILL microbes

  They do NOT REMOVE SOIL!

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Product Delivery

- Liquid products are preferred for routine cleaning because they are easy to use
- Products can be pre-diluted or diluted by the EVS worker according to specific calculations
- **Perfumes should not be used!**
  - May provoke allergies
  - Serve no purpose for HEH
- **Sprays are not recommended!**
  - It is difficult to control the dose of the product
  - Aerosolized particles can pose a health risk

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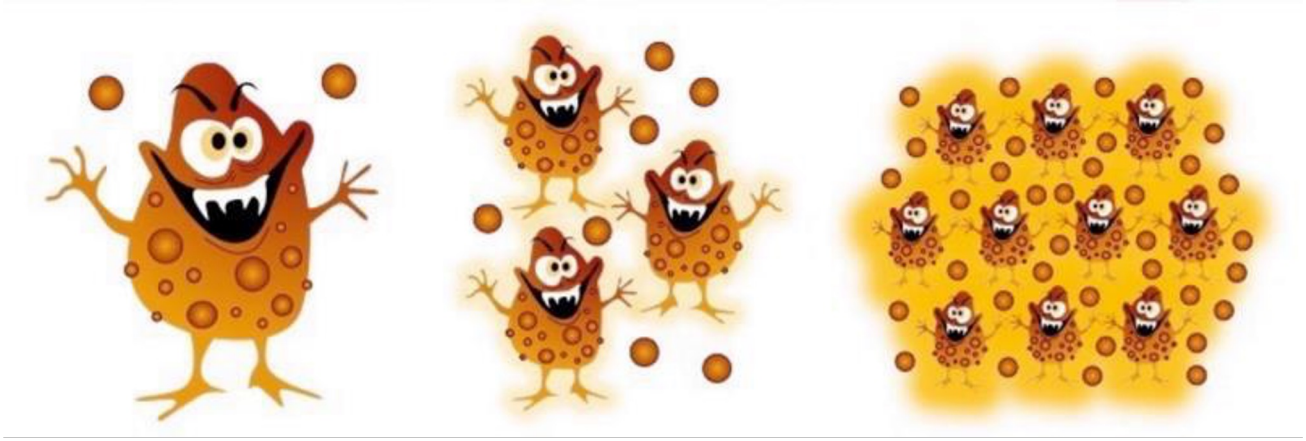
Biofilms

- Wet and dry biofilms
- Make it much harder to clean and remove microbes
- High disinfectant use can increase resistance…



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WASTE: Workforce, Area, Substance, Technique, Equipment

- **Workforce**- The individuals responsible of organizing, executing and verifying a cleaning activity
- **Area**- The environment to be cleaned. This includes the type of surface, if it is intact and the level and type of contamination
- **Substance**- The chemical component/product to cleaning, whether detergent or disinfectant
- **Technique**- The mechanism by how the cleaning substance is applied by either a person or a machine
- **Equipment**- The machines or tools used to effectuate cleaning. This includes everything from a microfiber cloth to a hydrogen peroxide vapor machine

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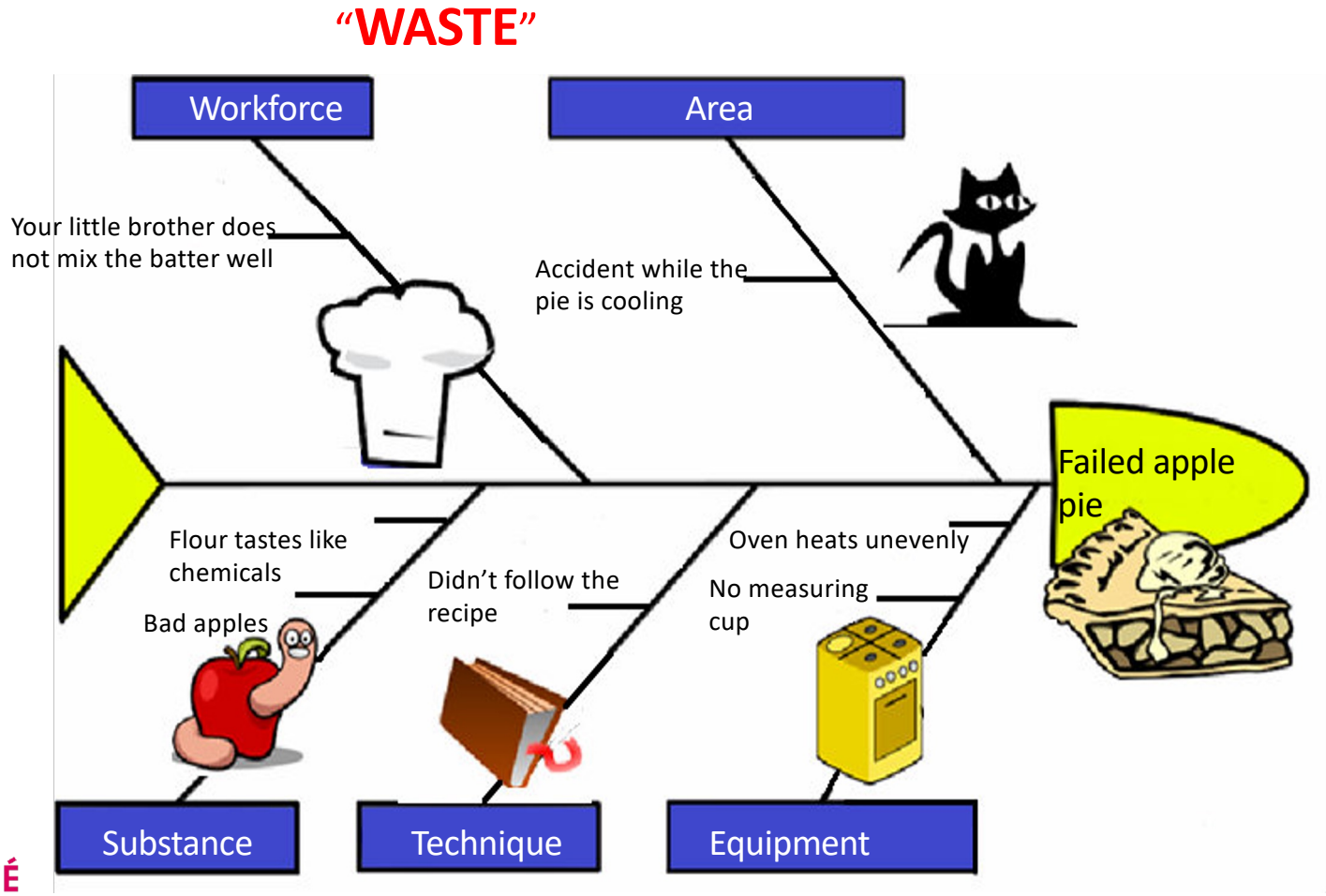
Peters et al. "Keeping hospitals clean and safe without breaking the bank. *JHI* (2018)

Environmental hygiene: How to get there ?



Courtesy of Patrick Albrecht HUG environmental hygiene services

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Sinner's circle: The basics of cleaning

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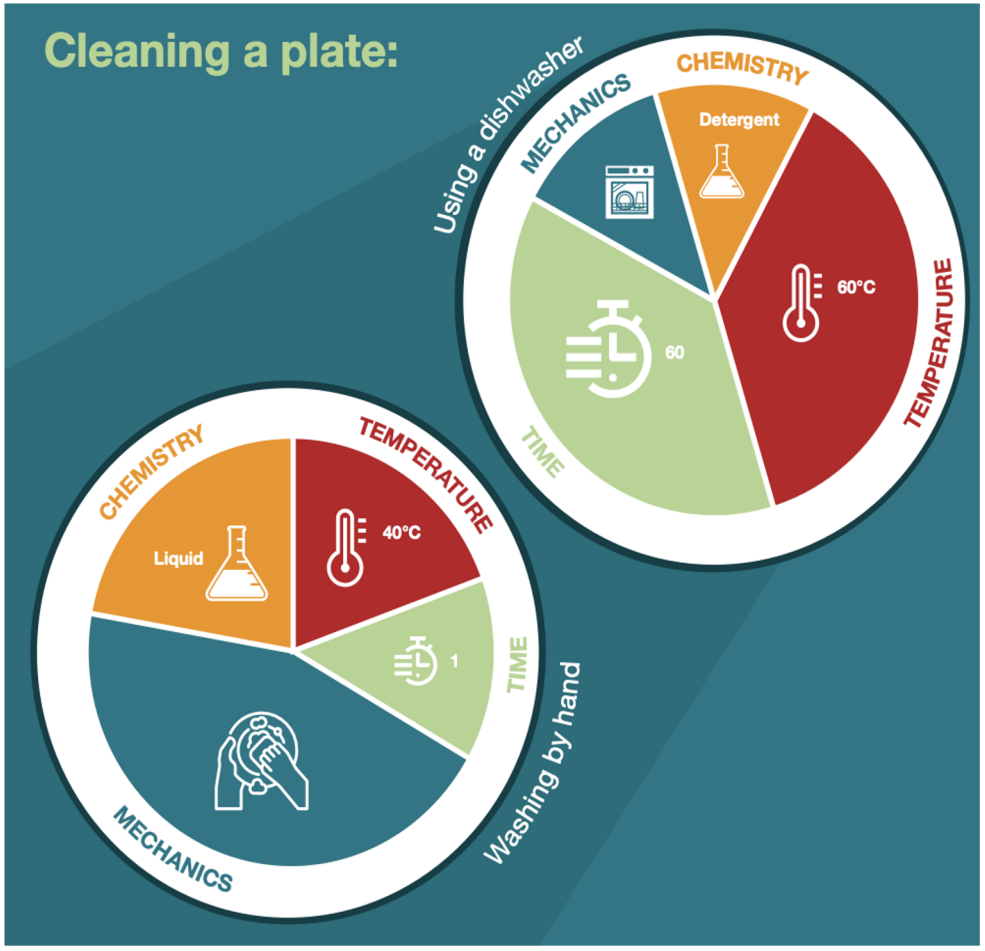
Sinner's circle example: Washing a plate



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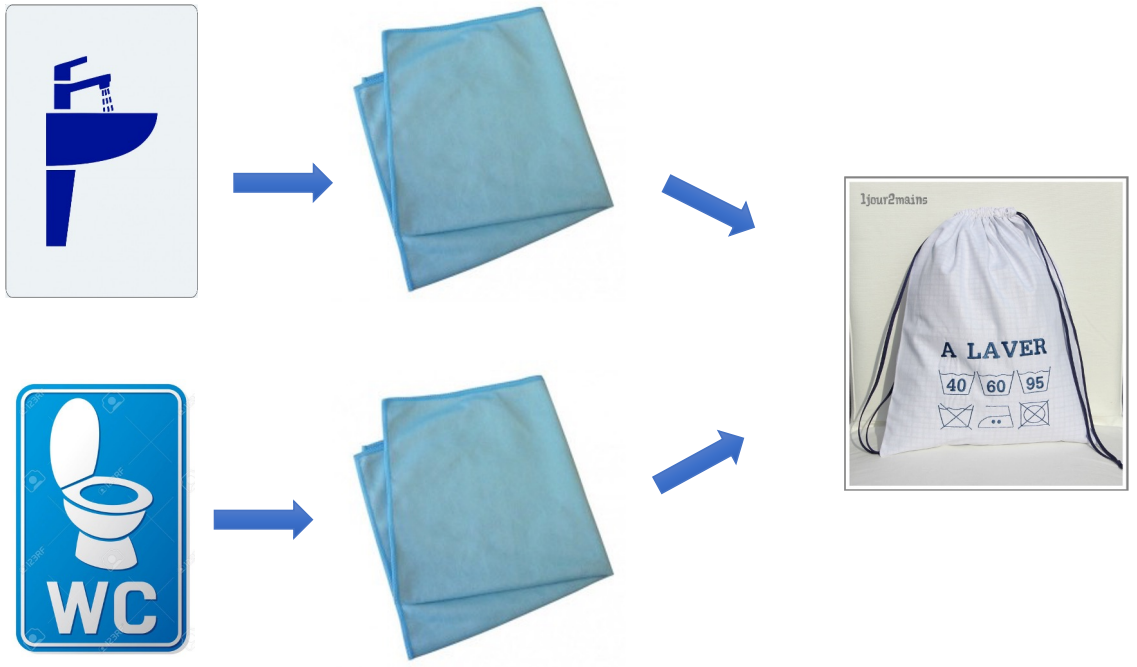
One object/action per cloth, and always move from the cleanest to the dirtiest areas



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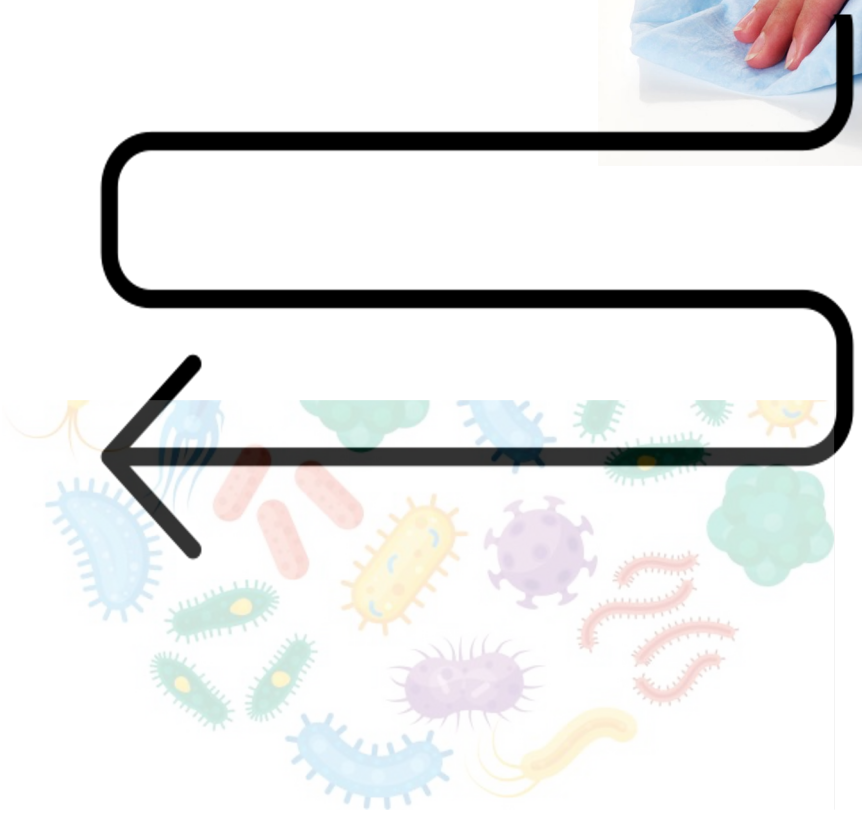
Wiping a surface safely

How do you safely wipe a surface?



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Contact time vs. dry time

- Contact time is the time that a liquid product needs to stay WET on a surface
- Dry time is how long a product takes to dry
- Sometimes contact times are longer than dry times depending on the product and application
- This means that the surface won't be well disinfected!

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Air Control

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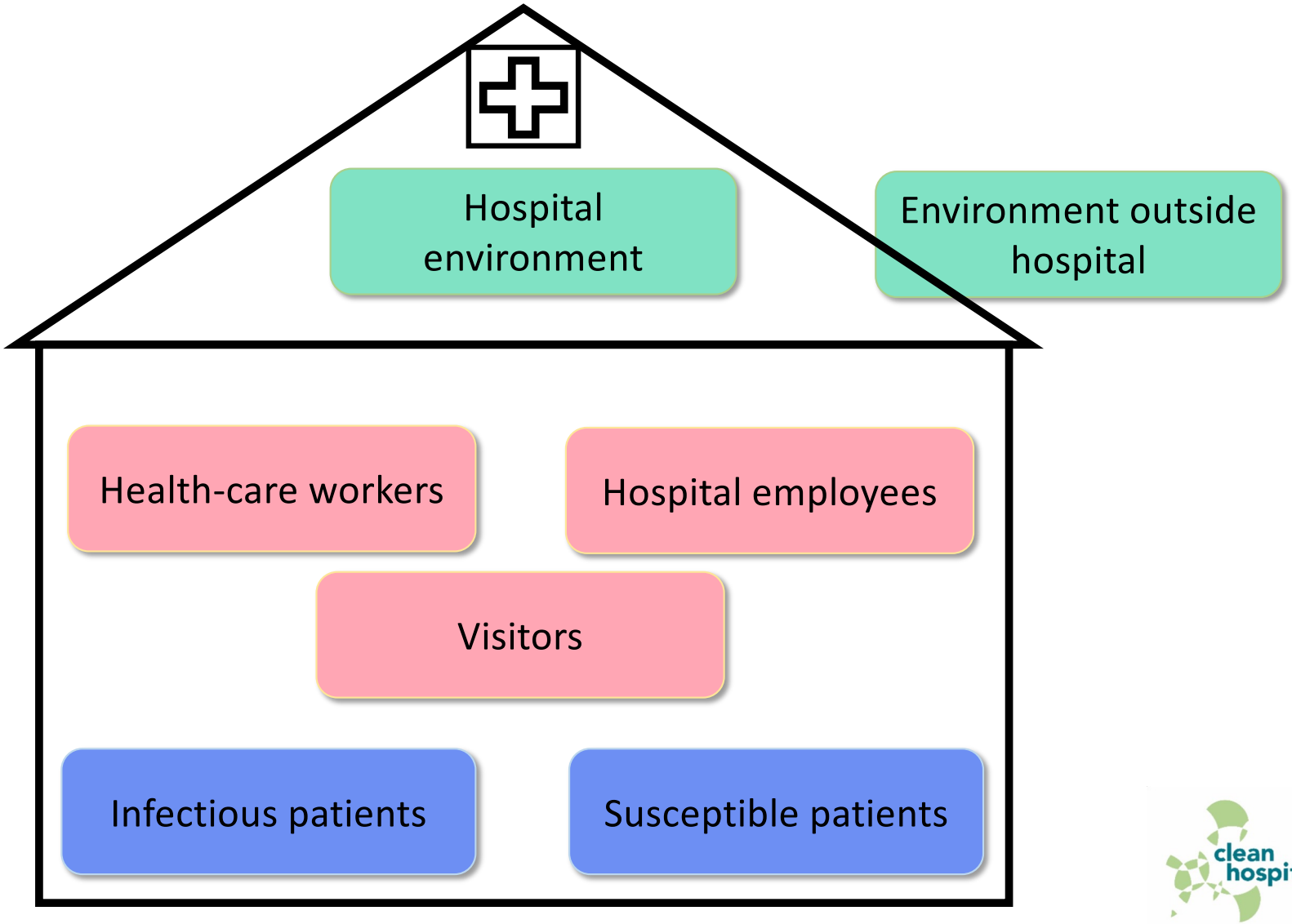

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The Usual Suspects

Fungi

Aspergillus spp.
Mucorales/Rhizopus spp.

Viruses

Measles virus
Varicella Zoster virus
Influenza virus
RSV
SARS-CoV-2

Bacteria

Mycobacterium tuberculosis

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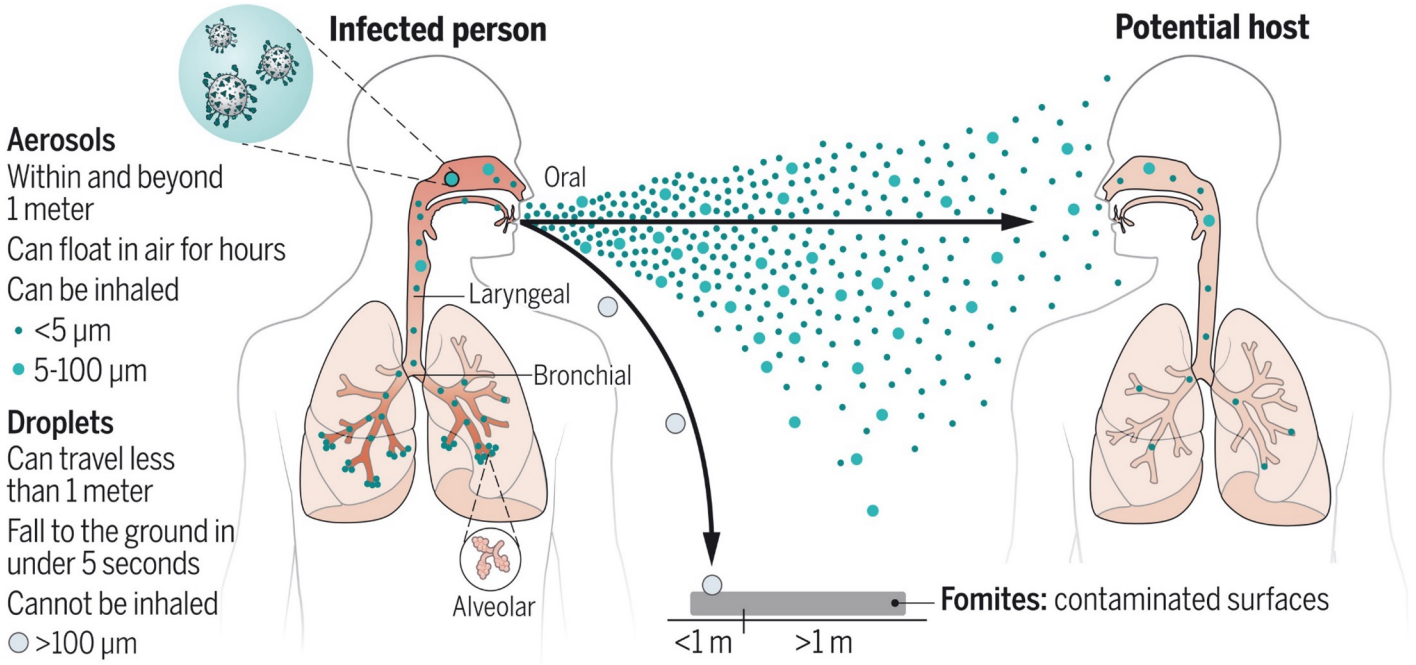
Health-care associated fungal infections

Fungus	Environmental vehicle
Aspergillus spp.	Improperly functioning ventilation systems Air filters Backflow of contaminated air Air exhaust contamination False ceilings Construction activities, opening doors to construction site
Mucorales / Rhizopus spp.	Air filters False ceilings
Scedosporium spp.	Construction activities

COVID-19 caused a paradigm shift regarding human to human transmission of respiratory pathogens



Wang et al., *Science* (2021) 373, eabd9149

Immunocompromised patients: A diverse population!

Immunologic disorders

- HIV infection, congenital immune deficiency syndrome, chronic diseases such as cancer

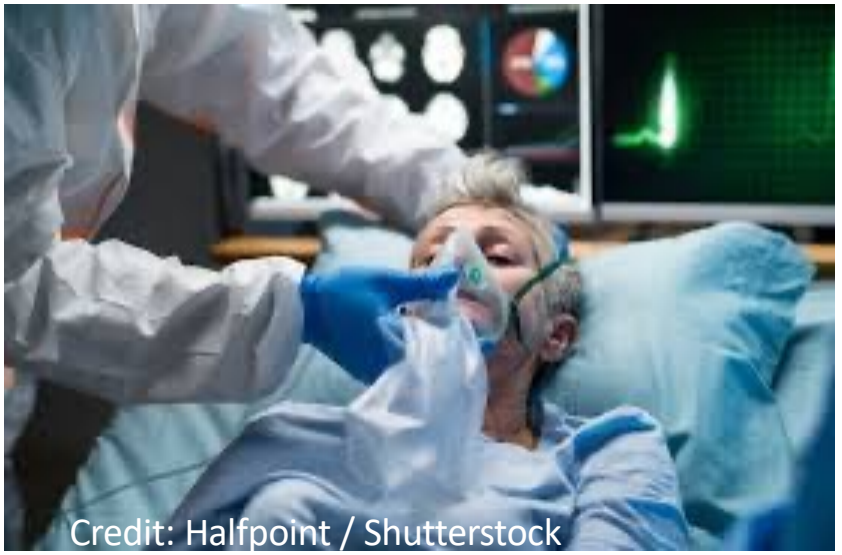
Immunosuppressive therapy

- Chemotherapy, corticosteroids, biologics, monoclonal antibodies

Neutropenic patients

Solid organ transplant recipients

Hematopoietic stem cell transplant recipients



Credit: Halfpoint / Shutterstock

Controlled environments

CONTROLLED ENVIRONMENTS:

Areas where sources of contamination are controlled by specified means

Clean rooms and associated environments

Provide air control to prevent the contamination of air and, if indicated, of environmental surfaces, to levels appropriate for accomplishing contamination-sensitive activities (i.e.):

- Some of the rooms dedicated to haematology and oncology patients
- Pharmacy and cell therapy clean rooms
- Sterilization premises
- Operating theaters
- Others

Positive pressure rooms - Higher air pressure than the external environment

Interventions to mitigate airborne transmission

• Ventilation system: heating ventilation and air conditioning (HVAC) systems	• Filtration	• Decontamination	• Protective rooms /Airborne isolation
• Turbulent, displacement, laminar airflow	• Filters with diverse efficiency • High efficiency particulate air (HEPA) filters	• UV germicidal irradiation	• Positive air pressure rooms • Negative air pressure rooms

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Jacob JT et al., *HERD: Health Environments Research & Design Journal.* 2013;7(1_suppl):74-98

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Water Control

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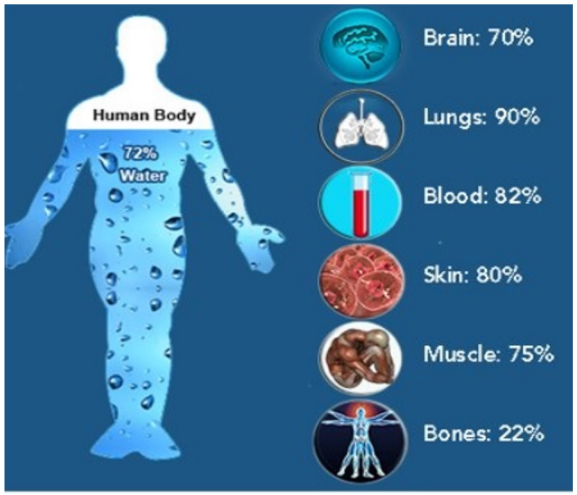
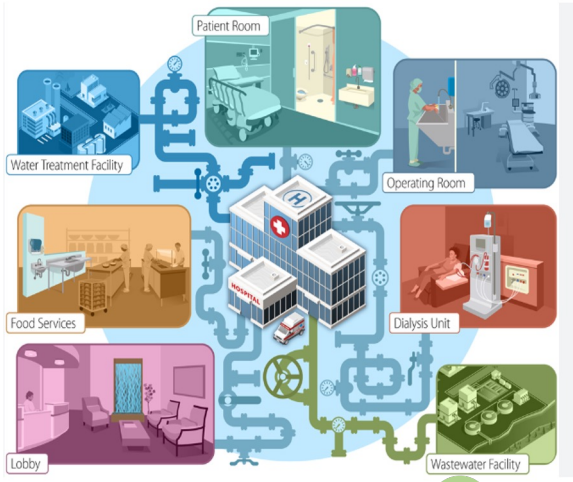
Water…

- Is the source of all life, very important to have in the healthcare environment- for drinking, cleaning, disinfection, cleaning patients and equipment
- **But bacteria also need water, so they can be everywhere where there is water**





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https://www.cdc.gov/hai/prevent/environment/index.html

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“From plumbing to patients”

A healthcare water management program identifies both hazardous conditions and corrective actions that can minimize the growth and spread of waterborne pathogens in healthcare facilities

Healthcare facilities can use water infection control risk assessment to assess:

- water sources
- mode of transmission
- patient susceptibility
- patient exposure
- program preparedness

https://www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html

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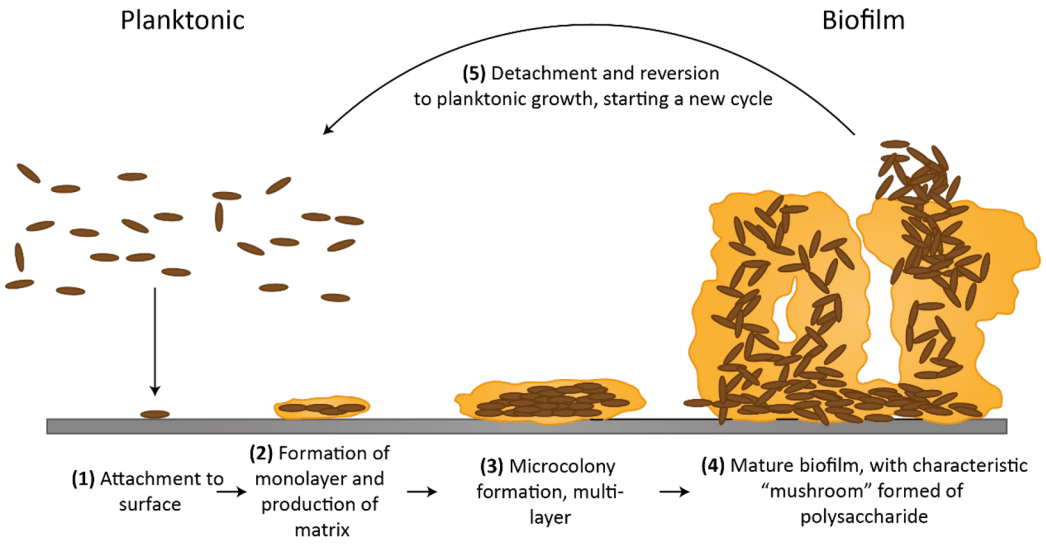
Biofilms

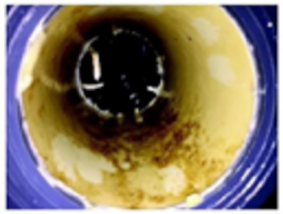


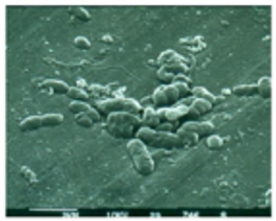
- Favoured by water stagnation and scale
- Up to **10^7 bacteria per cm^2** within biofilms

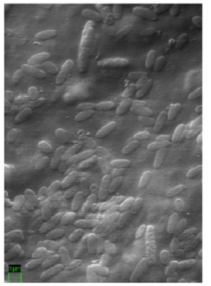
- Transient or long-term reservoirs for opportunistic pathogens

Whatever the constitutive support of wall pipes


Canalisation en PVC (D = 110 mm)


Canalisation en polyéthylène haute densité (D = 25 mm).


Canalisation en acier après 14 jours d'exposition à de l'eau de boisson


Canalisation en caoutchouc synthétique

Courtesy of Dr. Sara Romano Bertrand

Main challenges in hospitals

- Water in duct systems
- Periphery:
  - Sinks
  - Toilets
- High-risk environments

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Water in the duct system: *Legionella* spp

- Main challenge for water in the duct system
- Reservoirs in pipes- essential to control
- Most (may be all) systems have some level of *Legionella spp.* contamination
- The main challenges are keeping numbers low and protecting patients

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In a hospital

- Maintain / Secure permanent use & circulation of hospital water
- Filtration where needed (for drinking or showering water)
  - filters if the water's quality is inappropriate
  - Tap *Legionella* spp. filters
- Temperature control:
  - At least 60°C at the production
  - 50°C at water point-of-use
- Microbiological control:
  - plate count
  - bacteria chromogen BASIC Test (for coliform bacteria and *E coli*)
  - molecular methods
- Bottled water/high-level filtration water for at-risk populations
  - immunocompromised: hematology, oncology, transplant units, etc

Legionella spp. - strategies for management

- Maintain / Secure permanent use & circulation of hospital water
- Showerhead / sink filters where needed
- Eliminating “dead legs” in system/running taps
- Keeping temperature ideal >60°C:
  - *Legionella* spp. : dormant below 20°C and cannot survive above 60°C
  - *Legionella* spp. : multiply where temperatures are between 20-45°C
    - hot water storage cylinders should store >60°C
    - hot water distributed >50°C
    - cold water should be stored and distributed <20°C
- Various treatments of pipes when needed

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Periphery (sinks and toilets): Relevant bacteria

- Especially *Pseudomonas* spp. (also *Enterobacter* spp., *Stenotrophomonas* spp., and other Gram-negative bacteria)

De Geyter *et al. Antimicrobial Resistance and Infection Control* (2017) 6:24
DOI 10.1186/s13756-017-0182-3

Antimicrobial Resistance and Infection Control

RESEARCH Open Access

The sink as a potential source of transmission of carbapenemase-producing *Enterobacteriaceae* in the intensive care unit

Deborah De Geyter[1*], Lieve Blommaert[1], Nicole Verbraeken[1], Mark Sevenois[2], Luc Huyghens[2], Helena Martini[1], Lieve Covens[1], Denis Piérard[1] and Ingrid Wybo[1]

Abstract

Background: Carbapenemase-producing *Enterobacteriaceae* (CPE) are emerging pathogens that represent a major public health threat. In the University Hospital of Brussels, the incidence of new patients with CPE rose from 1 case in 2010 to 35 cases in 2015. Between January and August 2015, five patients became infected/colonized with CPE during their stay in the same room in the intensive care unit (ICU). Since the time period between those patients was relatively short and the strains belonged to different species with different antibiograms and mechanisms of resistance, the hypothesis was that the environment could be a possible source of transmission.

Methods and results: Environmental samples suggested that a contaminated sink was the source of the outbreak. Besides other strains, *Citrobacter freundii* type OXA-48 was frequently isolated from patients and sinks. To investigate the phylogenetic relationschip between those strains, pulsed-field gel electrophoresis was performed. The strains isolated from patients and the sink in the implicated room were highly related and pointed to sink-to-patient transmission. In total, 7 of 8 sinks in the isolation rooms of the ICU were found to be CPE contaminated. To control the outbreak, the sinks and their plumbings were replaced by new ones with another structure, they were flushed every morning with a glucoprotamin solution and routines regarding sink practices were improved leading to discontinuation of the outbreak.

Conclusions: This outbreak highlights that hospital sink drains can accumulate strains with resistance genes and become a potential source of CPE.

Keywords: Carbapenemase-producing *Enterobacteriaceae*, Hospital sinks, Outbreak, Intensive care unit, *Citrobacter freundii* OXA-48, Transmission

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At risk populations

- Immunocompromised patients, very frail patients, infants

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Sinks- the reality

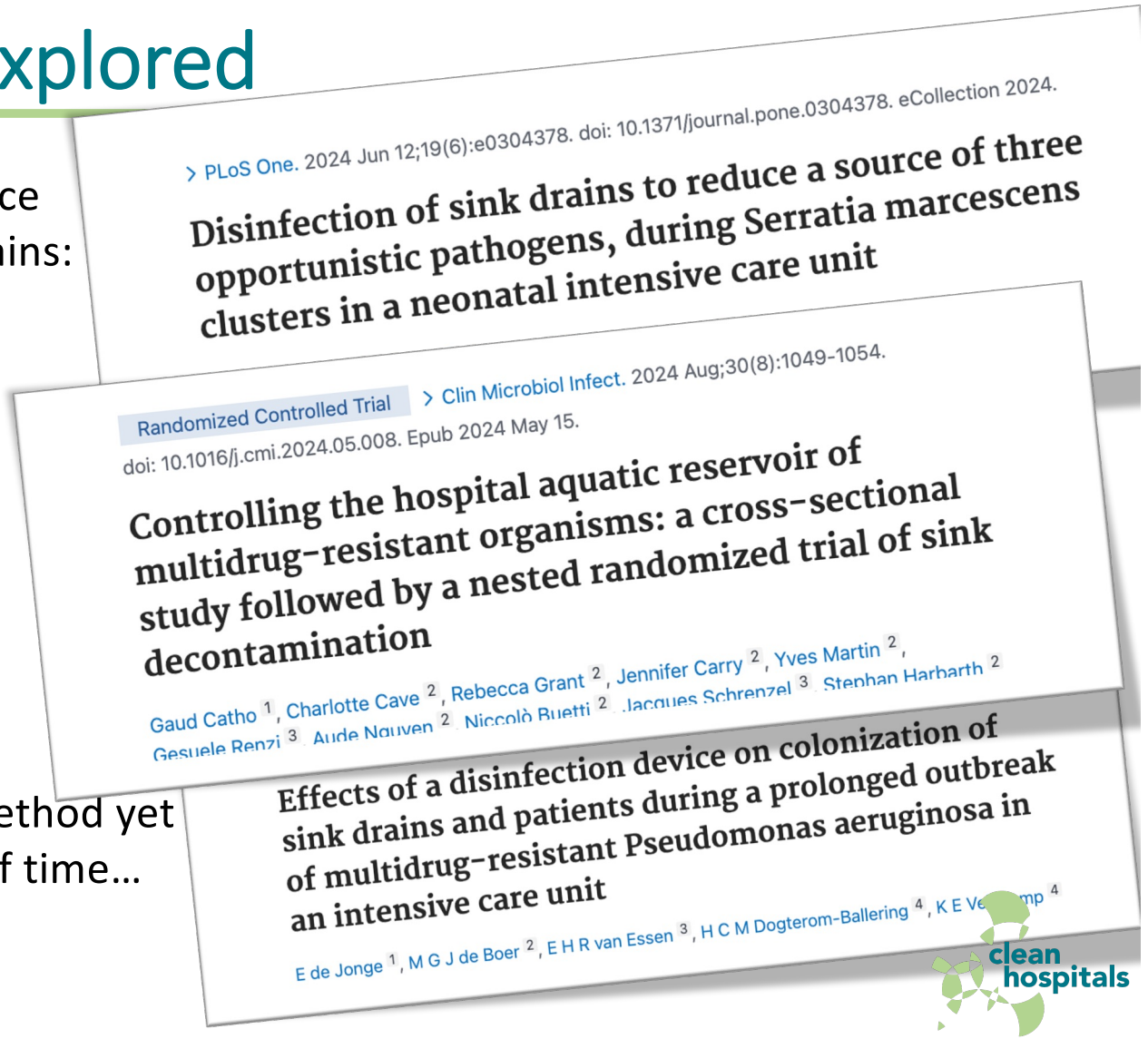
- Sinks are dirty, people don't use them correctly (pour biological liquids down drains etc.)
- Pathogenic bacteria live in the drain and sink trap
- Splash during use can spread harmful bacteria over 1m around the sink
- Inappropriately designed sinks can greatly increase the amount of splash during use

Strategies being explored

Strategies being studied to reduce bacterial colonization of sink drains:

- Steam
- Chlorine
- Hydrogen peroxide
- Peracetic acid
- Heating sink traps
- Vibrating sink traps
- And more…

No conclusive recommended method yet
Recolonization is just a matter of time…



> PLoS One. 2024 Jun 12;19(6):e0304378. doi: 10.1371/journal.pone.0304378. eCollection 2024.

Disinfection of sink drains to reduce a source of three opportunistic pathogens, during Serratia marcescens clusters in a neonatal intensive care unit

Randomized Controlled Trial > Clin Microbiol Infect. 2024 Aug;30(8):1049-1054.
doi: 10.1016/j.cmi.2024.05.008. Epub 2024 May 15.

Controlling the hospital aquatic reservoir of multidrug-resistant organisms: a cross-sectional study followed by a nested randomized trial of sink decontamination

Gaud Catho [1], Charlotte Cave [2], Rebecca Grant [2], Jennifer Carry [2], Yves Martin [2], Gesuele Renzi [3], Aude Nguyen [2], Niccolò Buetti [2], Jacques Schrenzel [3], Stephan Harbarth [2]

Effects of a disinfection device on colonization of sink drains and patients during a prolonged outbreak of multidrug-resistant Pseudomonas aeruginosa in an intensive care unit

E de Jonge [1], M G J de Boer [2], E H R van Essen [3], H C M Dogterom-Ballering [4], K E Ve[illegible]mp [4]

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On the menu…

The role of the healthcare environment in transmission

Clean Hospitals Day 2024

- Theme & Campaign materials

The 6 Technical Domains of HEH

- Surfaces
- Air control
- Water control
- Device reprocessing & Sterilization
- Laundry
- Waste management

The HEHSAF

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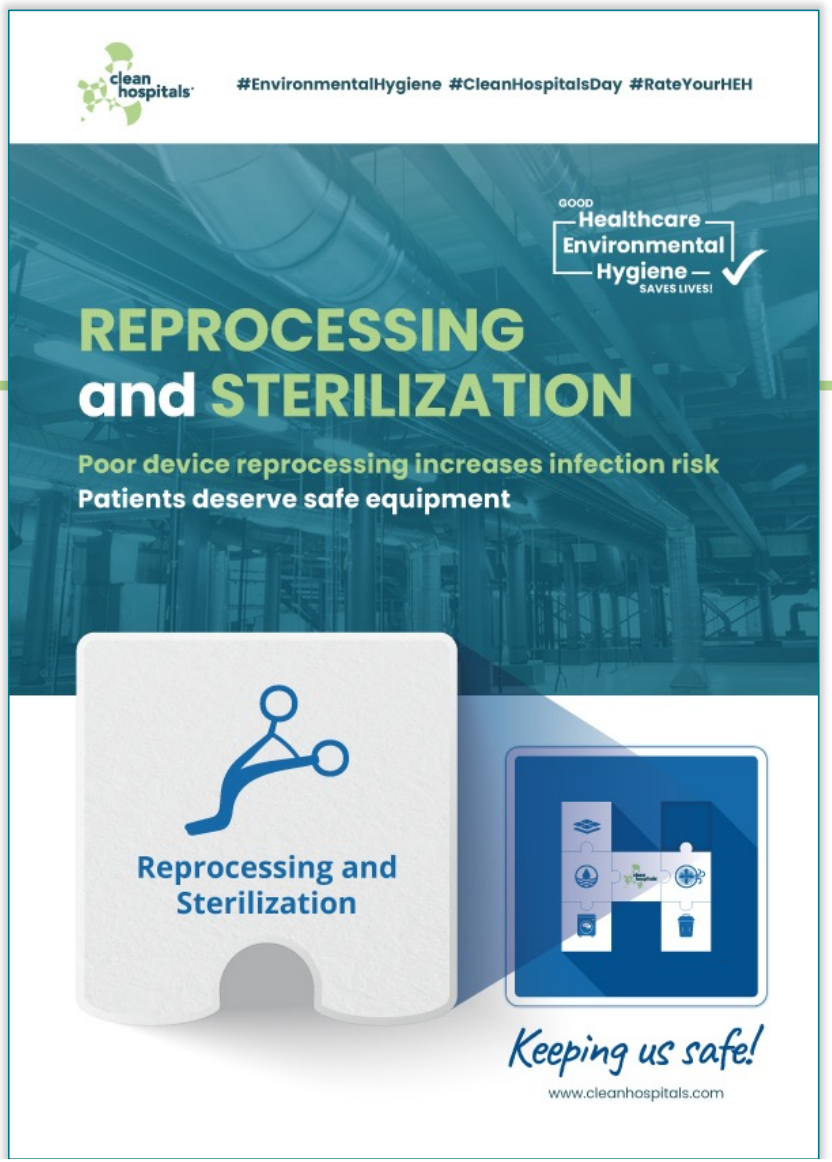
Device reprocessing and Sterilization



https://cleanhospitals.com/promotional-toolkit-2024/

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How bacteria multiply in favorable conditions

- **Warm and moist** conditions are an ideal breeding ground for bacteria
- Each bacterium can double every 20 minutes

Hour	# of Bacteria
>1	8
>3	512
>5	262,144

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What is decontamination?

A general term denoting the destruction or removal of contamination by microorganisms to a level harmless to health or the environment

.

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Decontamination includes…

- Cleaning
- Disinfection
- Sterilization
- Surgical instruments should be **presoaked/pre-disinfected** to prevent the drying and the binding of the proteins of biological liquids

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Cleaning

- **Cleaning**: the removal of foreign material (ex. soil and organic material) from objects
- Cleaning is performed using water with detergents (such as alkaline or enzymatic products)
- **Cleaning is the main prerequisite for disinfection and sterilization!**
- Quality cleaning reduces the number of microorganisms by at least 99.9% (3 log reduction)

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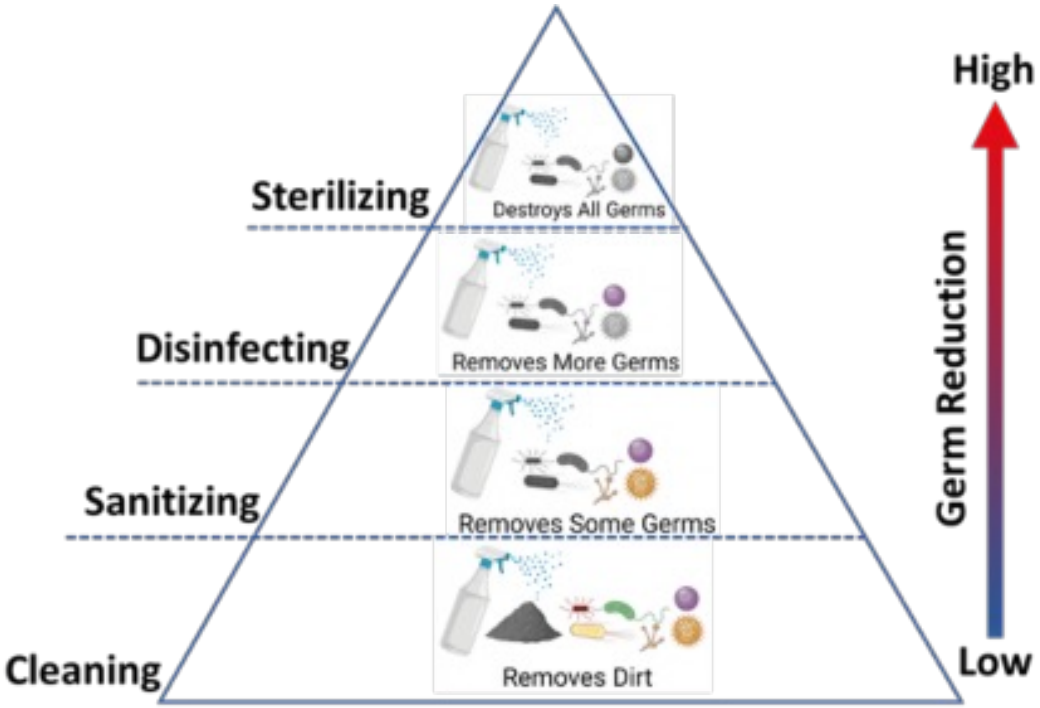
Disinfection and sterilization

- **Disinfection:** a process that eliminates many or all pathogenic microorganisms on objects
- **Low and intermediate-level disinfection:** disinfection processes that are bactericidal, virucidal, and fungicidal
- **High-level disinfection:** disinfection process which can also eliminate some spores



Disinfection and sterilization

- **Sterilization:** a process that destroys or eliminates all forms of microbial life, **including all bacterial spores** and which is carried out in health-care facilities by physical or chemical methods

- **Sterile:** the state of absence of any viable microorganisms

Washer disinfectors for instruments

Washer disinfectors are preferred because:

- Thermal / chemical disinfection is recommended for the safety of the healthcare worker
- Machines can raise the water temperature in the washing, disinfection, and drying cycles to the desired level
- The process is validated and reproducible (unlike manual disinfection)
- Manual disinfection can have validated processes but can be subject to human error

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Moist heat/ Saturated steam sterilization

- Sterilization with saturated (pressurized) steam
- Thermostable items such as objects made of rubber, most plastics, solutions, textiles and metal can be sterilized
- Mechanism of action: saturated steam

- Physical parameters that must be controlled:
  - Time of exposure to steam
  - Temperature
  - Quality of the steam (steam must be neither too hot nor too wet)

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Dry heat sterilization

- Sterilization with dry hot air
- Only suitable for highly thermostable items
  - Ex. metal, glass, fatty substances, oils, powders
- Mechanism of action: dry heat (oxidation)
- Physical parameters that must be controlled:
  - Temperature: 180-200°C
  - Time: 2 hours
- Objects must be clean and dry before sterilization

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Hydrogen peroxide vapor sterilization

- Mechanism of action: oxidation by Vaporized Hydrogen Peroxide (VH_2O_2)
- Physical parameters that must be controlled:
  - Temperature: 37-44°C
  - Time: 25 min - 55 min
  - Pressure: very low pressure, far below atmospheric pressure
- Suitable for thermolabile instruments
  - Ex. cameras, electronic guides, optical lens systems, metal micro instruments, etc.
  - Other thermolabile materials such as silicone, nylon, plastic, Teflon, etc.

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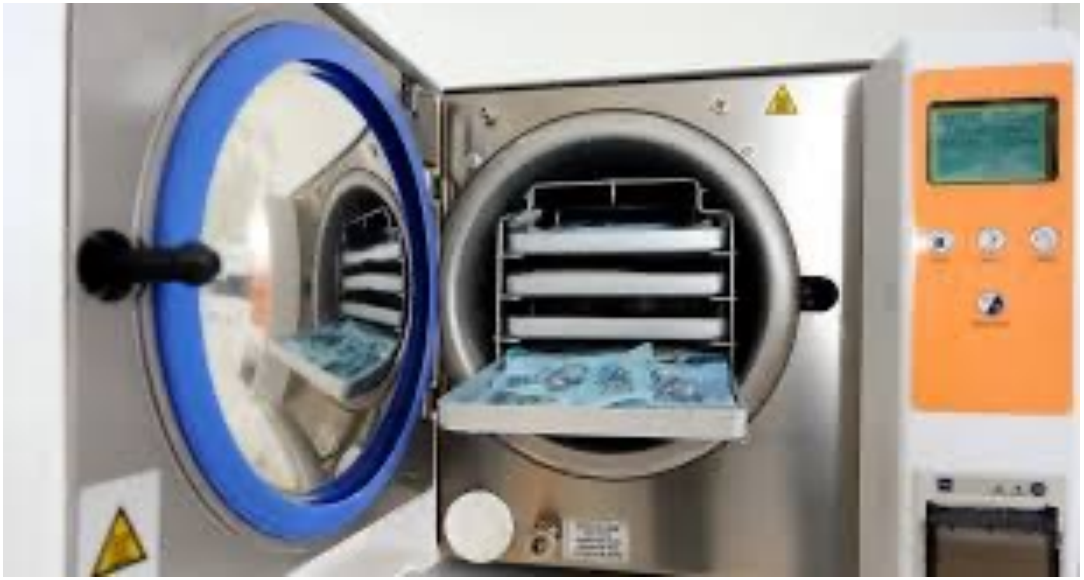
Low temperature sterilization methods: Ethylene oxide sterilization

- **Ethylene oxide sterilization:** can fully sterilize all materials, and is the preferred industrial method used by manufacturers for products that come to the market sterile
- Mechanism of action: alkylation by ethylene oxide gas
  - low temperature sterilization
  - colorless, odorless, volatile, flammable, toxic (carcinogenic and mutagenic)



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Classification of materials for sterilization

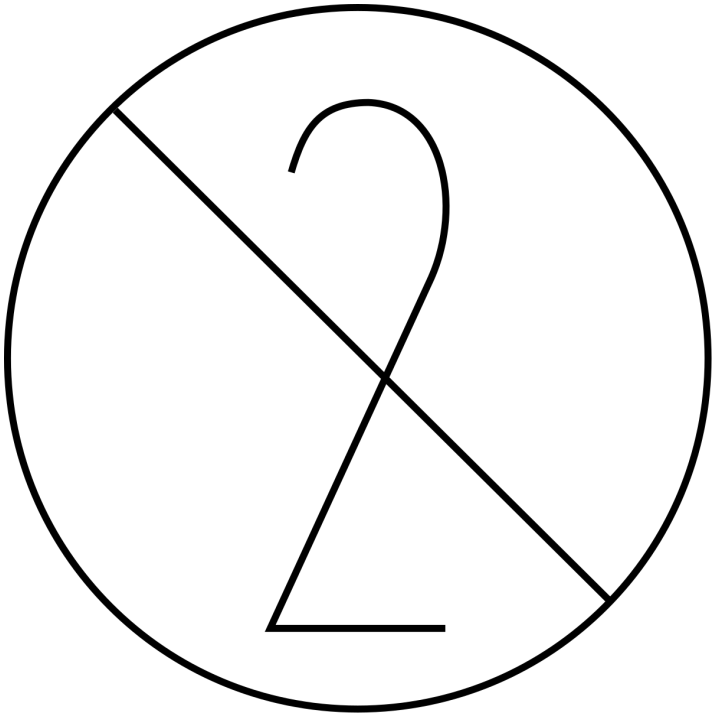
DRY HEAT	STEAM	IONIZING RADIATION	ETHYLENE OXIDE/ FORMALDEHYDE	VH_2O_2
Glass, metal, fats, oils powders, minerals	Textiles, rubber, instruments, glass, solutions, wood, paper	Thermolabile rubber, some types of plastic	All rigid thermolabile and thermostable materials	Thermolabile materials or devices that are not absorbent*

* For Vaporized Hydrogen Peroxide (VH_2O_2): all materials to be sterilized must have been validated and listed by the manufacturer as being compatible with this type of sterilization

Single use devices

One single use for one single patient!!

Should never be reused!!



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Errors

Caused by:

- Not understanding the principles of reprocessing of medical devices
- Overcrowding of sterilizers
- Improper preparation of trays or pouches
- Lack of maintenance of equipment and machinery
- Lack of compliance to the validated cycle

MANDATORY TRACEABILITY:

- Documenting the reprocessing **process** is extremely important!
- It is necessary to keep records of each performed sterilization **cycle** time, date, material, reprocessing conditions

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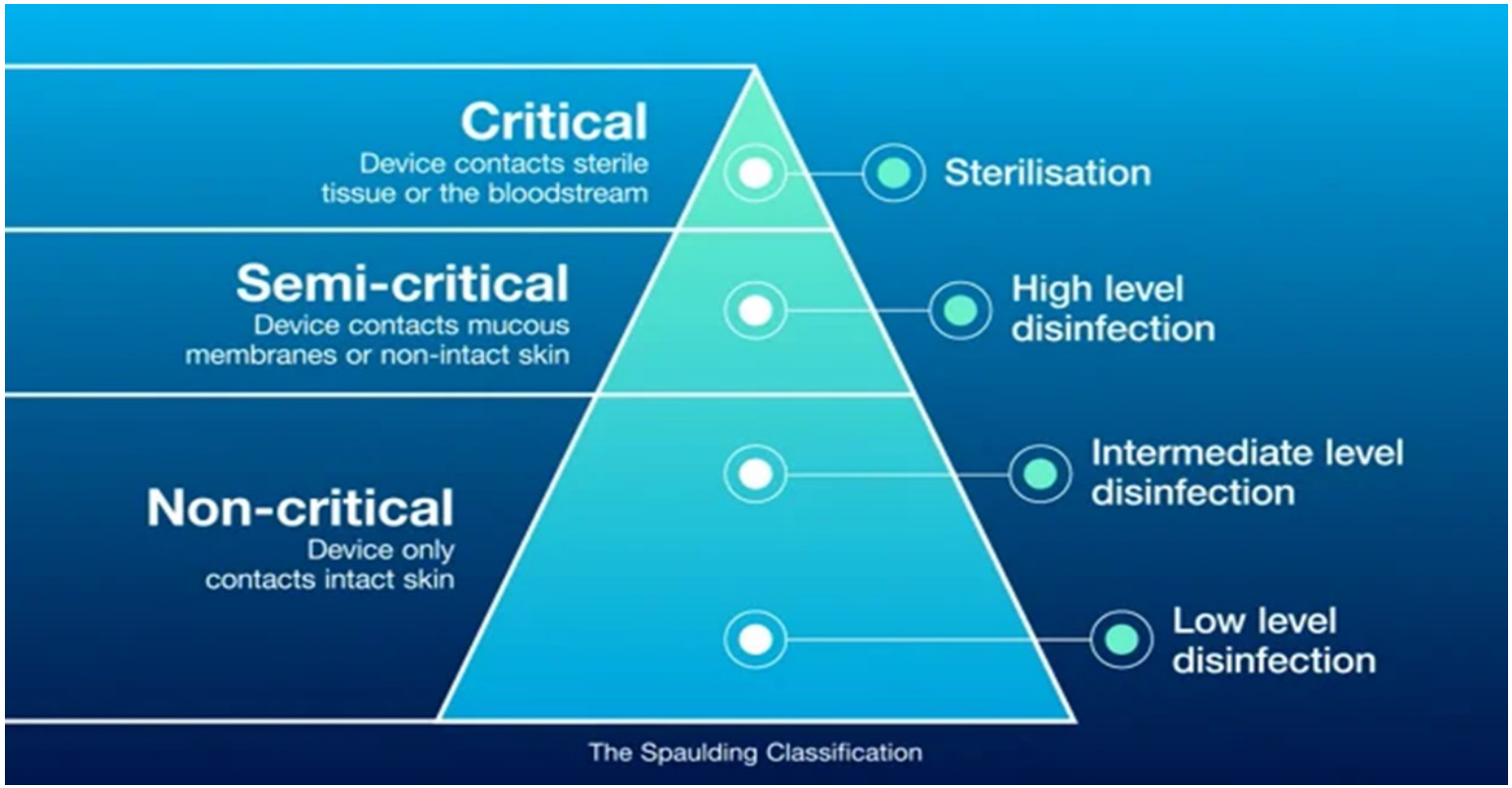
Spaulding classification



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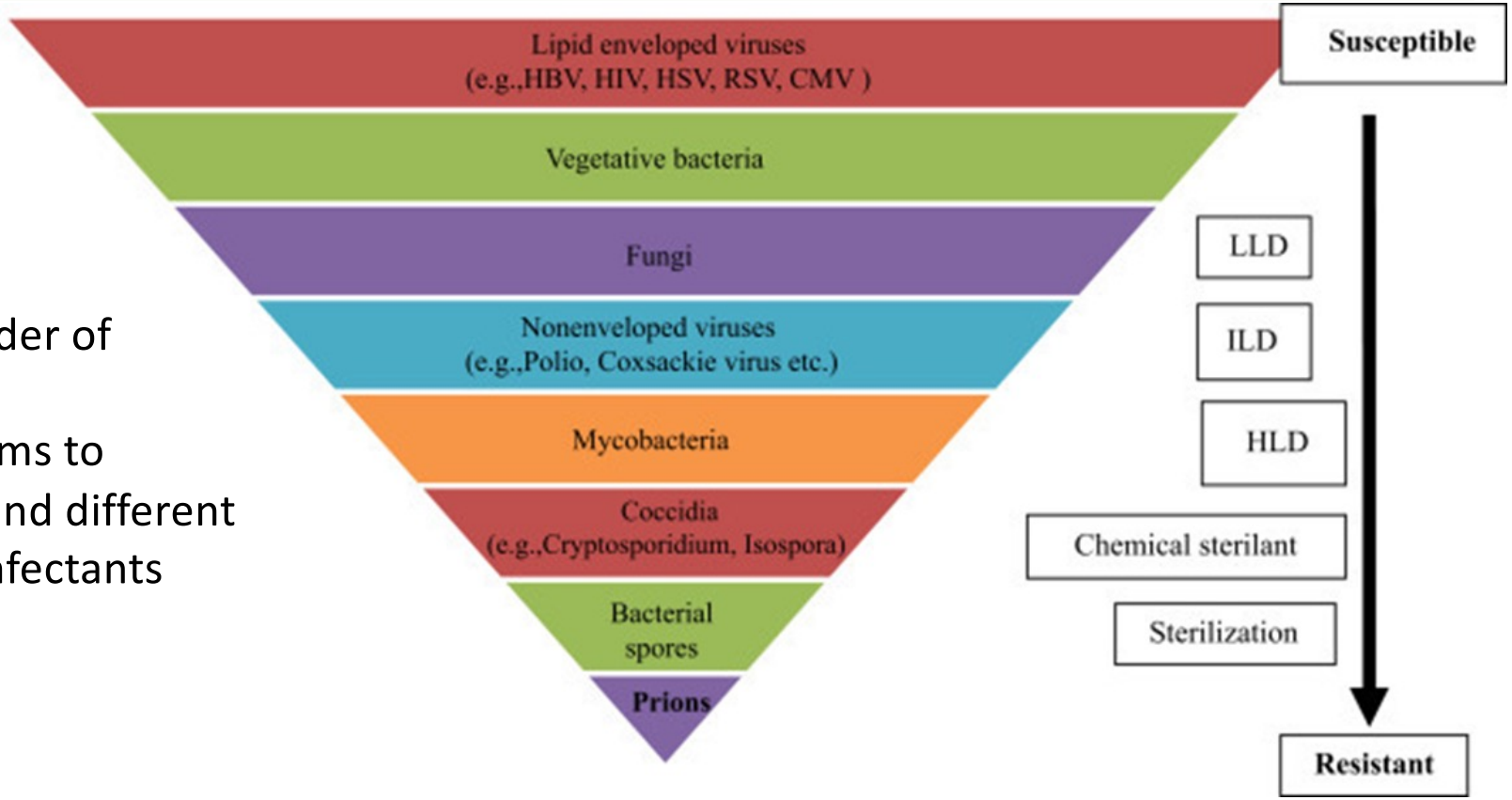
Classification of microorganism resistance

Increasing order of resistance of microorganisms to sterilization and different levels of disinfectants



Mohapatra S. Sterilization and Disinfection. *Essentials of Neuroanesthesia*. 2017

On the menu…

The role of the healthcare environment in transmission

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The 6 Technical Domains of HEH

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Laundry

https://cleanhospitals.com/promotional-toolkit-2024/

Definition of linen

All reusable textile items requiring cleaning and disinfection through washing, including:

- **Bed linen:** blankets, counterpanes, cot sheets and blankets, duvets, duvet covers, pillowcases and sheets, bibs, and blankets
- **Patient clothing:** gowns, nightdresses and shirts, pyjamas
- **Staff clothing:** coats, scrubs, uniforms
- **Other:** towels, hoist slings, curtains
- **Cleaning equipment:** cloths and mops

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Hospital laundry services

Missions

- Ensure an adequate supply of clean linen
- Prevent contamination of patients and staff from soiled linen
- Minimize the dissemination of infectious particles from soiled linen into the environment
- Minimize microbial cross-contamination between heavily and lightly soiled linen

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Infectious risk from improper handling of healthcare linen

- Bacteria
- Viruses
- Fungi
- Parasites (scabies)

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Epidemiology

- Soiled hospital sheets can harbour high density pathogenic organisms from body substances and fluids
- If linen is handled and washed properly, risk of disease transmission caused by soiled linen is low[1,2]
- Transmission depends on many factors including types of organism
- Transmission occurs through direct contact or aerosols of contaminated lint generated from sorting and handling contaminated textiles

[1]Blaser MJ, et al. *J Infect Dis* 149: 48-57. (1984)
[2]Owen L, Laird K. The role of textiles as fomites in the healthcare environment: a review of the infection control risk. *PeerJ*. 2020

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Important

- Soiled linen needs to be removed, transported appropriately and safely to avoid contamination of the environment of EVS workers, especially of their hands
- Soiled linen must be washed in sufficiently clean water, in appropriate machines with the correct detergents or disinfectants and at a high enough temperature to remove soil and kill pathogens
- Clean linen must be stored in a clean and dry environment

[1]Blaser MJ, et al. *J Infect Dis* 149: 48-57. (1984)
[2]Owen L, Laird K. The role of textiles as fomites in the healthcare environment: a review of the infection control risk. *PeerJ*. 2020

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Outbreaks occurred due to :

- Non-compliant PPE use (staff sorting used linen without gloves)
- Low/Non-compliance with hand hygiene
- Poor environmental hygiene- dirty surfaces
- Suboptimal conditions of washing, drying, and storage
- No clear segregation between clean and dirty areas
- Eating in laundry room

Linen needs to be handled safely during collection, transport, washing and drying!

Jordan A et al. Open Forum Infect Dis 2022 .; Duffy, J et al. *Pediatr Infect Dis* J 2014; A Shanmugarajoo et al. *International Journal of Infectious Diseases* 101(S1) (2021) 300–335; J. Glowicz et al. *American Journal of Infection Control* 50 (2022); John W. Oliphant, et al *American Journal of Epidemiology*, 1949; Standaert SM, et al. *Infect Control Hosp Epidemiol*. 1994; Thomas MC,et al. Infect Control. 1987

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Ref: https://professional.electrolux.com/gb/hospitals/

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Take home messages

- Linen can be a source of pathogen transmission and outbreaks
- HCW, patients and laundry staff are at risk
- Proper washing, handling, and storing of linen prevents microbial contamination and dissemination

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Waste management

https://cleanhospitals.com/promotional-toolkit-2024/

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Waste Management

Waste management plays a key role in infection prevention and control

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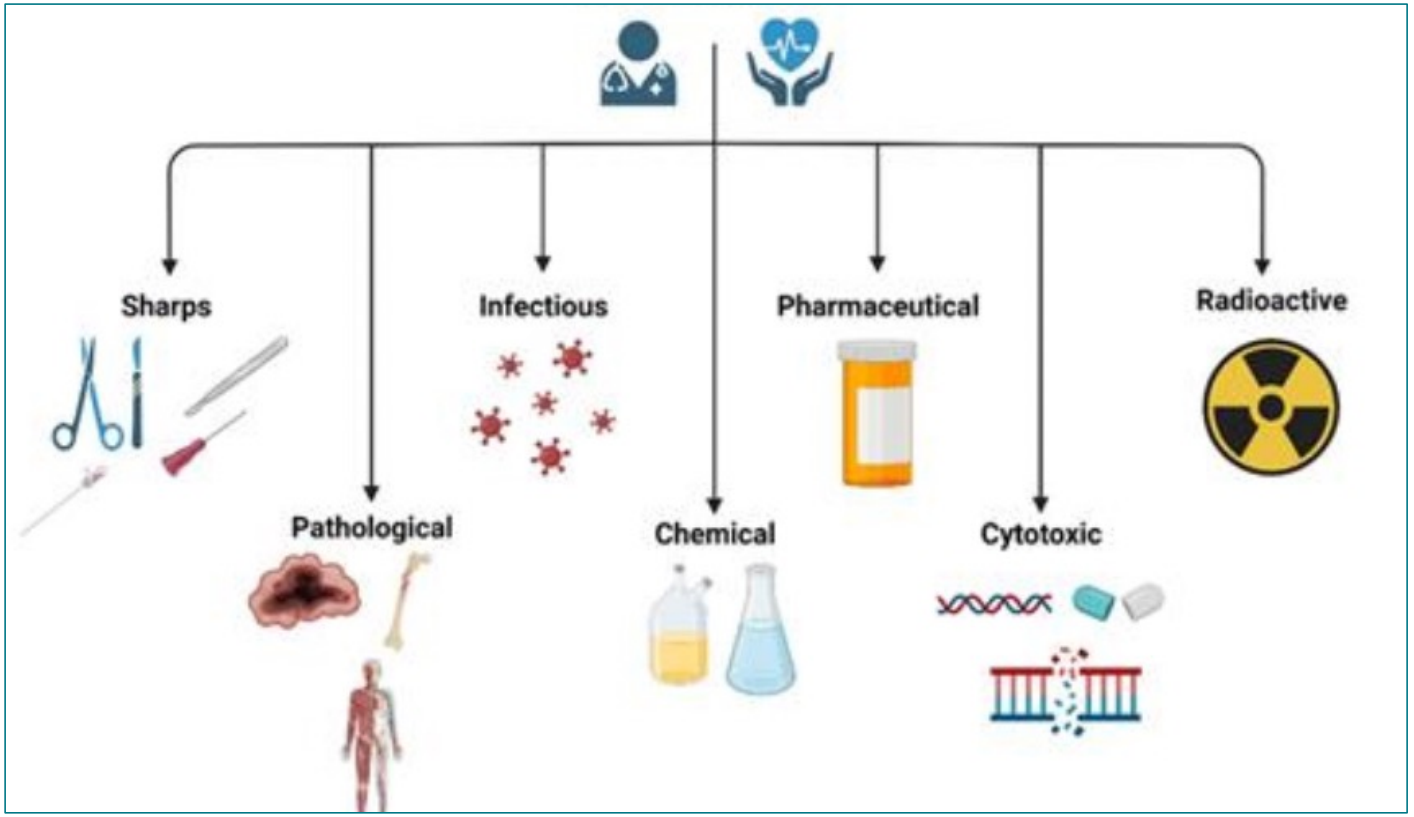
Medical waste



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Attrah M, Elmanadely A, Akter D, Rene ER. A Review on Medical Waste Management: Treatment, Recycling, and Disposal Options. *Environments*. 2022; 9(11):146.

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Medical Waste

- General waste → (85%)
- Infectious (incl. Pathological) → (15%)
- Hazardous (sharps, chemical, pharmaceutical, cytotoxic, radioactive) → (15%)

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Dangers for people & the environment

- Sharps injuries
- Exposure to toxic pharmaceutical products
- Mercury or dioxin exposure during the handling / incineration of health care waste
- Chemical burns from waste treatment activities
- Thermal injuries due to open burning and incinerator operation
- Radiation burns
- Air pollution during medical waste incineration
- Biological or chemical environmental contamination and damage to ecosystems

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Source WHO: https://www.who.int/news-room/fact-sheets/detail/health-care-waste

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Improper disposal

- Open/no incineration
- Putting waste in concrete
- People living in and off landfills
- Can lead to the reuse of single-use items

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High-resource environments

Containers

- Adapted and solid
- Bags- not for liquids or sharps
- Boxes/Bins- permanently closing

Transport

- ADR European norms for transport
- Special locking bins
- Adapted trucks

Incineration

- 800°C /1300°C

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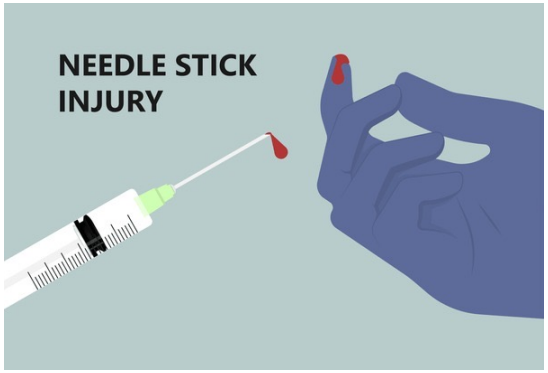
High-resource environments: Challenges

- Issues with separation and communication
- Containers not correctly closed
- Liquid in bags
- Sharps not in appropriate containers
- Needle sticks- we have 1-2 per year in Geneva
  - (Declaration of incident, health follow-up etc.)



We need to address the human factors!

(education, training, assessment, management)

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Low-resource environments: Challenges

- Same human factor challenges as in high resource environments

PLUS

- Waste infrastructure around the hospital might be lacking
- Issues with availability of suitable containers/bags
- Frequent use of open dump sites
- Lack of resources & machinery breaks (ex. a shredder/sterilizer)
- Frequent use of open dump sites

We need to address the resource, technical and human factors!

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The HEHSAF (healthcare environmental hygiene self-assessment framework)

- A secure online tool for healthcare facilities (HCFs) to analyze and assess their healthcare environmental hygiene (HEH) programs
- Can be used as a benchmark for improvement over time
- The first time a global snapshot for HEH is being attempted
- Available in 12 languages

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https://cleanhospitals.com/hehsaf/

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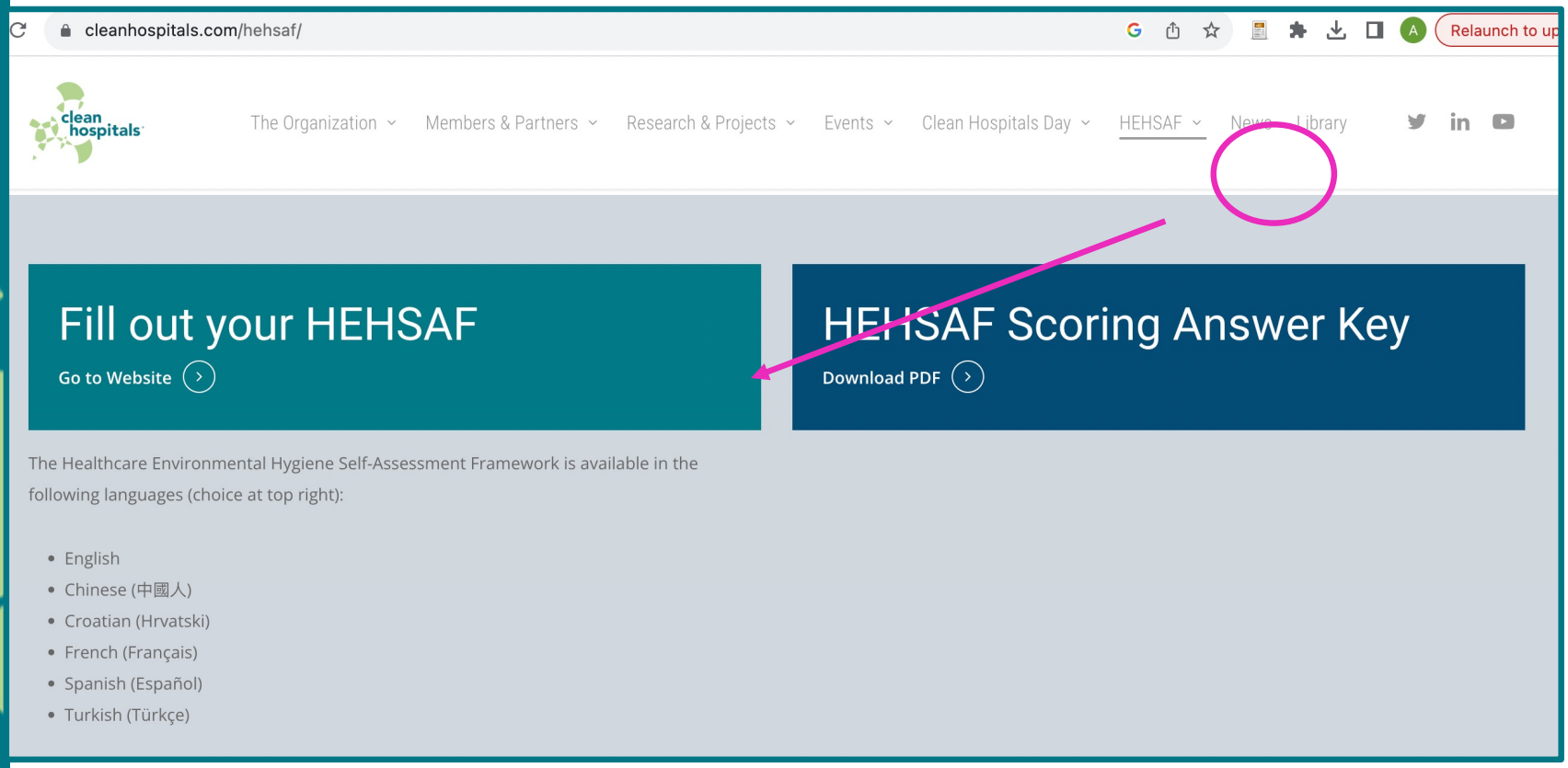
How to access the HEHSAF



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https://cleanhospitals.com/hehsaf/

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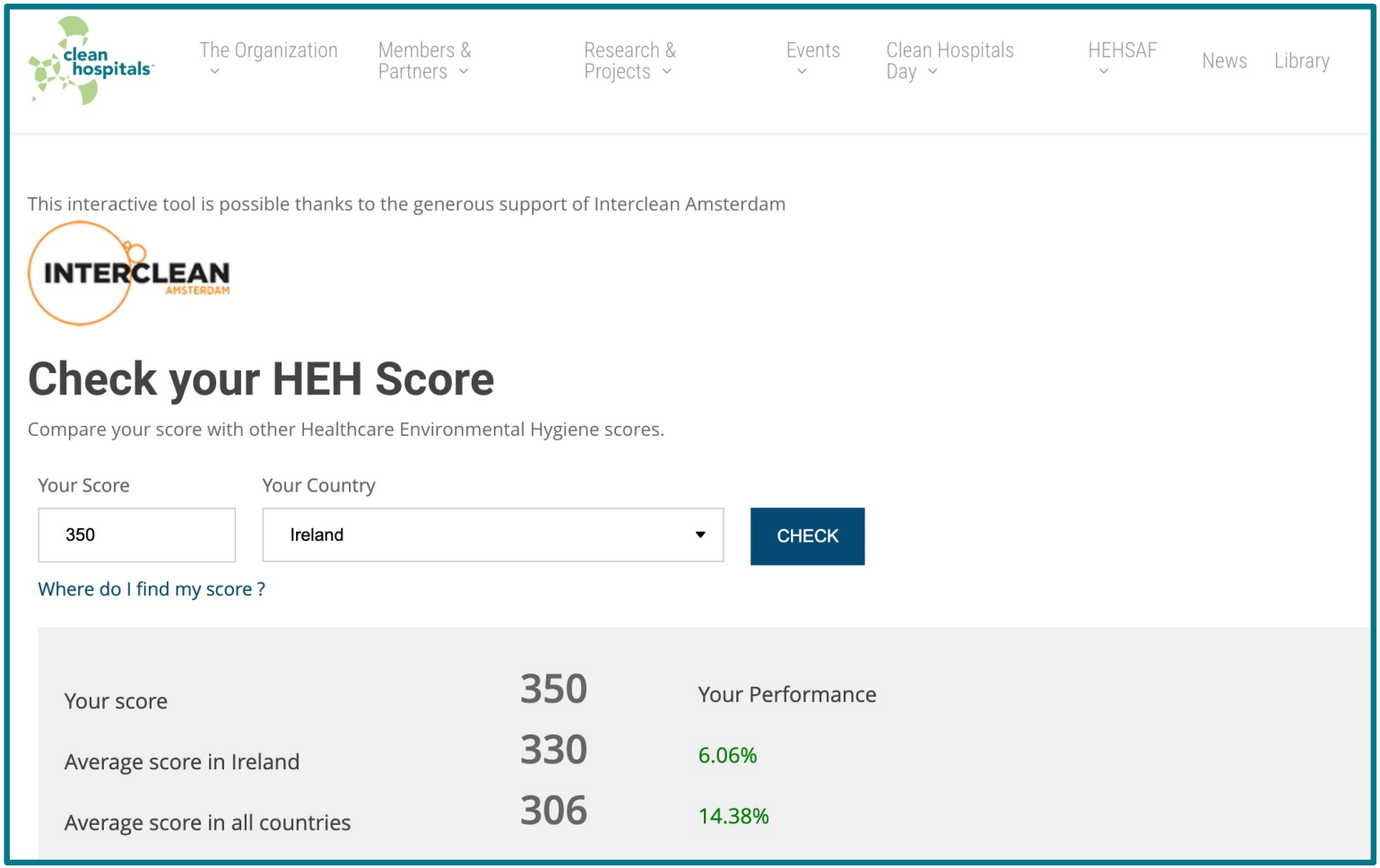
Scoring:

https://cleanhospitals.com/hehsaf/



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Webber Training® 20 YEARS Anniversary

APIC®
Association for Professionals in Infection Control and Epidemiology

MOVING THE NEEDLE ON INFECTION PREVENTION APIC

International Infection Prevention Week

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Clean Hospitals

sharing our passion

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October 24, 2024	*(FREE Teleclass)* **WHY CERTIFY? THE VALUE OF CERTIFICATIONIN INFECTION PREVENTION AND CONTROL** Speaker: **Shazia Irum**, CBIC Ambassador, Saudi Arabia
November 7, 2024	**AN ETHICAL FRAMEWORK FOR SMART SANITATION TECHNOLOGY AS A PUBLIC HEALTH TOOL** Speaker: **Prof. Maria Carnovale**, Johns Hopkins School of Advanced International Studies
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