WATER SAFETY IN HEALTHCARE

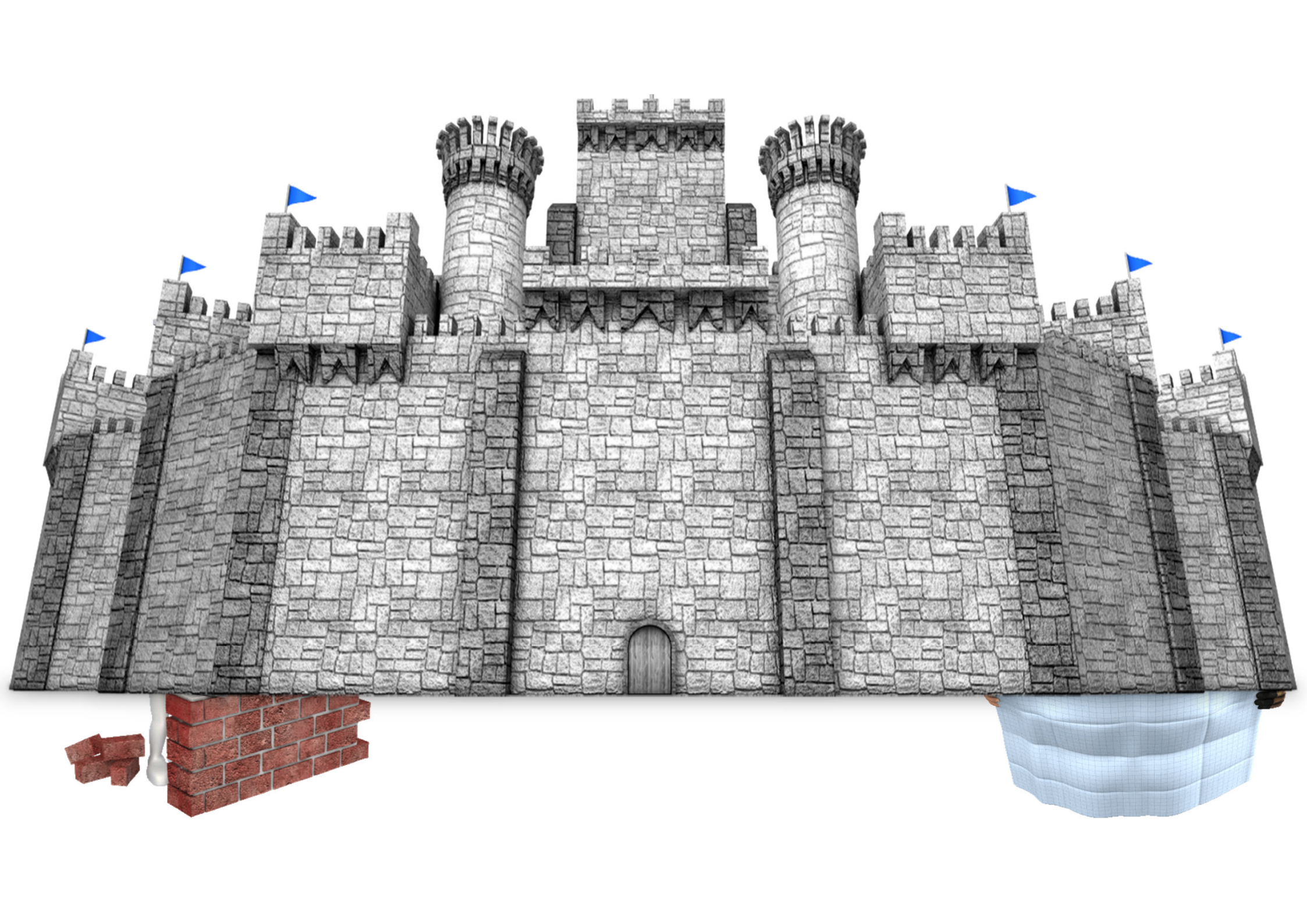
TUESDAY 28TH NOVEMBER

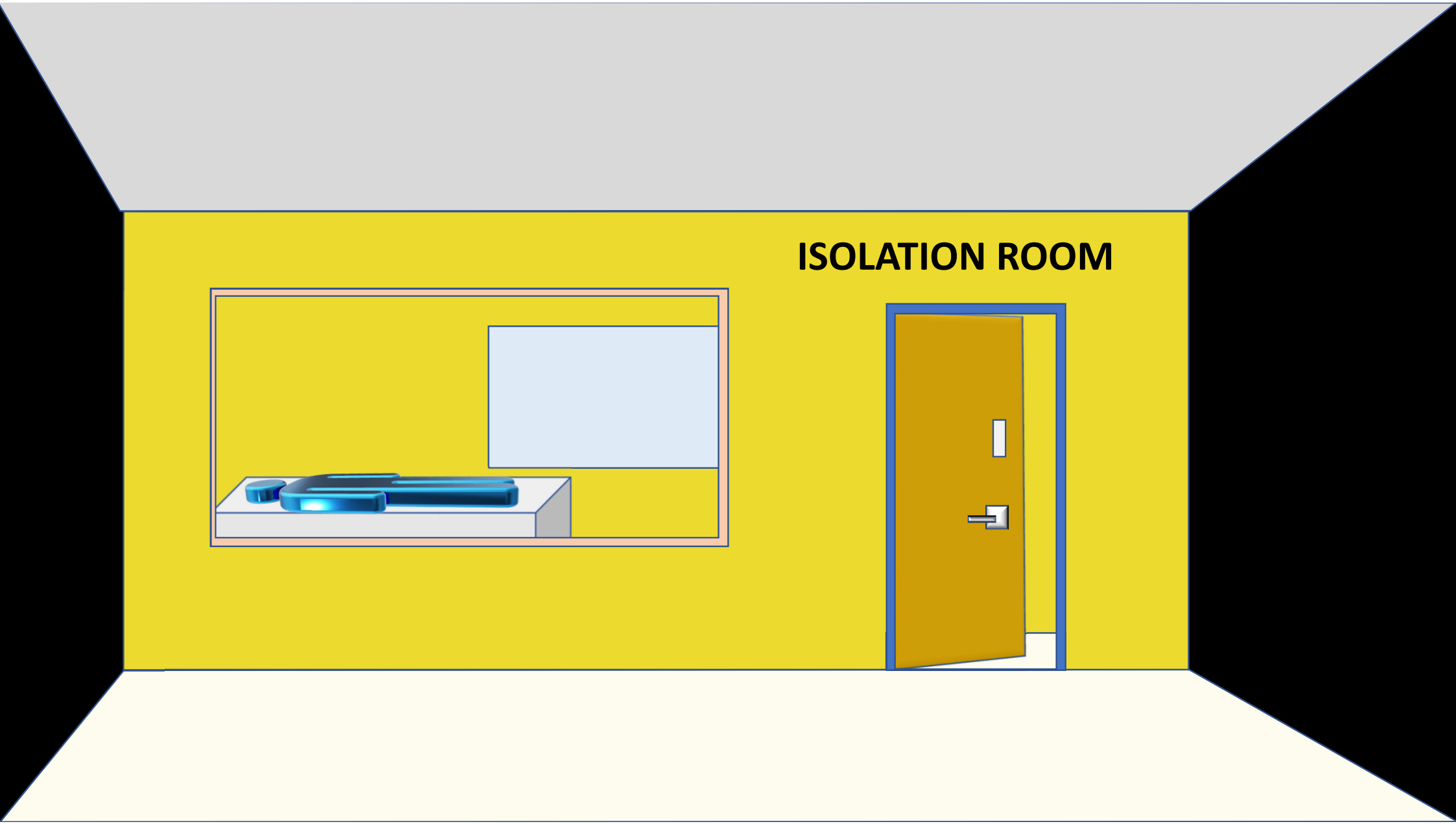
SCANDIC HOTEL
OSLO AIRPORT

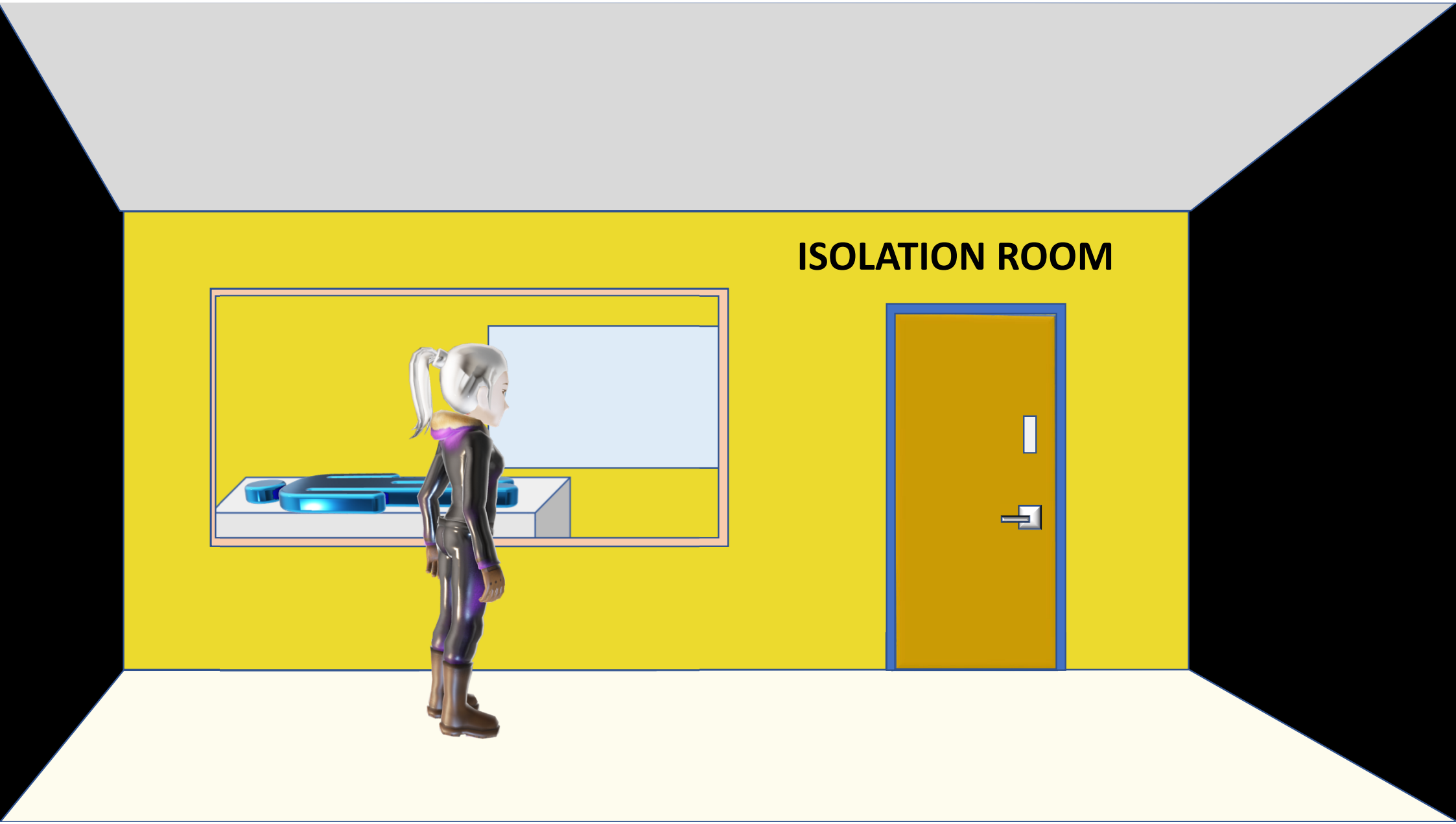

ANTIMICROBIAL RESISTANCE
HOSPITAL


ANTIMICROBIAL RESISTANCE
HOSPITAL


ANTIMICROBIAL RESISTANCE
HOSPITAL




ISOLATION ROOM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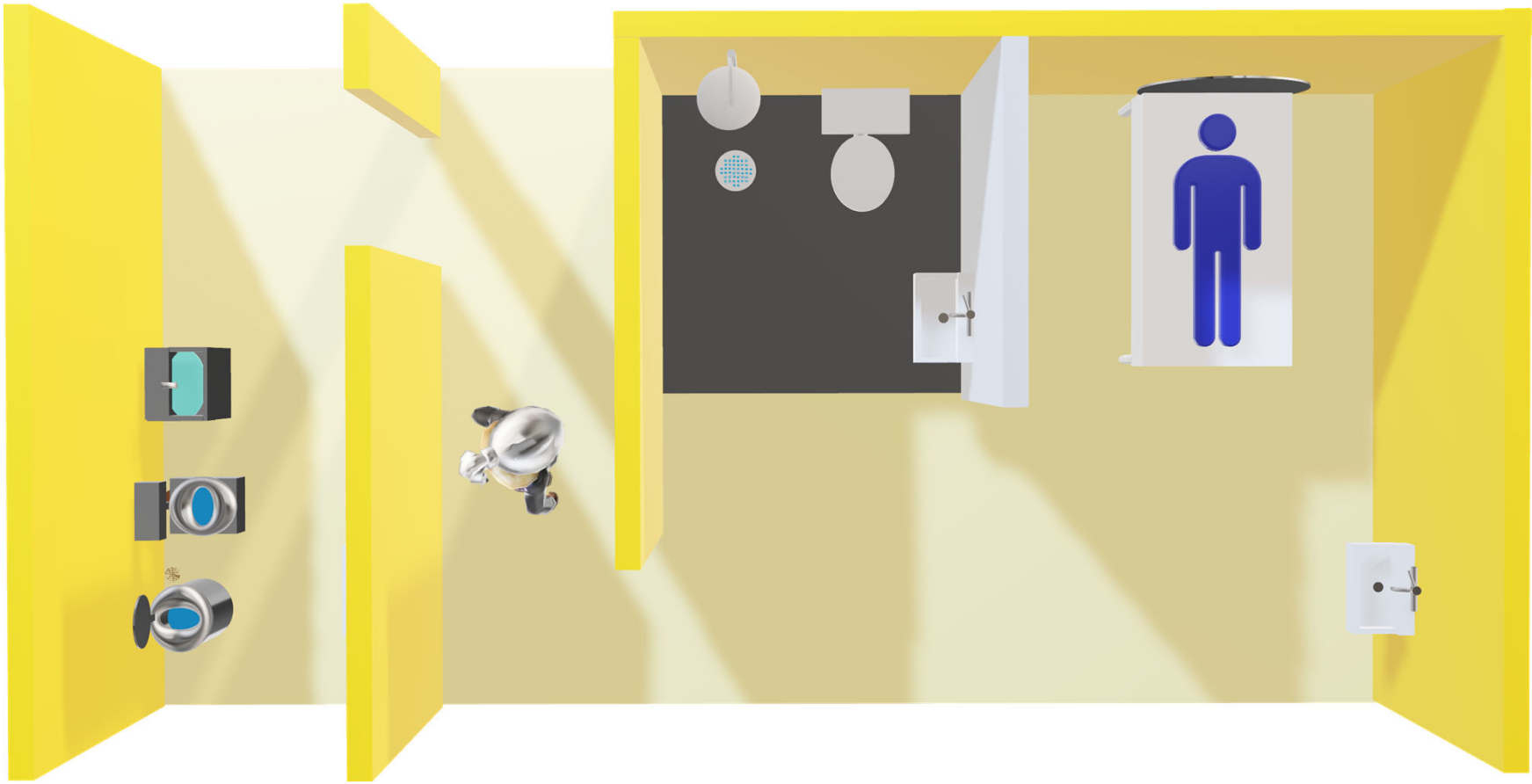


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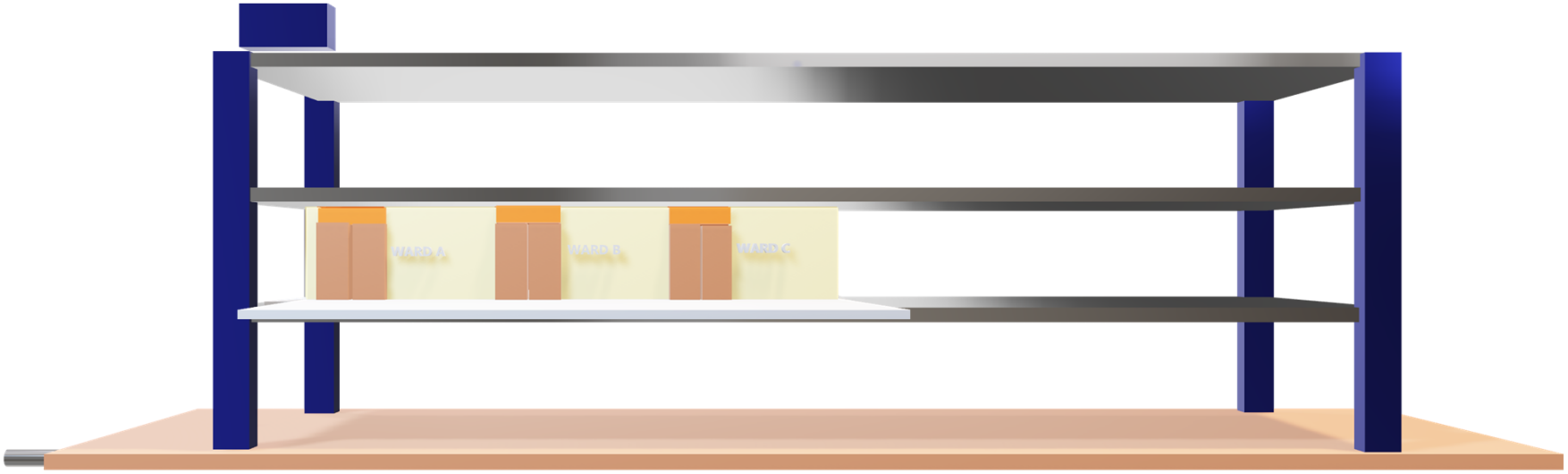
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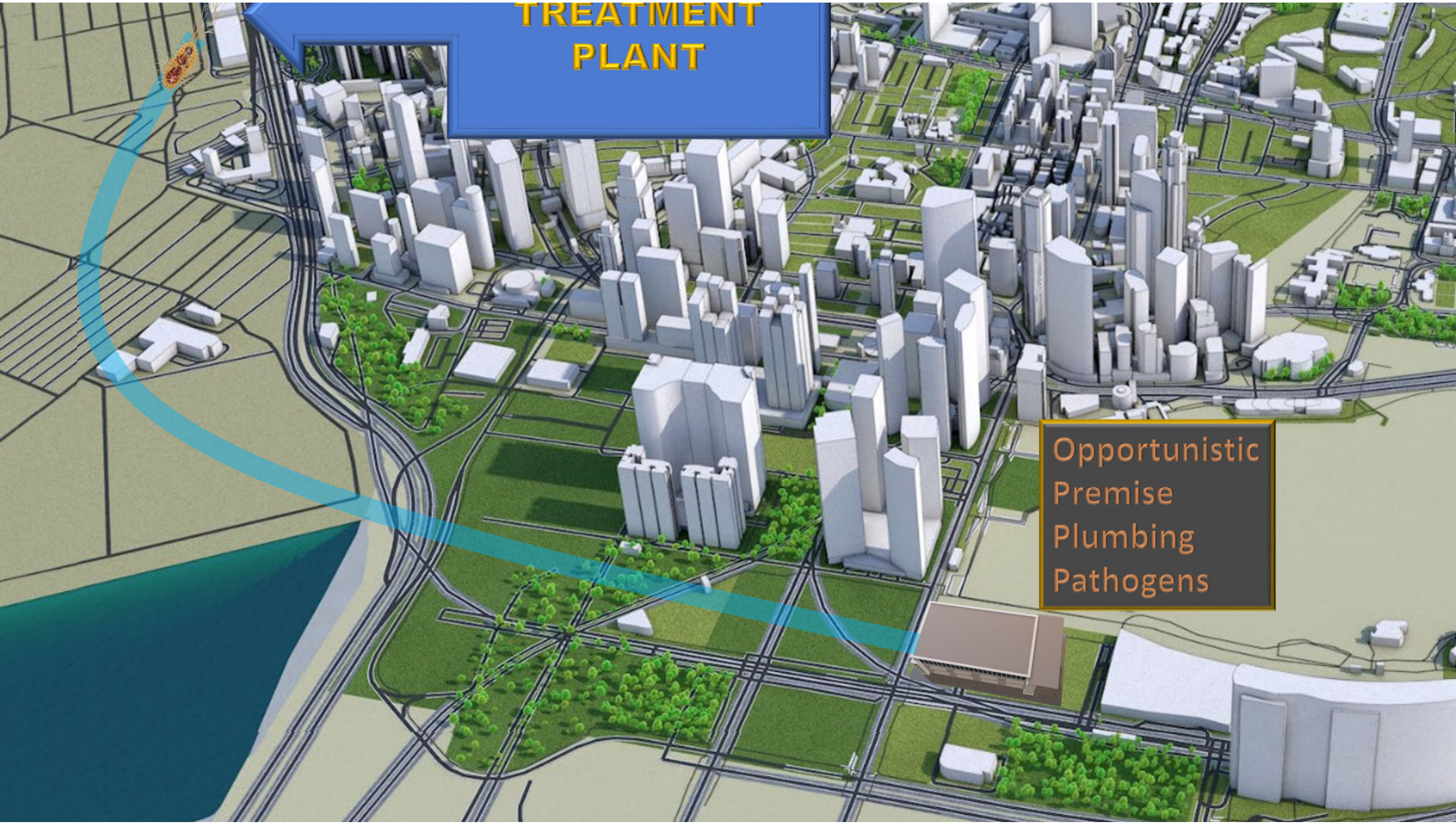
WATER
TREATMENT
PLANT


TREATMENT
PLANT
Opportunistic
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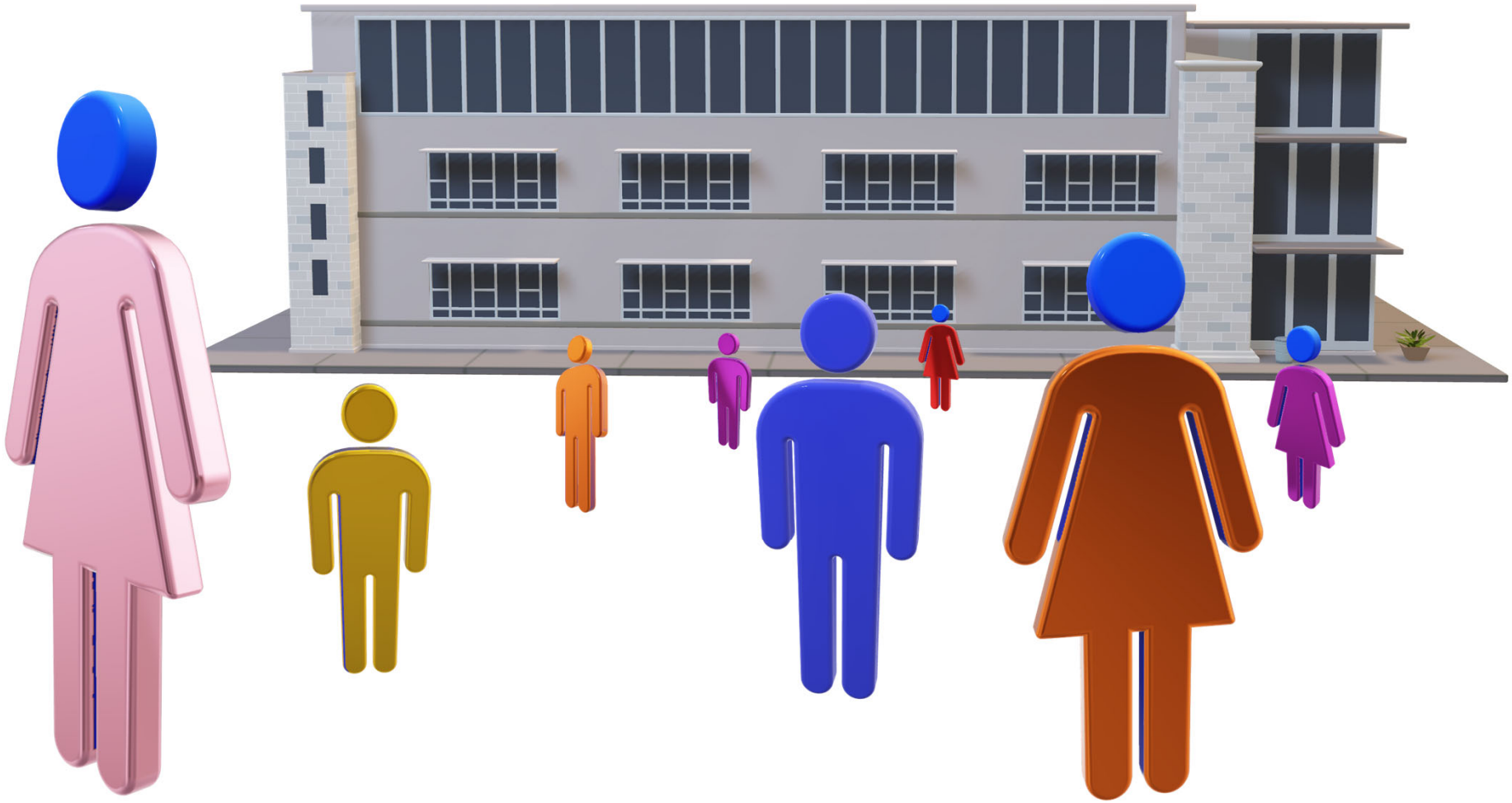
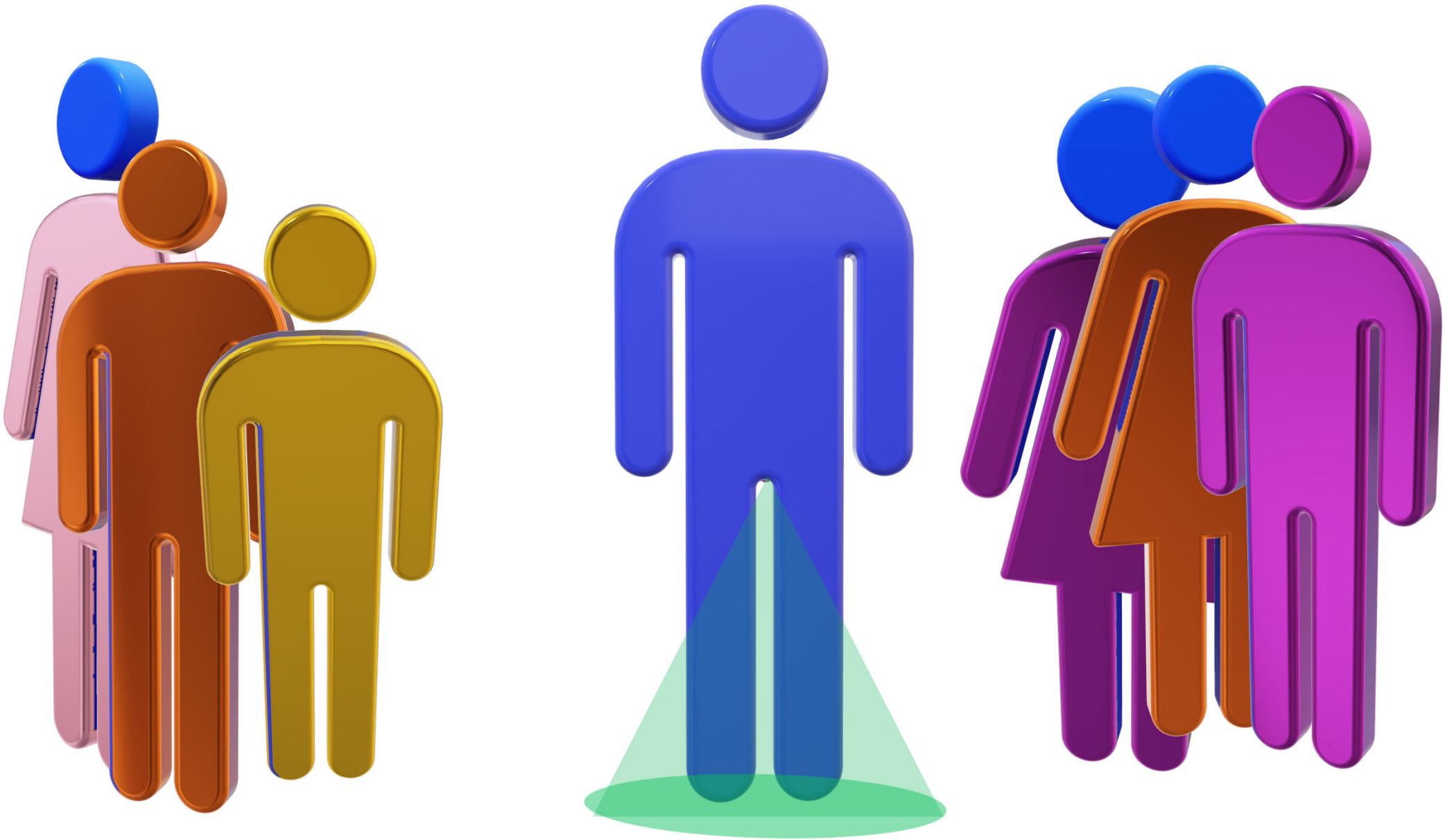
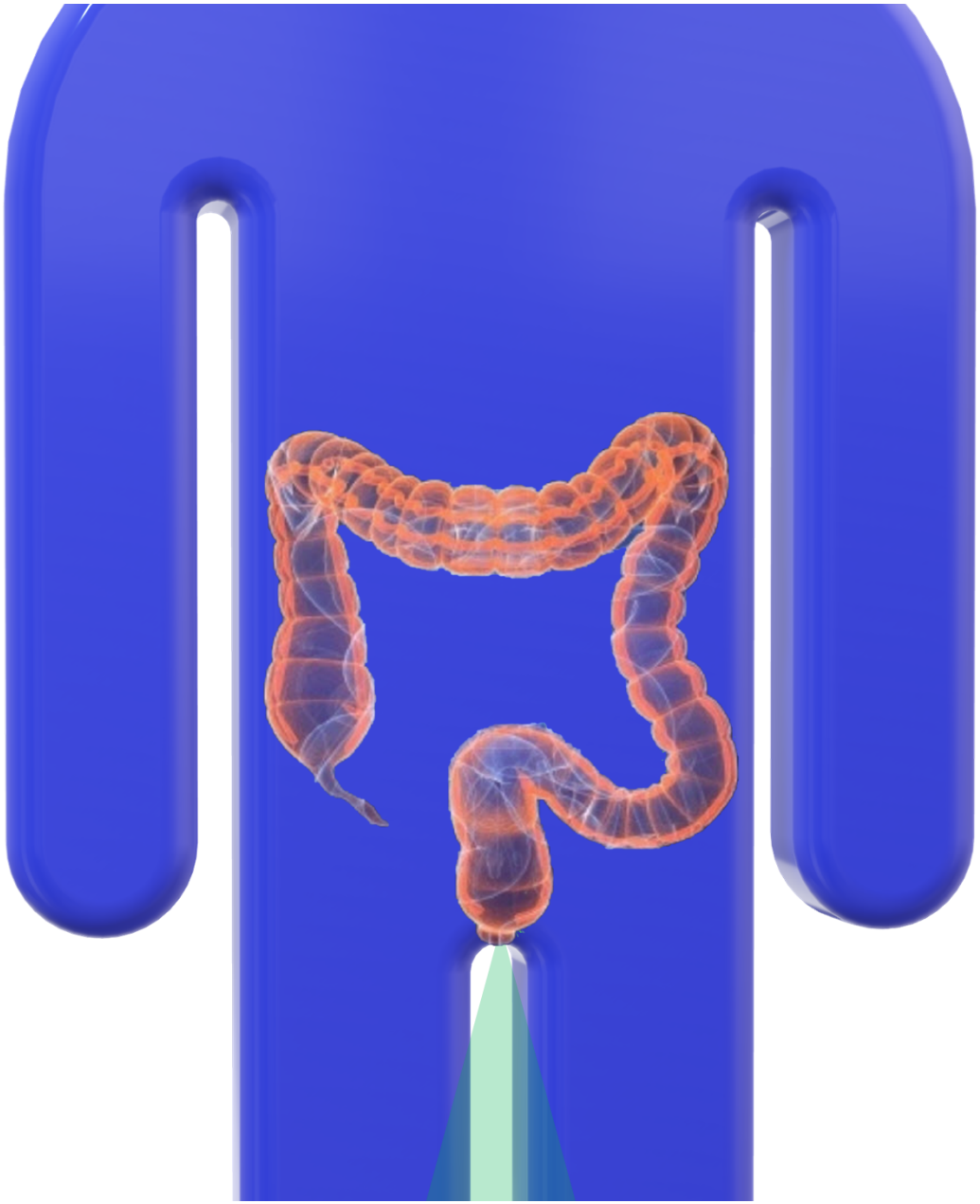
Plumbing
Pathogens







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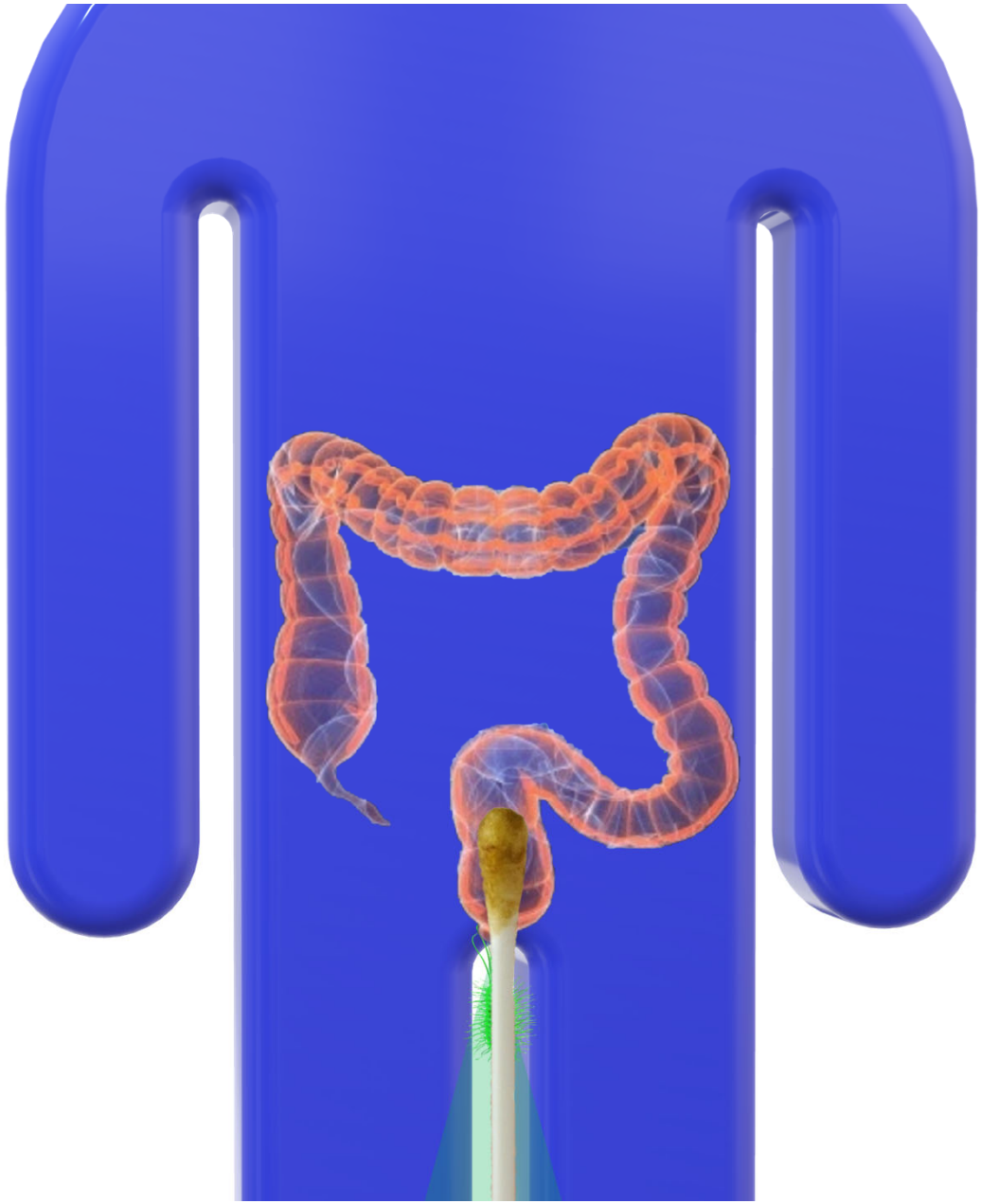

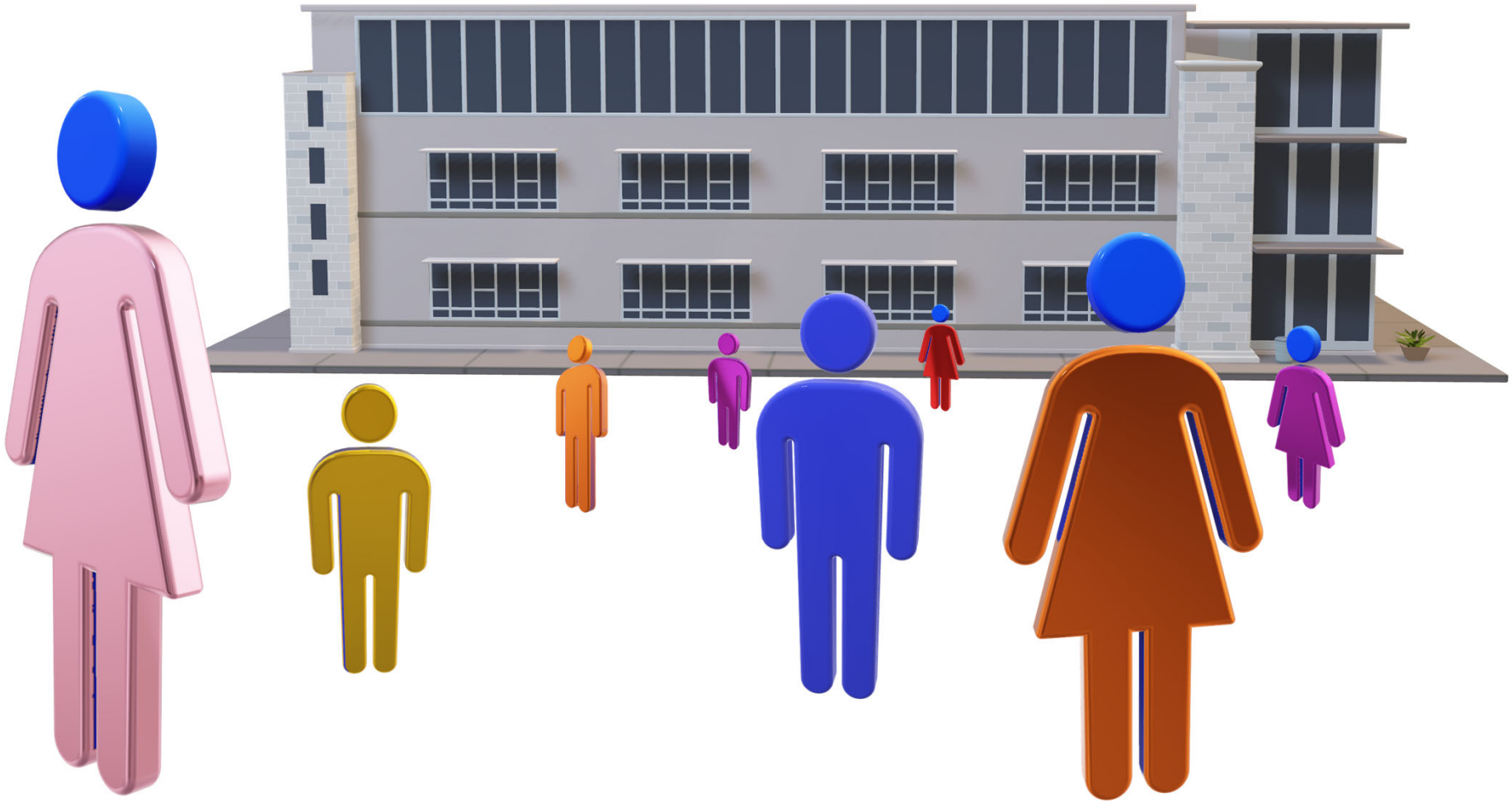

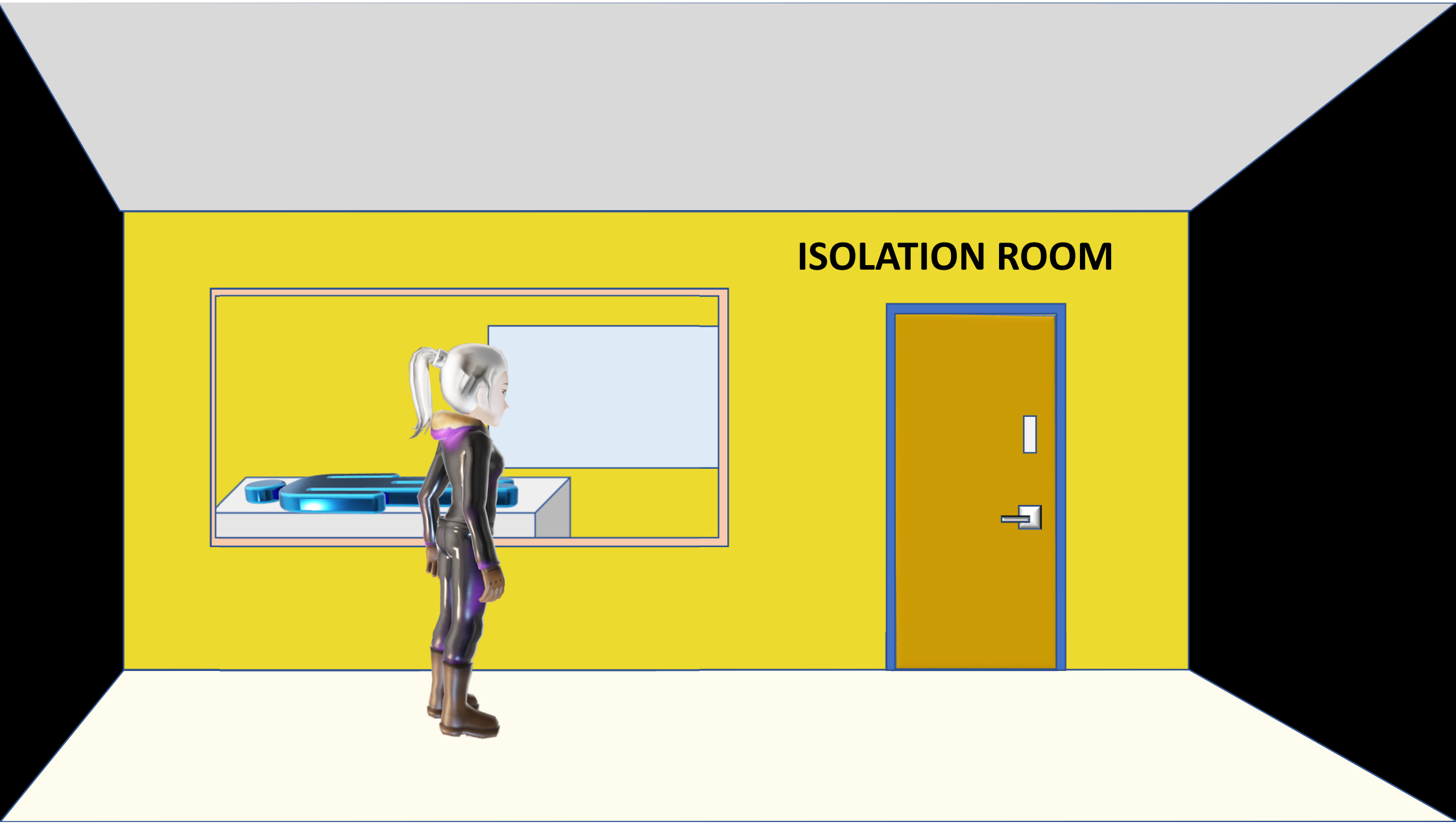
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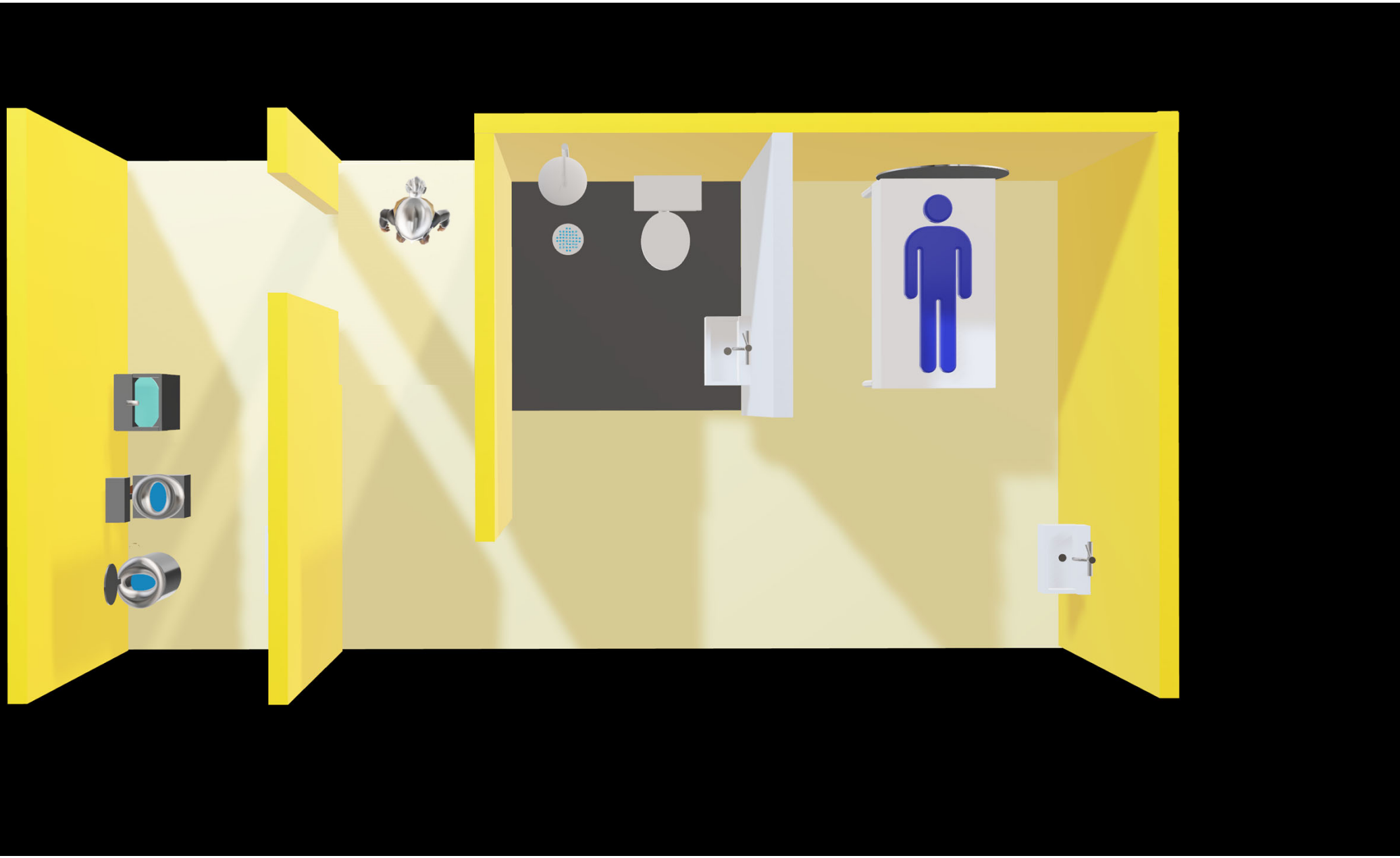
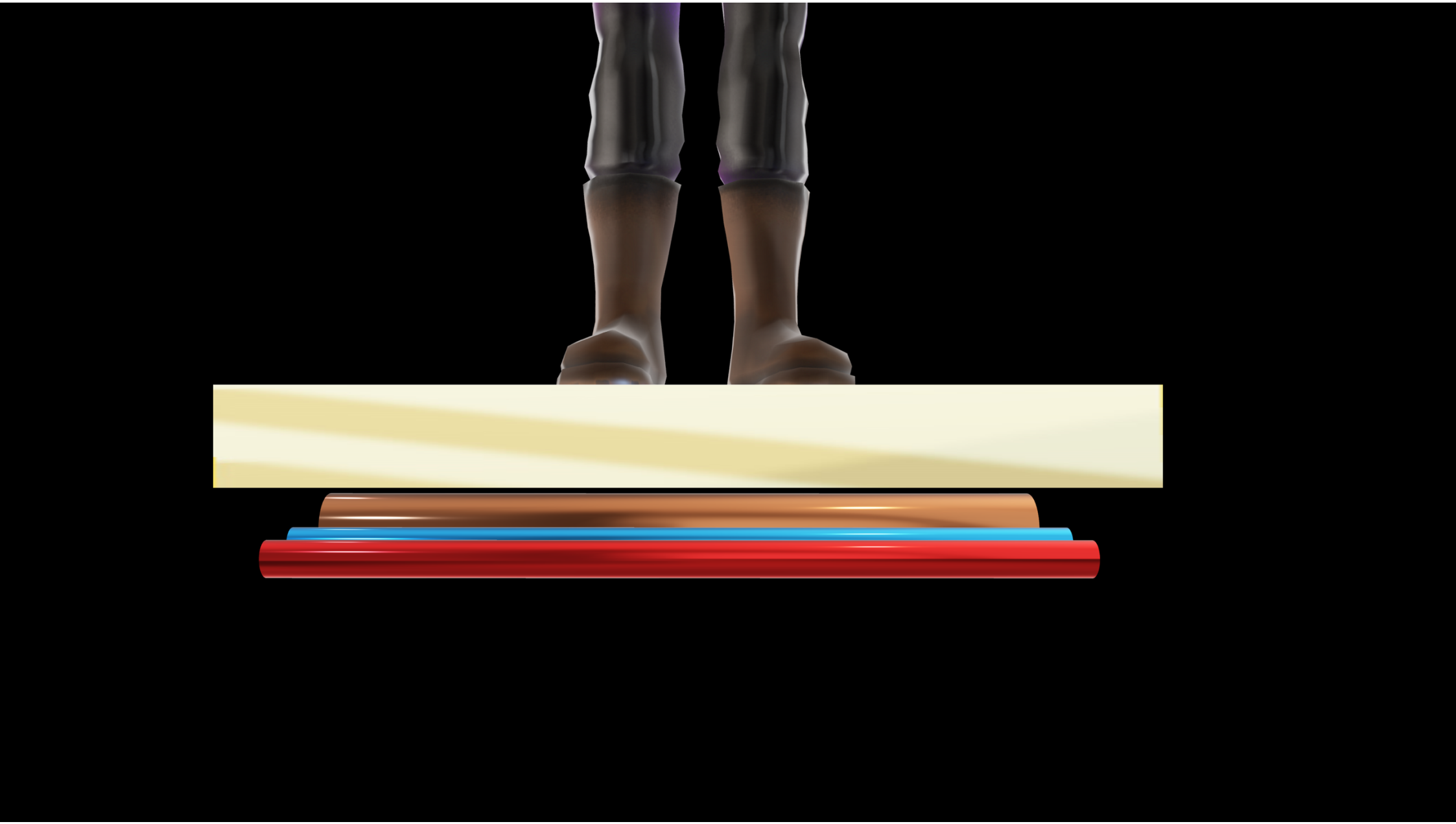
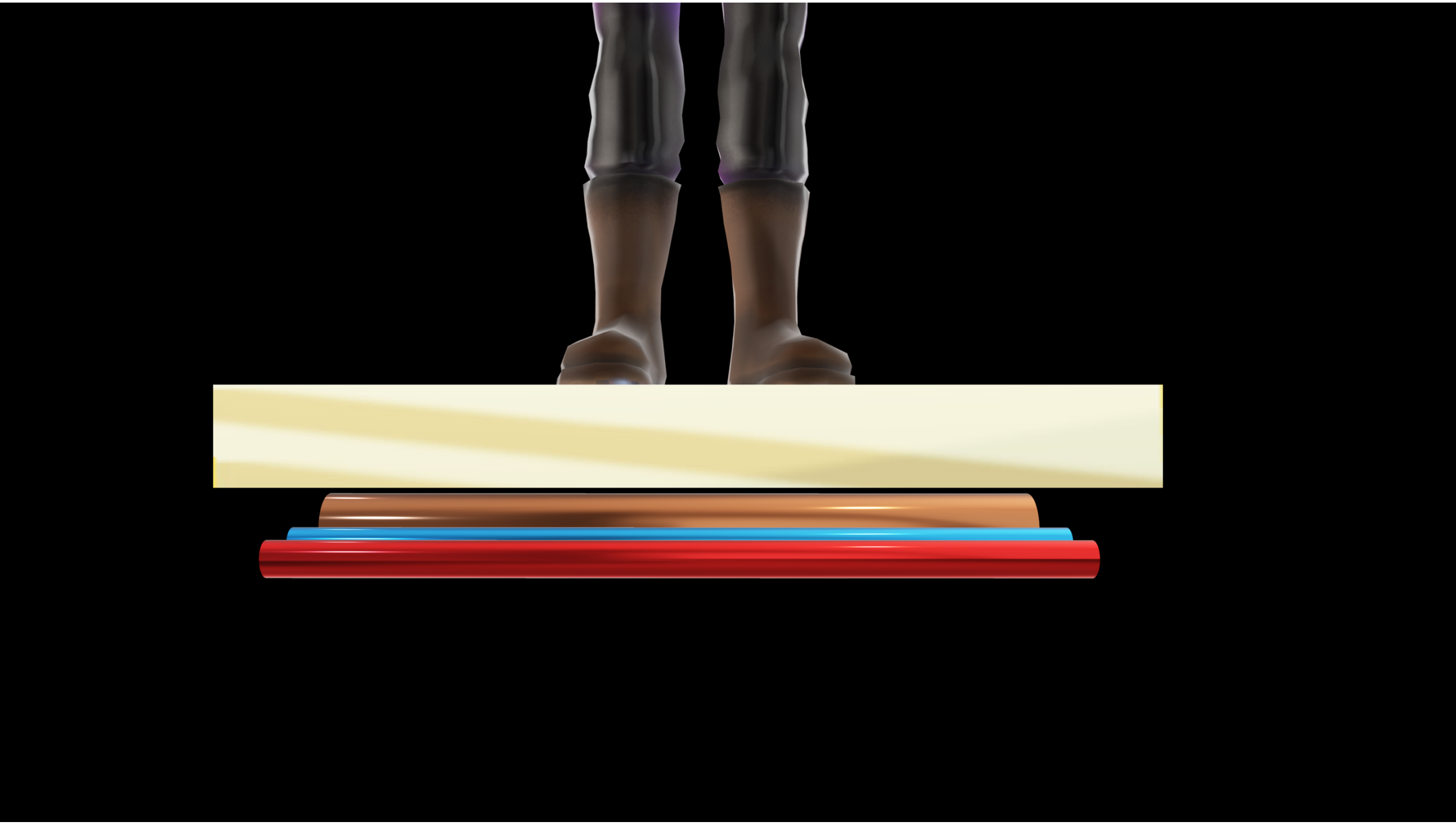
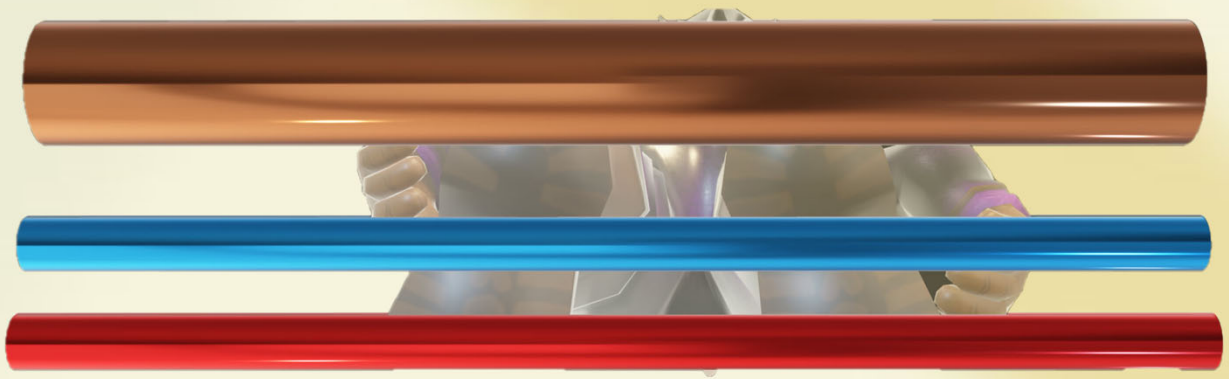








Infection Control & Hospital Epidemiology (2019), **40**, 621–626
doi:10.1017/ice.2019.60

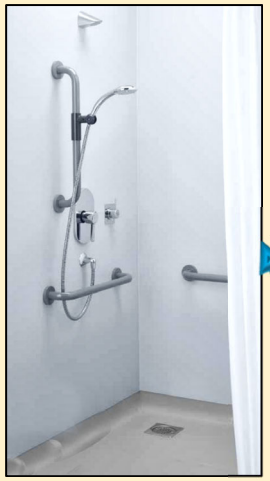
Original Article

Investigation of healthcare infection risks from water-related organisms: Summary of CDC consultations, 2014—2017

Kiran M. Perkins MD, MPH, Sujan C. Reddy MD, Ryan Fagan MD, MPH, Matthew J. Arduino MS, DrPH and Joseph F. Perz DrPH, MA

Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Perkins, K.M. et al (2019). Investigation of healthcare infection risks from water-related organisms: Summary of CDC consultations, 2014-2017. *Infectious Control and Hospital Epidemiology*. **40**(6): 621-626.



DIRECT OR INDIRECT CONTACT

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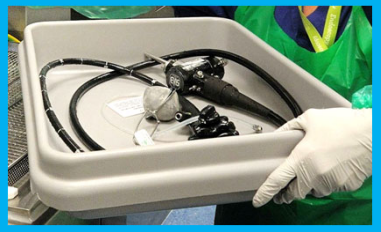

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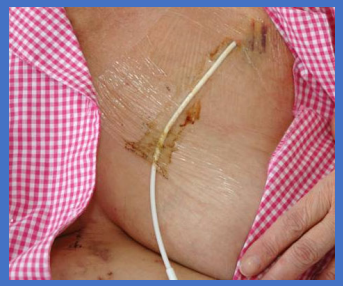
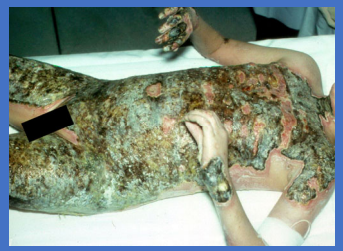
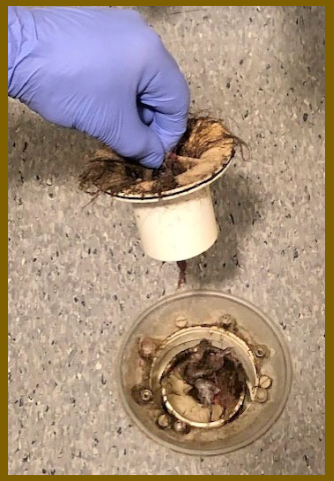
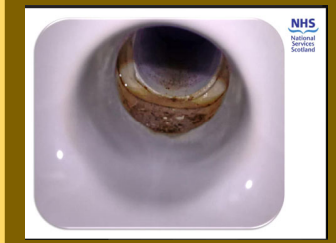




WASTEWATER SYSTEMS





01/01/2014 – 31/12/2017

620 investigations

134 (21.6%) met inclusion criteria

1380 patients involved

Average of 10.3 patients affected/ investigation

7.5% of investigations were polymicrobial

1/3rd of investigations were multi-drug resistant organisms

Injection/medication preparation near sink[a]
Nutrition (including breast milk and infant formula) preparation near sink[a]
Patient care supplies stored by sinks and toilets in intensive care unit[a]
Contaminated compounded nasal spray used prior to laryngoscopy
Contaminated water from neonatal intensive care unit (NICU) sinks[a]
Contaminated water from operating room scrub sinks[a]
Contaminated sink drains[a]
Contaminated dialysis wall boxes[a]
Use of nonsterile ice for patient care among immunocompromised patients[a]
Use of contaminated water in dental water lines[10,11,a]
Water introduction during respiratory therapy[a]
Use of tap water during bronchoscopy procedures[a]
Use of nonsterile water for humidification reservoirs of infant incubators in NICU[a]
Use of consumer-grade humidifier in operating room during LASIK procedures[12]
Use of nonsterile water and inadequate disinfection of heater-cooler devices used during cardiac surgery[13–15,a]
Intrinsic contamination of medical products due to water contamination at production site[16,17,a]
Poor medical device reprocessing procedures[a]
Contaminated automated endoscope reprocessors
Poor cleaning and disinfection of hydrotherapy rooms and equipment[a]
Water from contaminated shower heads[a]
Improperly cleaned mobile shower trolleys
Hot tub use by surgical personnel[a]
Water contamination of specimens/reagents in the laboratory[a]
Building water leaks in patient care areas

Injection/medication preparation near sink[a]
Nutrition (including breast milk and infant formula) preparation near sink[a]
Patient care supplies stored by sinks and toilets in intensive care unit[a]
Contaminated compounded nasal spray used prior to laryngoscopy
Contaminated water from neonatal intensive care unit (NICU) sinks[a]
Contaminated water from operating room scrub sinks[a]
Contaminated sink drains[a]
Contaminated dialysis wall boxes[a]
Use of nonsterile ice for patient care among immunocompromised

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Journal of Hospital Infection

journal homepage: www.elsevier.com/locate/jhin

Review

Risk of multi-drug-resistant organism acquisition from prior bed occupants in the intensive care unit: a meta-analysis

G.Y. Gu [a,†], M. Chen [b,†], J.C. Pan [a], X.L. Xiong [c,*]

[a] *Neurosurgical Intensive Care Unit, The Affiliated BenQ Hospital of Nanjing Medical University, Nanjing, Jiangsu, China*
[b] *Rehabilitation Medicine Department, The Affiliated BenQ Hospital of Nanjing Medical University, Nanjing, Jiangsu Province, China*
[c] *The Affiliated BenQ Hospital of Nanjing Medical University, Nanjing, Jiangsu Province, China*

ARTICLE INFO

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ICU
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Mult
MDR
Meta-analysis

SUMMARY

colonized with MDROs, 421 had acquired MDROs. The control group consisted of 55,933 patients without exposure factors, of which 1768 had been infected/colonized with MDROs. The pooled acquisition OR for MDROs was 1.80 (95% CI: 1.42, 2.29), $P<0.00001$. Subgroup analysis based on multi-drug-resistant Gram-positive and Gram-negative organisms was conducted using a fixed-effects model. The results significantly varied between the groups. Heterogeneity was partially explained by the MDRO type. In conclusion, exposure of bed occupants to infected/colonized MDROs significantly increased the risk of MDRO acquisition in subsequent bed occupants.

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Introduction

The term 'multi-drug-resistant organisms' (MDROs) mainly refers to bacteria simultaneously resistant to three or more types of commonly susceptible antimicrobial drugs used in clinical practice at the same time [1]. MDROs include meticillin-resistant *Staphylococcus aureus* (MRSA), vancocyin-resistant enterococci (VRE), carbapenem-resistant Enterobacterales (CRE), extended-

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† These authors contributed equally to this work.

medicina *intensiva*

http://www.medintensiva.org/

ORIGINAL ARTICLE

Impact of the ''Zero Resistance'' program on acquisition of multidrug-resistant bacteria in patients admitted to Intensive Care Units in Spain. A prospective, intervention, multimodal, multicenter study

Francisco Álvarez-Lerma [a,*], Mercedes Catalán-González [b], Joaquín Álvarez [c], Miguel Sánchez-García [d], Mercedes Palomar-Martínez [e], Inmaculada Fernández-Moreno [f], José Garnacho-Montero [g], Fernando Barcenilla-Gaite [h], Rosa García [i], Jesús Aranaz-Andrés [j], [m]

Spain

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[j] *Service of Preventive Medicine and Public Health, Hospital Universitario Ramón y Cajal, Madrid, Spain*
[k] *Service of Preventive Medicine, Hospital General Universitario de Burgos, Burgos, Spain*
[l] *Service of Intensive Care Medicine, Hospital Universitario i Politècnico La Fe, Valencia, Spain*
[m] *Department of Basic Sciences, Unit of Biostatistics, Institut de Reserca Biomèdica de Lleida-Universitat de Lleida, Lleida, Spain*

Received 28 September 2022; accepted 12 December 2022

KEYWORDS
Critical ill patient;
ICU;
Multidrug-resistant bacteria;
Surveillance studies;
Preventive isolation;
Antimicrobial use;
Elimination of reservoirs;
''Zero Resistance Project''

Abstract
Objective: To assess the impact of a multimodal interventional project (''Zero Resistance'') on the acquisition of multidrug-resistant bacteria (MDR-B) during the patient's ICU stay.
Design: Prospective, open-label, interventional, multicenter study.
Setting: 103 ICUs.
Patients: Critically ill patients admitted to the ICUs over a 27-month period.
Interventions: Implementation of a bundle of 10 recommendations to prevent emergence and spread of MDR-B in the ICU.
Main variable of interest: Rate of patients acquiring MDR-B during their ICU stay, with differentiation between colonization and infection.

UK NATIONAL ACTION PLAN AMR
NO RECOGNITION OF BUILT ENVIRONMENT

EXECUTIVE SUMMARY

Following 19 months of consultation and eight interim papers, each focusing on a specific aspect of antimicrobial resistance (AMR), this report sets out the Review on Antimicrobial Resistance's final recommendations to tackle AMR in a global way, as commissioned by our sponsors, the UK Government and the Wellcome Trust.

The magnitude of the problem is now accepted. We estimate that by 2050, 10 million lives a year and a cumulative 100 trillion USD of economic output are at risk due to the rise of drug-resistant infections if we do not find proactive solutions now to slow down the rise of drug resistance. Even today, 700,000 people die of resistant infections every year. Antibiotics are a special category of antimicrobial drugs that underpin modern medicine as we know it: if they lose their effectiveness, key medical procedures (such as gut surgery, caesarean sections, joint replacements, and treatments that depress the immune system, such as chemotherapy for cancer) could become too dangerous to perform. Most of the direct and much of the indirect impact of AMR will fall on low and middle-income countries.

It does not have to be this way. It is in policy makers and governments' hands to take steps to change this situation. Because microbes travel freely, some of the steps that are required will need to be taken in a coordinated way internationally. What is certain is that no single country can solve the AMR problem on its own and several of our proposed solutions will require at least a critical mass of countries behind them if they are to make a difference. Tackling AMR is core to the long-term economic development of countries and our well-being. Solutions to address it must have global access to healthcare at their heart and they must help us to stop wasting medicines that we rely on and yet are exhaustible.

To stop the global rise of drug-resistant infections, there is a supply and demand problem that needs to be fixed. The supply of new medicines is insufficient to keep up with the increase in drug resistance as older medicines are used more widely and microbes evolve to resist them. At the same time, the demand for these medicines is very badly managed: huge quantities of antimicrobials, in particular antibiotics, are wasted globally on patients and animals who do not need them, while others who need them do not have access.

Fundamental change is required in the way that antibiotics are consumed and prescribed, to preserve the usefulness of existing products for longer and to reduce the urgency of discovering new ones. Governments should be held accountable on this goal to reduce the demand for antimicrobials and in particular antibiotics, as should the main sectors that drive antibiotic consumption: healthcare systems, the pharmaceutical industry and the farming and food production industry.

Firstly, the specific steps to reduce demand are:

1. A massive global public awareness campaign

We need to improve global awareness of AMR across the board, so that patients and farmers do not demand, and clinicians and veterinarians do not prescribe, antibiotics when they are not needed, and so that policy makers ensure that policies to tackle AMR are taken forward now. The cost of running a sustained public awareness campaign across the world would depend on its nature and scope. Based on estimates we have considered, it could cost between 40 and 100 million USD a year. It could be met by a mix of existing public health programmes in high-income countries, support for programmes in low and middle-income countries and corporate sponsorship for major events.

2. Improve hygiene and prevent the spread of infection

Improving hygiene and sanitation was essential in the 19th century to counter infectious diseases. Two centuries later, this is still true and is also crucial to reducing the rise in drug resistance: the less people get infected, the less they need to use medicines such as antibiotics, and the less drug resistance arises. All countries need to act. Some in the developing world will need to focus on improving the basics first, by expanding access to clean water and sanitation. For other countries the focus will be to reduce infections in health and care settings, such as limiting superbugs in hospitals. The simplest way that all of us can help counter the spread of infections is by proper hand washing.

3. Reduce unnecessary use of antimicrobials in agriculture and their dissemination into the environment

There are circumstances where antibiotics are required in agriculture and aquaculture – to maintain animal welfare and food security. However, much of their global use is not for treating sick animals, but rather to prevent infections or simply to promote growth. The quantity of antibiotics used in livestock is vast. In the US, for example, of the antibiotics defined as medically important for humans by the US Food and Drug Administration (FDA), over 70 percent (by weight) are sold for use in animals. Many countries are also likely to

MANCHESTER HOSPITAL

Articles

Inappropriate empirical antibiotic therapy for bloodstream infections based on discordant in-vitro susceptibilities: a retrospective cohort analysis of prevalence, predictors, and mortality risk in US hospitals

Sameer S Kadri, Yi Ling Lai, Sarah Warner, Jeffrey R Strich, Ahmed Babiker, Emily E Ricotta, Cumhur Y Demirkale, John P Dekker, Tara N Palmore, Chanu Rhee, Michael Klompas, David C Hooper, John H Powers 3rd, Arjun Srinivasan, Robert L Danner, Jennifer Adjemian, forming the National Insititutes of Health Antimicrobial Resistance Outcomes Research Initiative (NIH-ARORI)

Summary

Background The prevalence and effects of inappropriate empirical antibiotic therapy for bloodstream infections are unclear. We aimed to establish the population-level burden, predictors, and mortality risk of in-vitro susceptibility-discordant empirical antibiotic therapy among patients with bloodstream infections.

Lancet Infect Dis 2021; 21: 241–51
Published Online Sept 8, 2020

Clinical Trial > Am J Med. 2003 Nov;115(7):529-35. doi: 10.1016/j.amjmed.2003.07.005.

Inappropriate initial antimicrobial therapy and its effect on survival in a clinical trial of immunomodulating therapy for severe sepsis

Stephan Harbarth [1], Jorge Garbino, Jérome Pugin, Jacques A Romand, Daniel Lew, Didier Pittet

Affiliations + expand

PMID: 145996[illegible]

Abstract

Purpose: To e[illegible]
patients with s[illegible]
108 hospitals i[illegible]

Methods: We [illegible]
patients who h[illegible]
receive at least[illegible]

ANTIMICROBIAL AGENTS AND CHEMOTHERAPY, Nov. 2010, p. 4631–4663 VOL. 54, NO. 11
0066-4804/10/$12.00 doi:10.1128/AAC.00627-10
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Systematic Review and Meta-Analysis of the Efficacy of Appropriate Empiric Antibiotic Therapy for Sepsis▽†

Mical Paul,[1]* Vered Shani,[2] Eli Muchtar,[2] Galia Kariv,[2] Eyal Robenshtok,[2] and Leonard Leibovici[2]

Interpretation Approximately one in five patients with bloodstream infections in US hospitals received discordant empirical antibiotic therapy,

Conclusion: In[illegible]
initial antimicr[illegible]
improving dete[illegible]

empirical antibiotic treatment was associated with significantly higher mortality in the unadjusted and adjusted comparisons, with considerable heterogeneity occurring in both analyses (I^2 > 70%). Study design, time of mortality assessment, the reporting methods of the multivariable models, and the covariates used for adjustment were significantly associated with effect size. Septic shock was the only clinical variable significantly affecting results (it was associated with higher ORs). Studies adjusting for background conditions and sepsis severity reported a pooled adjusted OR of 1.60 (95% confidence interval = 1.37 to 1.86; 26 studies; number needed to treat to prevent one fatal outcome, 10 patients [95% confidence interval = 8 to 15]; I^2 = 46.3%) given 34% mortality with inappropriate empirical treatment. Appropriate empirical antibiotic treatment is associated with a significant reduction in all-cause mortality. However, the methods used in the observational studies significantly affect the effect size reported. Methods of observational studies assessing the effects of antibiotic treatment should be improved and standardized.

therapy and associated deaths occurred among patients with bloodstream infections caused by *Staphylococcus aureus* or Enterobacterales.

Interpretation Approximately one in five patients with bloodstream infections in US hospitals received discordant empirical antibiotic therapy, receipt of which was closely associated with infection with antibiotic-resistant pathogens. Receiving discordant empirical antibiotic therapy was associated with increased odds of mortality overall, even in patients without sepsis. Early identification of bloodstream pathogens and resistance will probably improve population-level outcomes.

Funding US National Institutes of Health, US Centers for Disease Control and Prevention, and US Agency for Healthcare Research and Quality.

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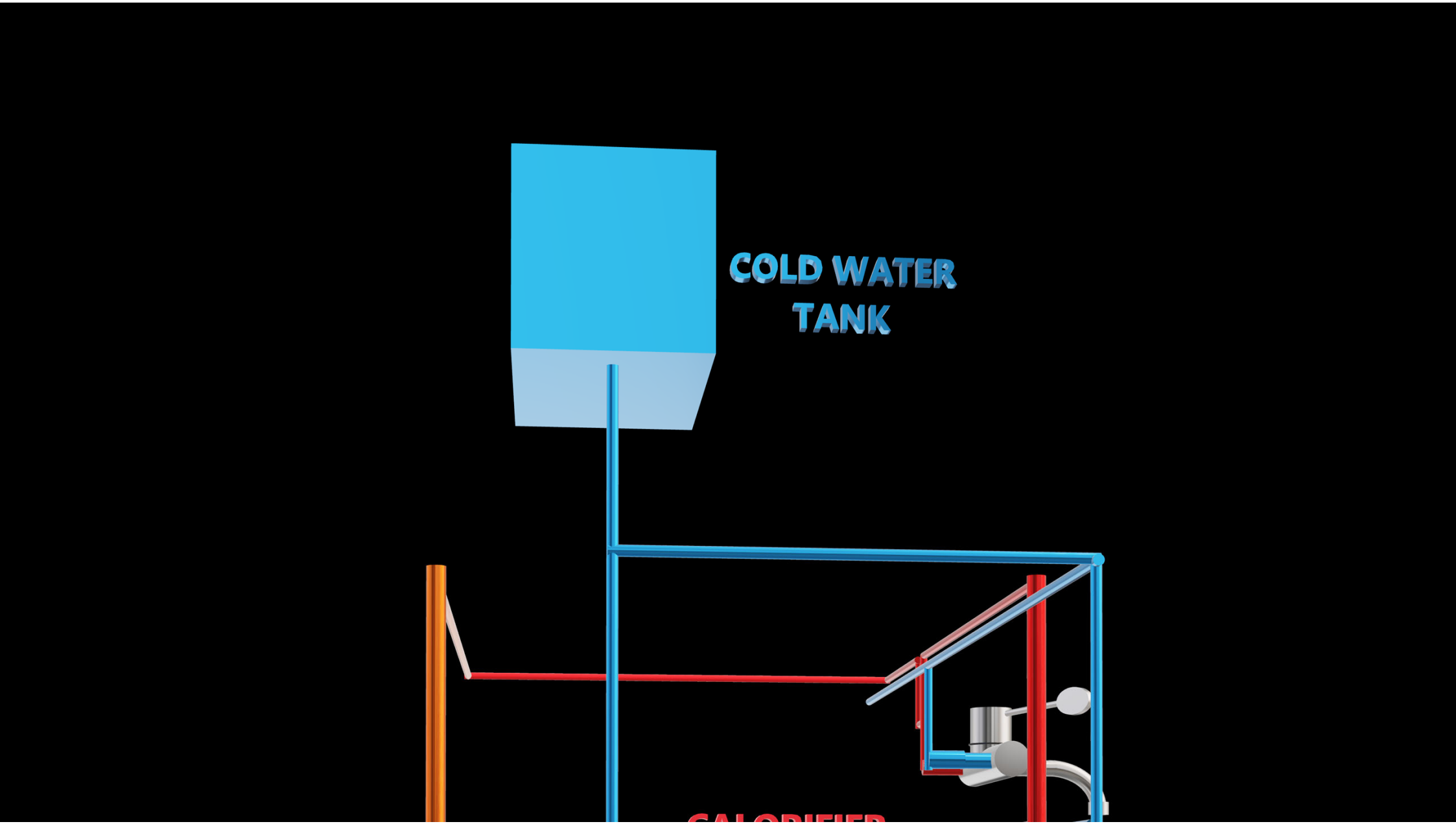
Introduction

Prompt and effective antibiotic therapy is associated with improved outcomes in patients with serious infections such as bloodstream infection and sepsis.[1,2] However, the rise of antibiotic resistance and the inherent lag between blood sampling for culture and establishment of in-vitro susceptibility of isolated bacteria make empirical selection of antibiotics challenging.[3] Prescription of broad-spectrum regimens to all patients could increase de-novo resistance, the prevalence of *Clostridioides difficile* infection, antibiotic-related toxicities, and costs.[4,5] Understanding the burden of inappropriate empirical antibiotic therapy in serious infections, as well as how such therapy affects prognosis, could inform the development of improved antibiotic prescribing practices.

The population-level prevalence and effects of inappropriate empirical antibiotic therapy for serious infections in hospitals is not definitively known. In a 2015

Microbiology (J P Dekker MD), National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, MD, USA; United States Public Health Service, Commissioned Corps, Rockville, MD, USA (J R Strich, J Adjemian); Department of Pathology and Laboratory Medicine, Emory University School of Medicine, Atlanta, GA, USA (A Babiker MBBS); Brigham and Women's Hospitals, Boston, MA, USA (C Rhee MD, Prof M Klompas MD); Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, MA, USA (C Rhee, Prof M Klompas); Division of Infectious Diseases, Massachusetts General Hospital and Harvard Medical School, Boston, MA, USA (Prof D C Hooper MD); Clinical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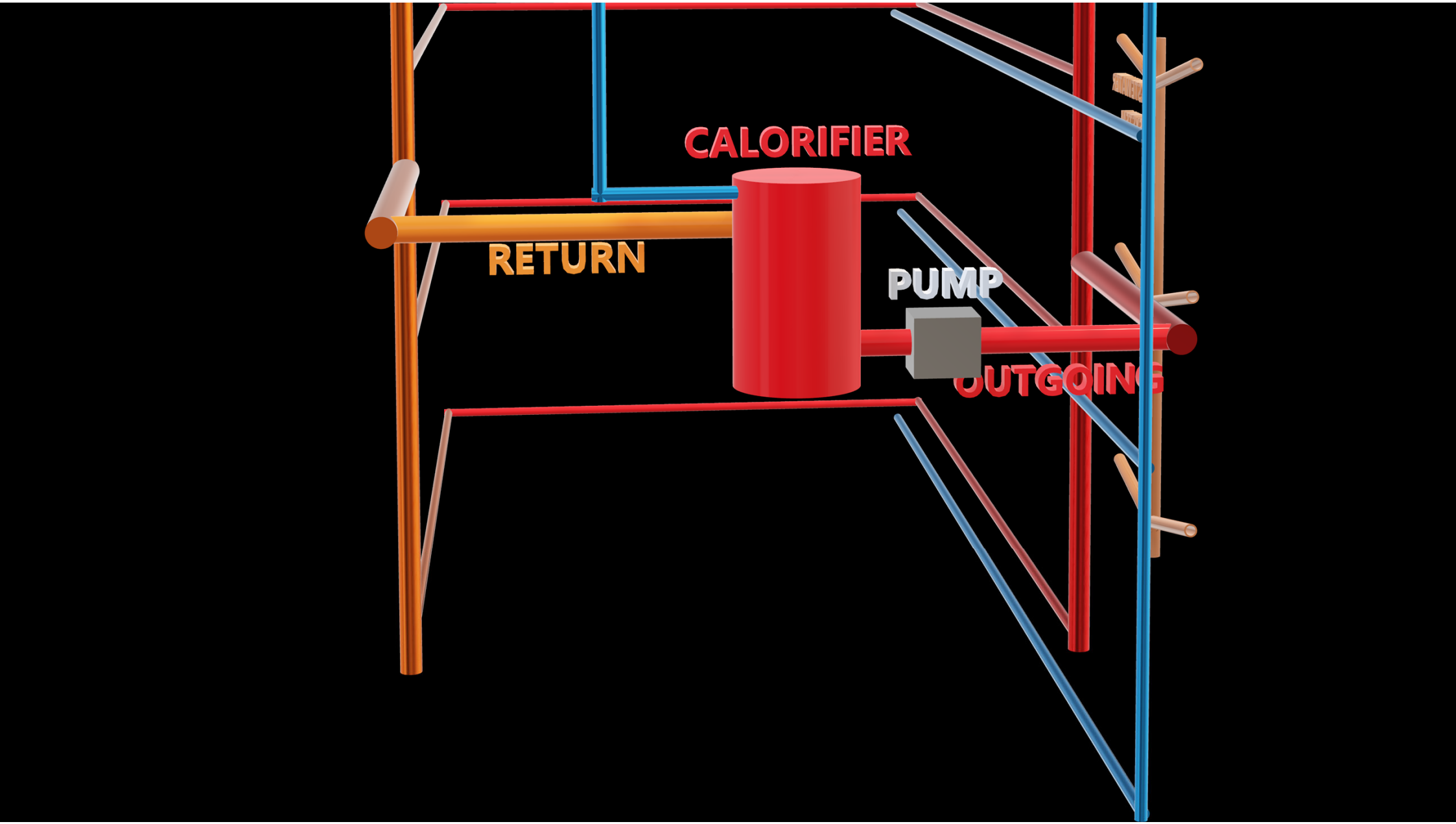
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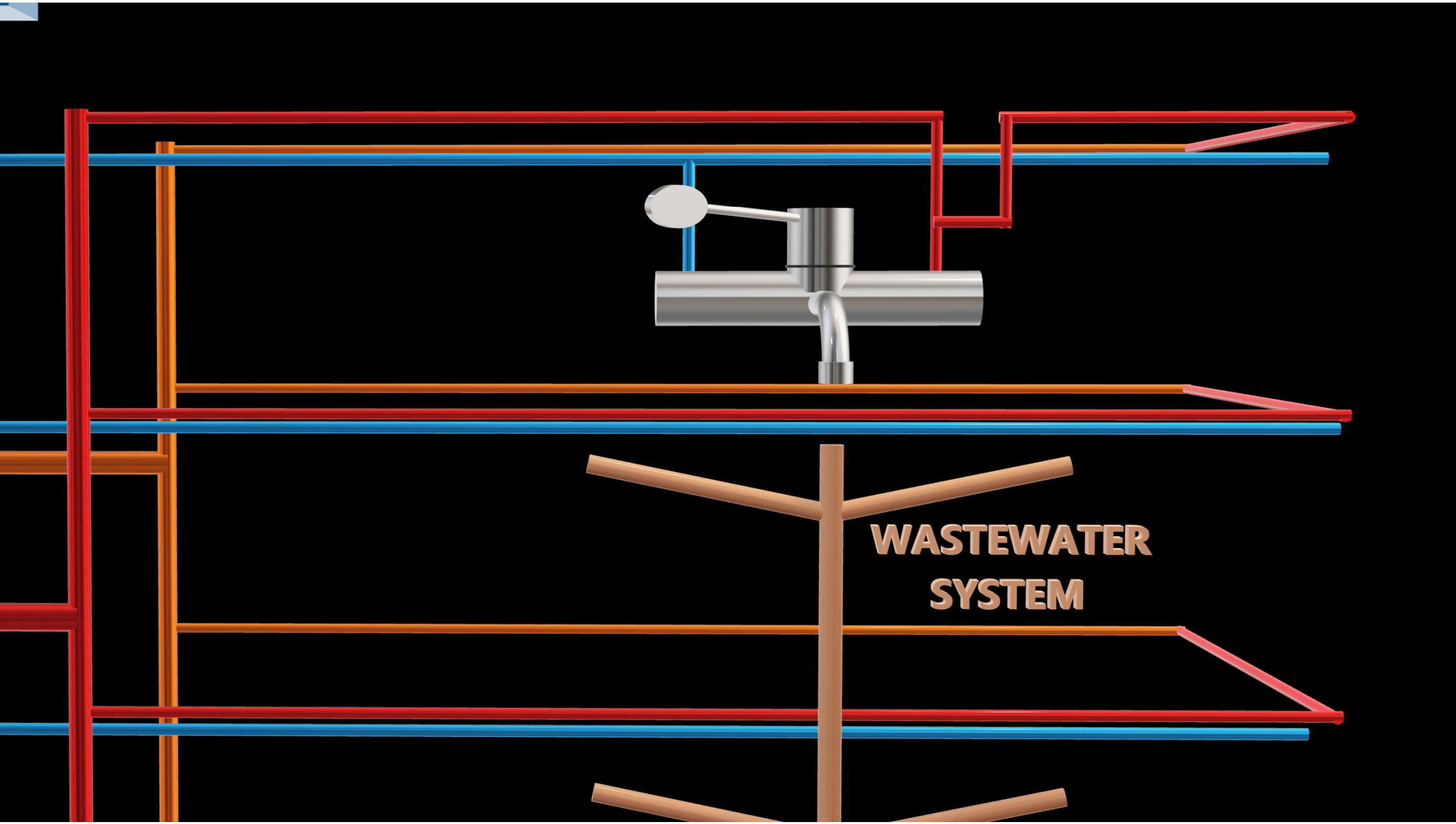
WASTEWATER
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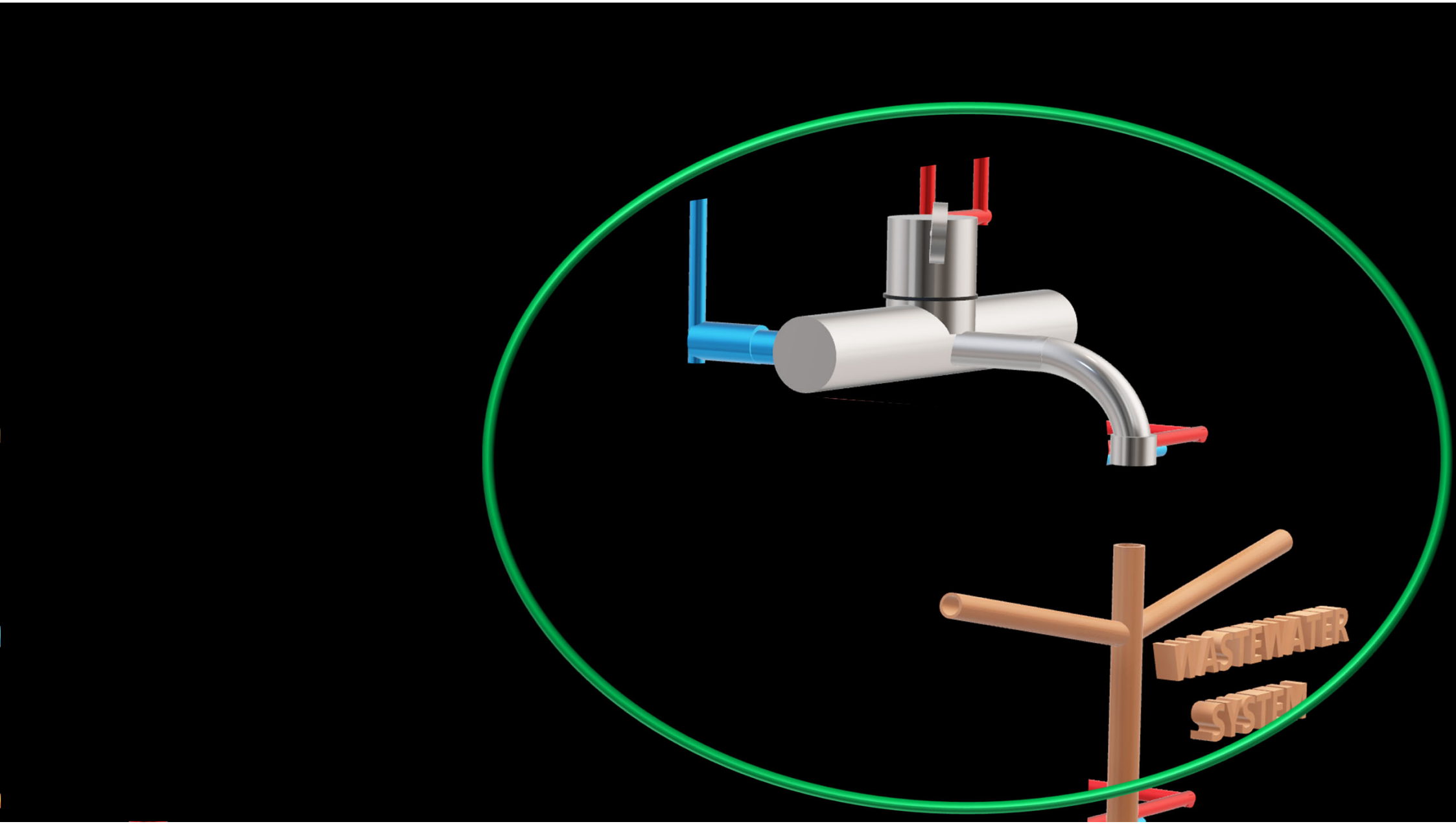
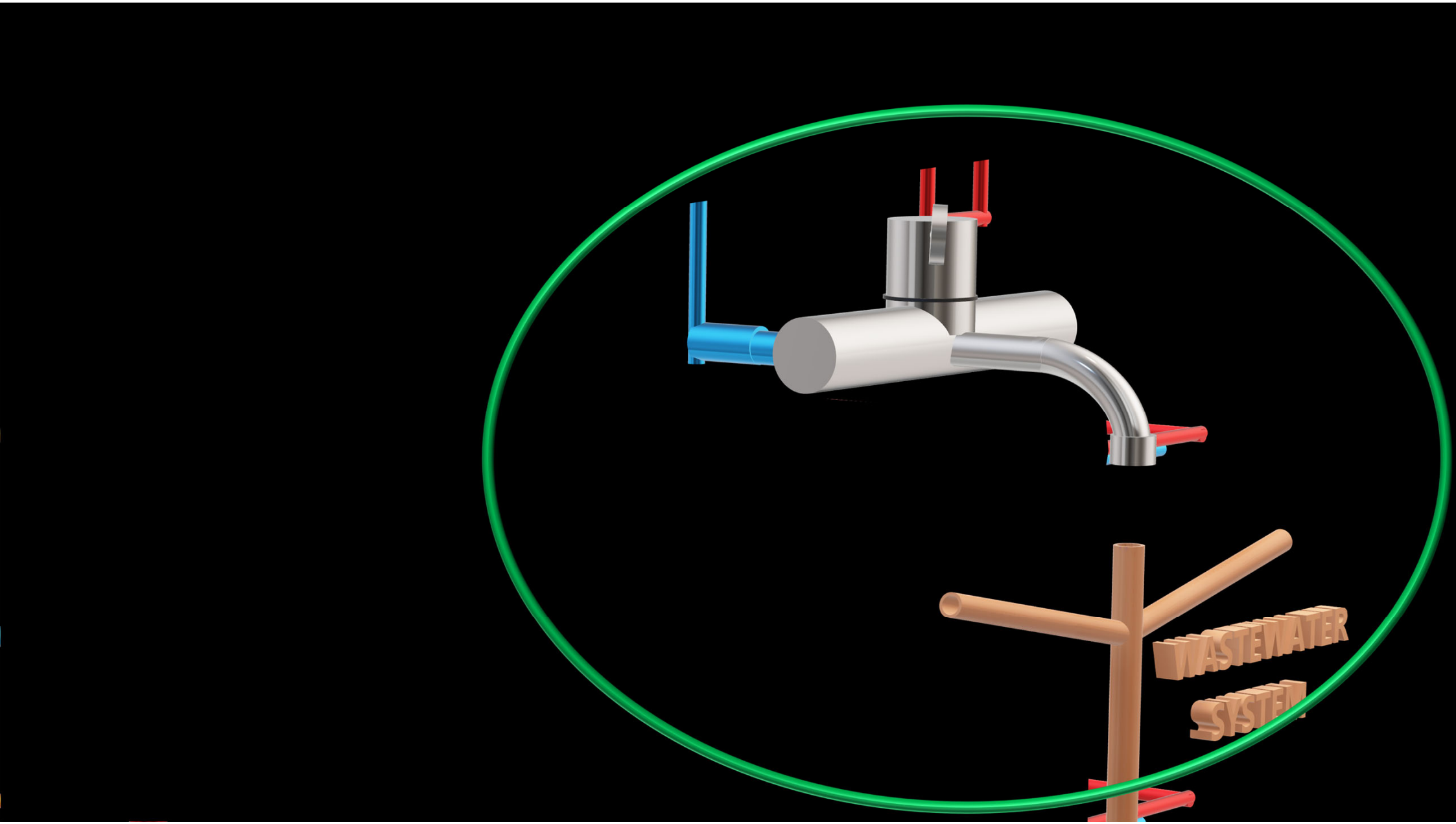
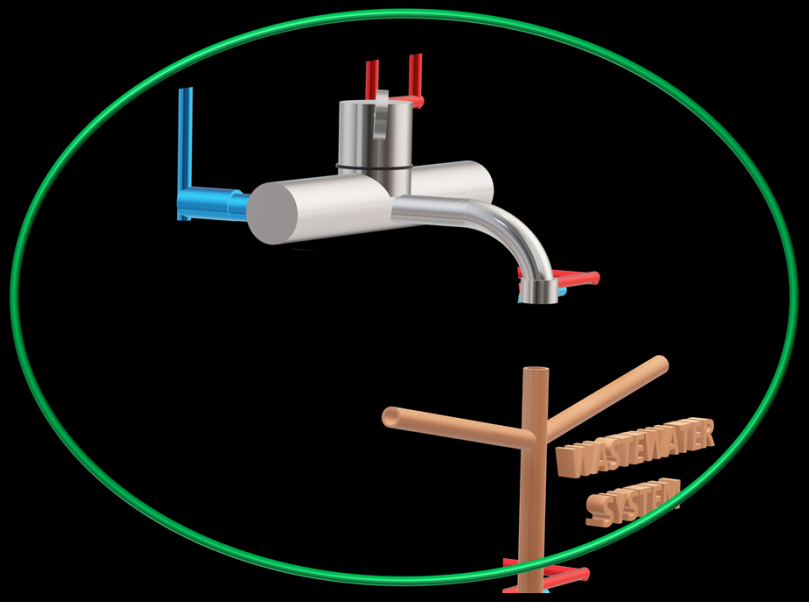

WASTEWATER


WASTEWATER

PERIPHERY OF WATER SYSTEM



LAST 2M OF PIPEWORK

CONNECTED DEVICES

ASSOCIATED WASTEWATER SYSTEM

PERIPHERY OF SYSTEM

CONTROL METHODS (TEMPERATURE / BIOCIDES) DIFFICULT TO MAINTAIN

NECESSITATES USE OF MATERIALS WITH HIGHER BIOFILM FORMING PROPENSITY

INTERFACE BETWEEN WATER SUPPLY AND WASTE SYSTEM

INNATELY FRAGILE SYSTEM

SOURCE OF VAST MAJORITY OF TRANSMISSION EVENTS

SUBJECT TO VAGARIES OF HUMAN INTERACTION

NOT RECOGNISED AS A DISCIPLINE IN ITS OWN RIGHT REQUIRING SPECIFIC EXPERTISE AND TRAINING


Video camera
ATTENTION
HELP US TO PREVENT THE SPREAD OF INFECTIONS.
PLEASE WASH YOUR HANDS
Thank You
B BRAUN
Softaskin pure foam
Gentle Wash Lotion
B BRAUN
SONY
TORK
SCA

Characterisations of hand washing sink activities in a single hospital medical intensive care unit.

Marika Grabowski,; Jennifer M. Lobo, Brian Gunnell, Kyle Enfield, Rick Carpenter, Laura Barnes, Amy Mathers, Journal of Hospital Infection in Press

- Of the 2,973 videos with analysed behaviours there were 5,614 observed behaviours which were assessed as; 37.4% medical care, 29.2% additional behaviours, 17.0% hand hygiene, 7.2% patient nutrition, 5.0% environmental care, 4.2% non-medical care.
- Hand washing was only 4% (224/5,614) of total behaviours. Subanalysis of 2,748 of the later videos further categorised 56 activities where a variety of nutrients, which could promote microbial growth, were disposed of in the sink.

Grabowski, M. et al (2018). Characterizations of handwashing sink activities in a single hospital medical intensive care unit. *The Journal of Hospital Infection.* **100**(3): e115-e122.

Catho *et al. Crit Care* (2021) 25:301
https://doi.org/10.1186/s13054-021-03726-y

Critical Care

RESEARCH Open Access

Outbreak of *Pseudomonas aeruginosa* producing VIM carbapenemase in an intensive care unit and its termination by implementation of waterless patient care

Gaud Catho[1*], R. Martischang[1], F. Boroli[2], M. N. Chraïti[1], Y. Martin[1], Z. Koyluk Tomsuk[2], G. Renzi[3], J. Schrenzel[3], J. Pugin[2], P. Nordmann[4,5], D. S. Blanc[5,6] and S. Harbarth[1]

Abstract

Background: Long-term outbreaks of multidrug-resistant Gram-negative bacilli related to hospital-building water systems have been described. However, successful mitigation strategies have rarely been reported. In particular, environmental disinfection or replacement of contaminated equipment usually failed to eradicate environmental sources of *Pseudomonas aeruginosa*.

Methods: We report the investigation and termination of an outbreak of *P. aeruginosa* producing VIM carbapenemase (PA-VIM) in the adult intensive care unit (ICU) of a Swiss tertiary care hospital with active case finding, environmental sampling and whole genome sequencing (WGS) of patient and environmental strains. We also describe the implemented control strategies and their effectiveness on eradication of the environmental reservoir.

Results: Between April 2018 and September 2020, 21 patients became either infected or colonized with a PA-VIM strain. For 16 of them, an acquisition in the ICU was suspected. Among 131 environmental samples collected in the ICU, 13 grew PA-VIM in sink traps and drains. WGS confirmed the epidemiological link between clinical and environmental strains and the monoclonal pattern of the outbreak. After removing sinks from patient rooms and implementation of waterless patient care, no new acquisition was detected in the ICU within 8 months after the intervention.

Discussion: Implementation of waterless patient care with removal of the sinks in patient rooms was successful for termination of a PA-VIM ICU outbreak linked to multiple environmental water sources. WGS provides highly discriminatory accuracy to investigate environment-related outbreaks.

Keywords: *Pseudomonas aeruginosa*, VIM, Carbapememase, Sink, Waterless, Outbreak, Aquatic reservoir, cgMLST

THE DRIVER FOR 'WATER FREE' CARE HAS BEEN DUE TO INTRACTABLE ISSUE OF WASTEWATER ORGANISMS REACHING THE PATIENT OR THEIR ENVIRONMENT WHEN ACCESSING WATER SERVICES

Chapter 1: Standard infection control precautions (SICPs)

Contents

1.6 Safe management of the care environment

The care environment must be:

- visibly clean, free from non-essential items and equipment to facilitate effective cleaning
- well maintained, in a good state of repair and with adequate ventilation for the clinical specialty.

Always adhere to COSHH risk assessments for product use and processes for decontamination of the care environment.

Routine cleaning

- the environment should be routinely cleaned in accordance with the National Cleaning Standards
- use of detergent wipes is acceptable for cleaning surfaces/frequently touched sites within the care area
- a fresh solution of general-purpose neutral detergent in warm water is recommended for routine cleaning. This should be changed when dirty or when changing tasks
- routine disinfection of the environment is not recommended however, 1,000ppm available chlorine should be used routinely on sanitary fittings
- staff groups should be aware of their environmental cleaning schedules for their area and clear on their specific responsibilities
- cleaning protocols should include responsibility for, frequency of, and method of environmental decontamination.

Further information can be found in the safe management of the care environment literature review.

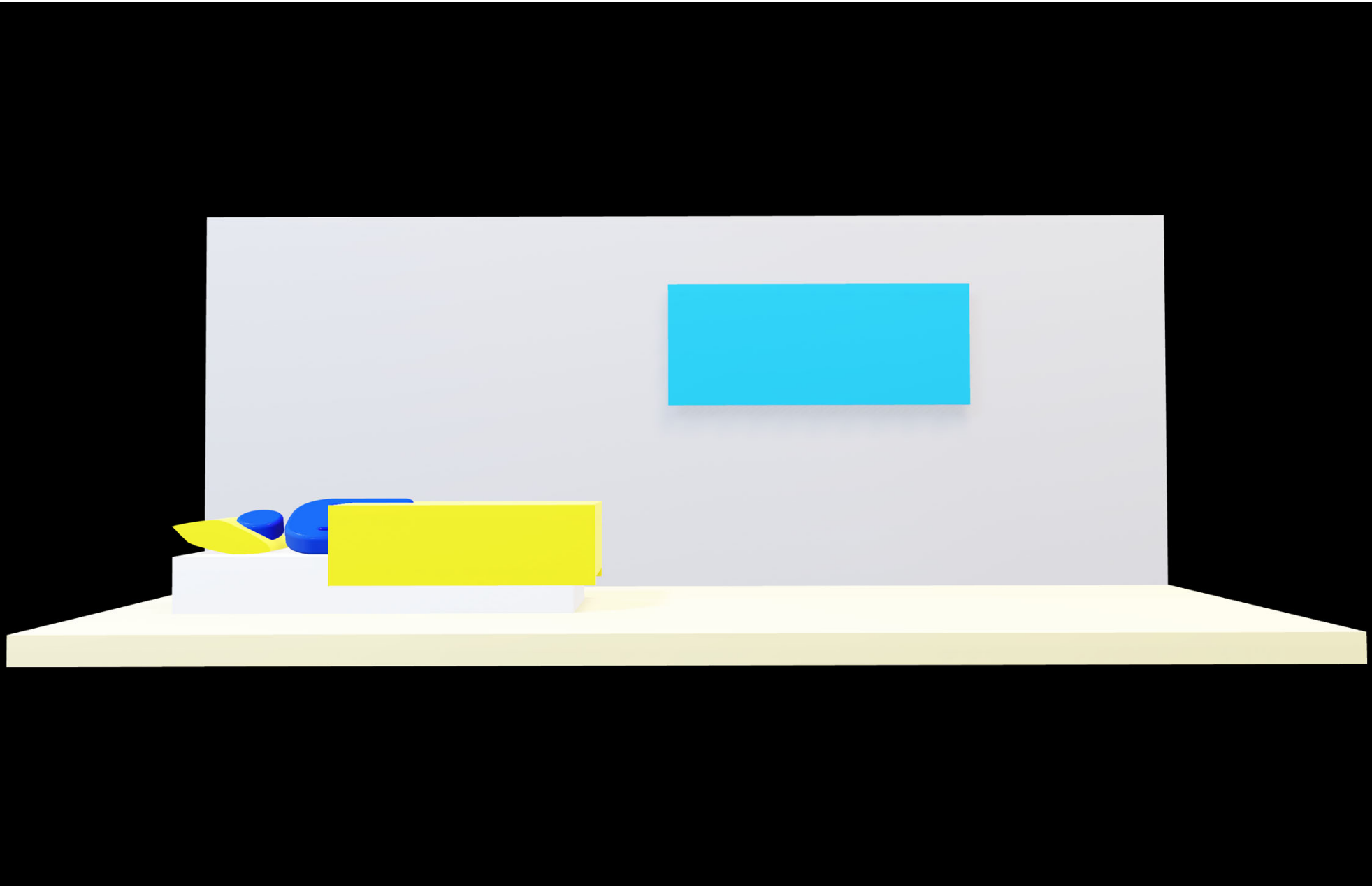
STANDARD INFECTION CONTROL PRECAUTIONS

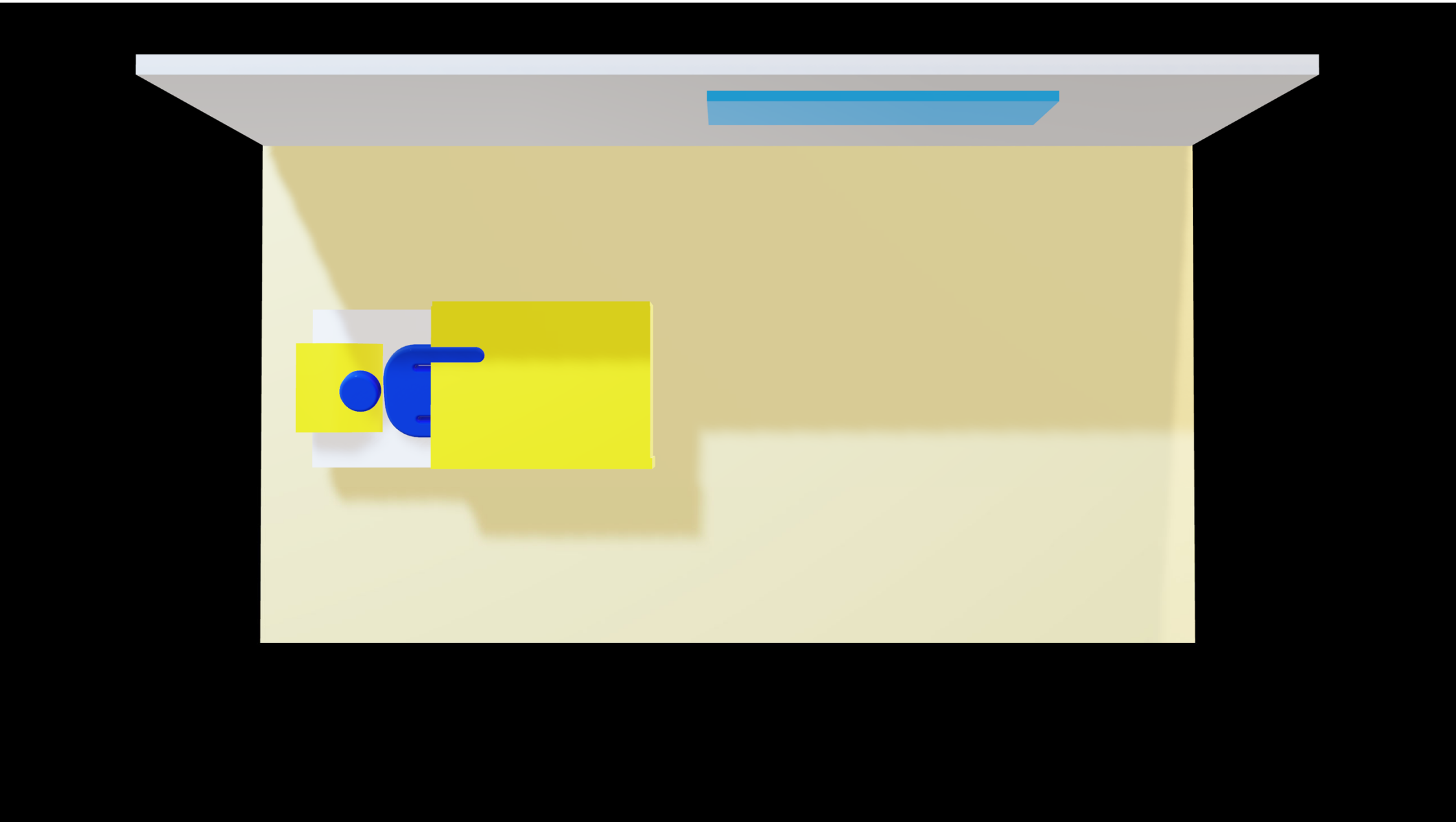
PREVENT TRANSMISSION OF WATER / WASTEWATER ORGANISMS

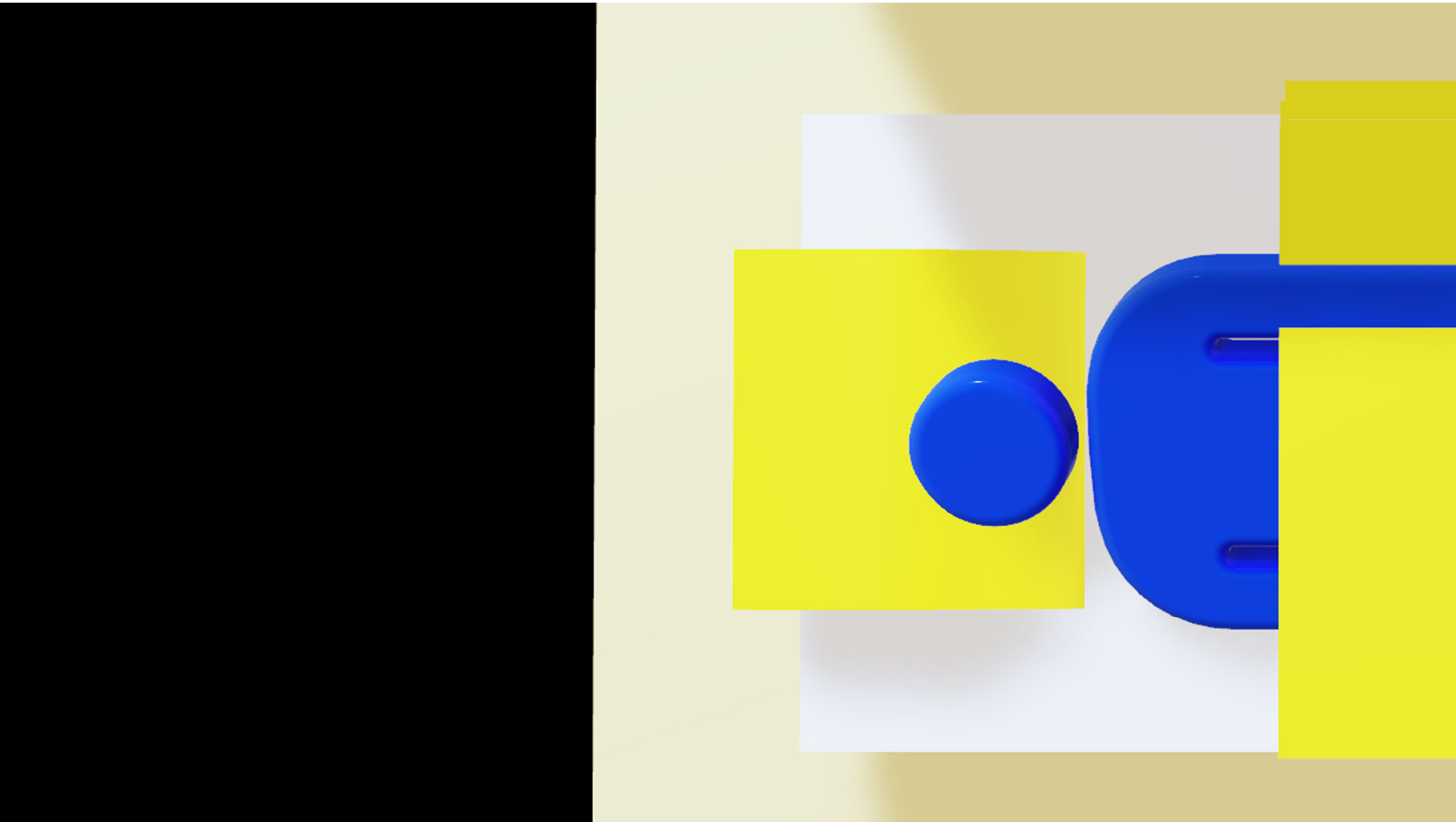
STANDARD INFECTION CONTROL PRECAUTIONS

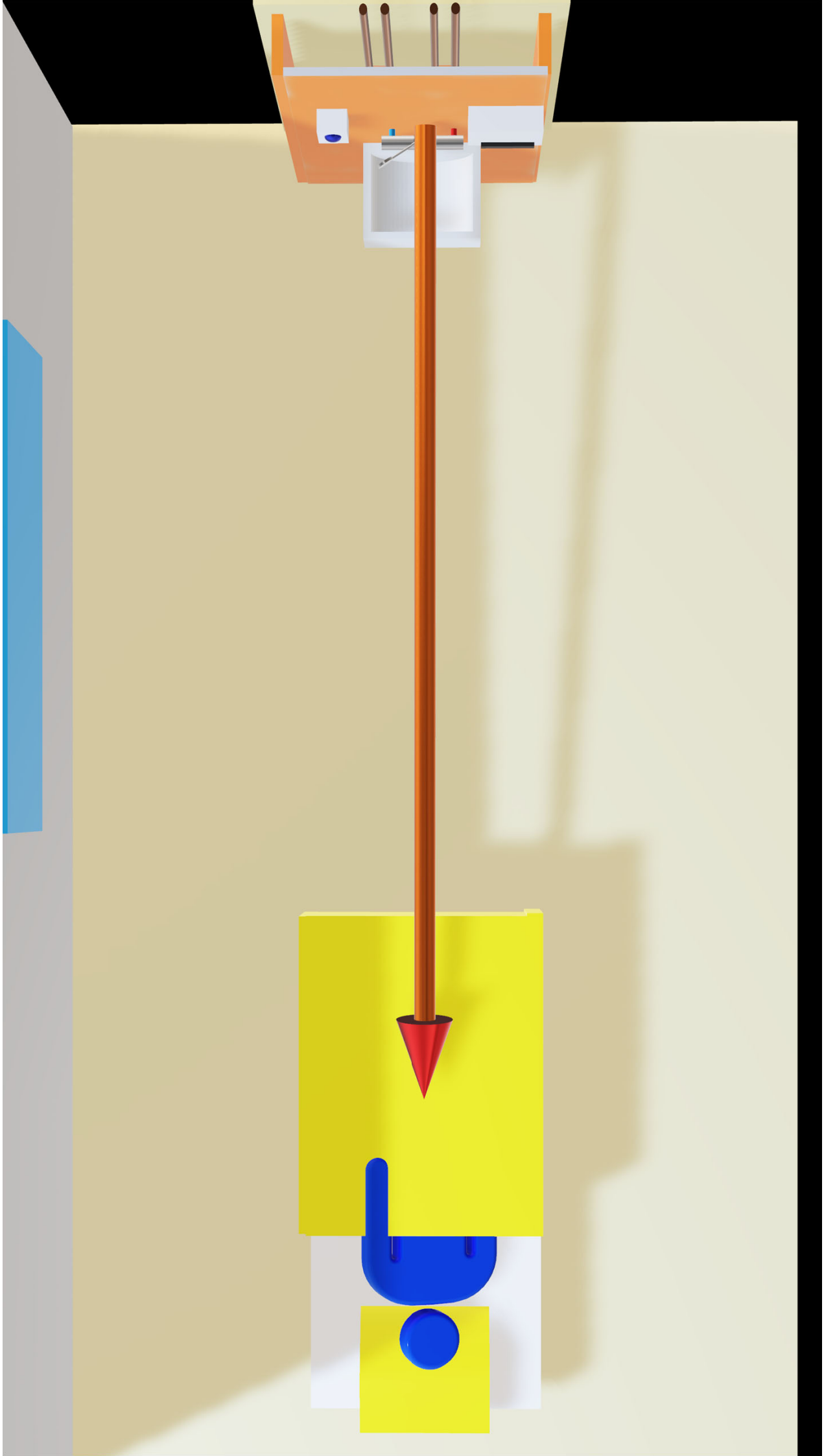
DO NOT

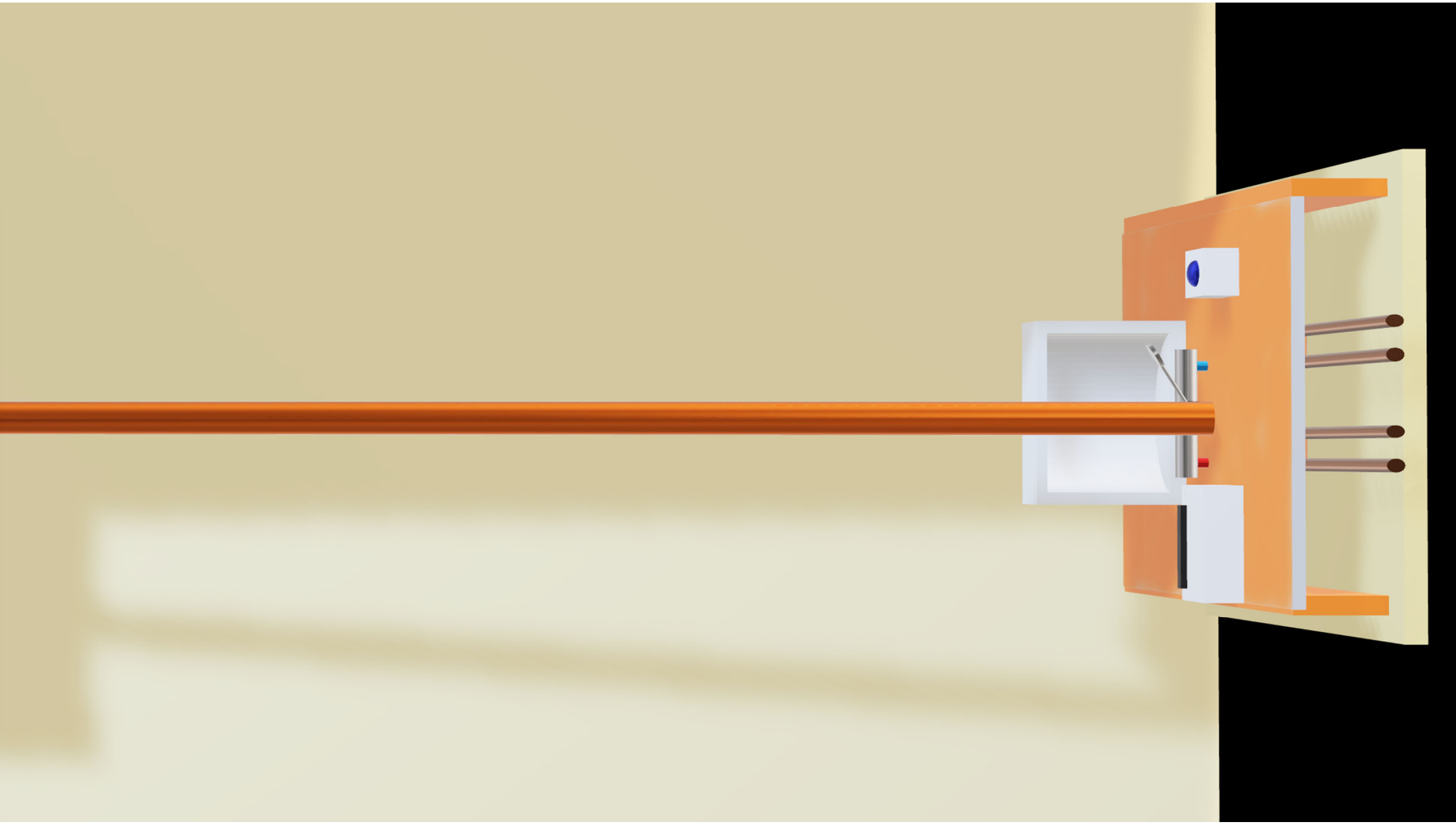
PREVENT TRANSMISSION OF WATER / WASTEWATER ORGANISMS

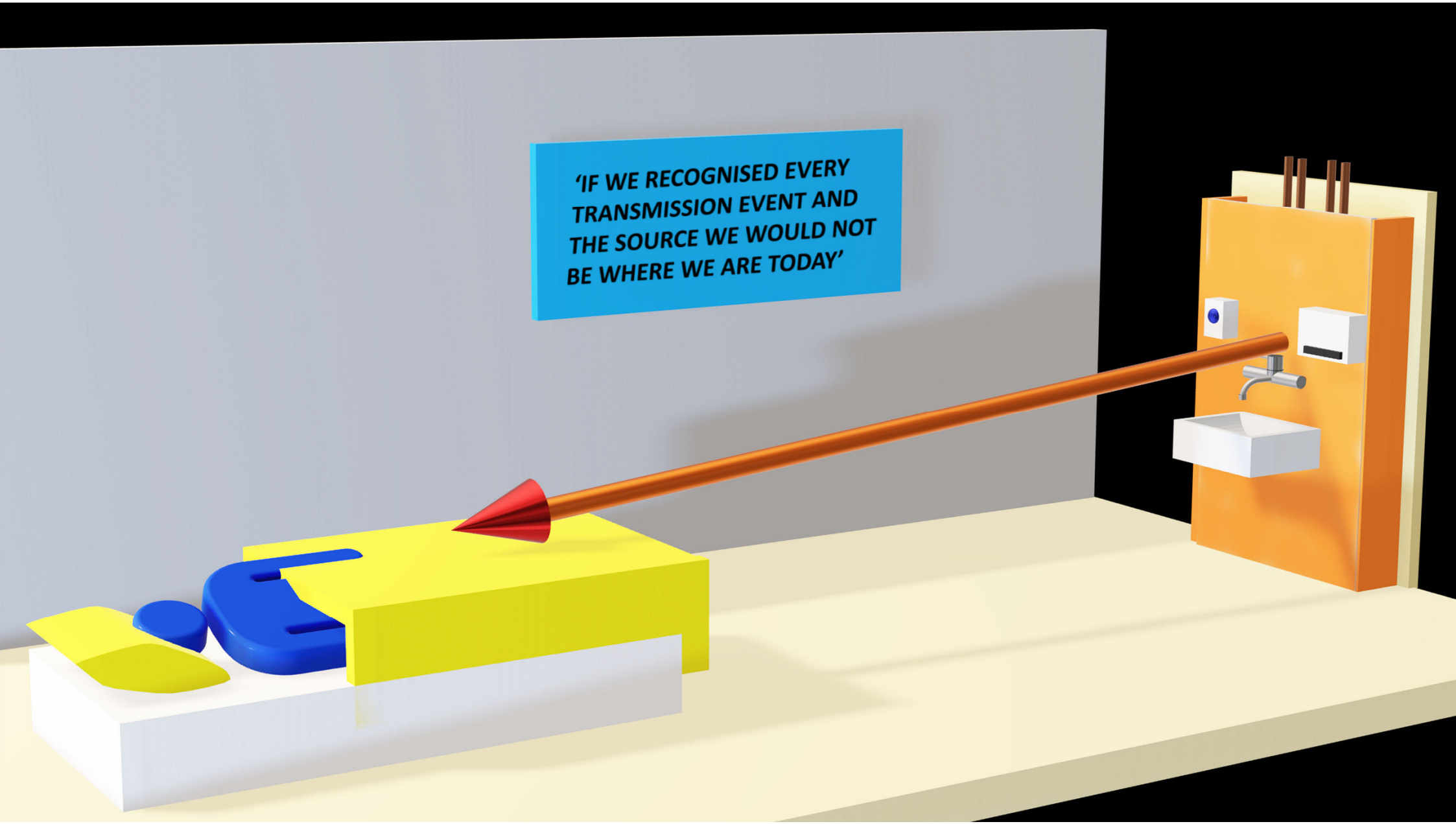











'IF WE RECOGNISED EVERY
TRANSMISSION EVENT AND
THE SOURCE WE WOULD NOT
BE WHERE WE ARE TODAY'

Pseudomonas aeruginosa infection in augmented care: the molecular ecology and transmission dynamics in four large UK hospitals

F.D. Halstead [a, b, 1], J. Quick [a, c, 1], M. Niebel [a, b], M. Garvey [a, b], N. Cumley [a, b], R. Smith [d], T. Neal [e], P. Roberts [e], K. Hardy [f], S. Shabir [f], J.T. Walker [g], P. Hawkey [b, c, *], N.J. Loman [c]

[a] *NIHR Surgical Reconstruction and Microbiology Research Centre, Queen Elizabeth Hospital, Birmingham, UK*
[b] *Department of Clinical Microbiology, Queen Elizabeth Hospital, University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK*
[c] *Institute of Microbiology and Infection, School of Biosciences, University of Birmingham, Birmingham, UK*
[d] *Royal Free London NHS Foundation Trust, Hampstead, London, UK*
[e] *Royal Liverpool University Hospital, Royal Liverpool and Broadgreen University Hospitals NHS Trust, Liverpool, UK*
[f] *Public Health England, Heartlands Hospital, University Hospitals Birmingham, Birmingham, UK*
[g] *Walker On Water, Salisbury, UK*

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Keywords:
P. aeruginosa
Water-outlets
Transmission
Molecular-ecology
Infections
Augmented-care

SUMMARY

Background: *Pseudomonas aeruginosa* is a common opportunistic pathogen and molecular typing in outbreaks has linked patient acquisition to contaminated hospital water systems.
Aim: To elucidate the role of *P. aeruginosa* transmission rates in non-outbreak augmented care settings in the UK.
Methods: Over a 16-week period, all water outlets in augmented care units of four hospitals were sampled for *P. aeruginosa* and clinical isolates were collected. Outlet and clinical *P. aeruginosa* isolates underwent whole-genome sequencing (WGS), which with epidemiological data identified acquisition from water as definite (level 1), probable (level 2), possible (level 3), and no evidence (level 4).
Findings: Outlets were positive in each hospital on all three occasions: W (16%), X (2.5%), Y (0.9%) and Z (2%); and there were 51 persistently positive outlets in total. WGS identified likely transmission (at levels 1, 2 and 3) from outlets to patients in three hospitals for *P. aeruginosa* positive patients: W (63%), X (54.5%) and Z (26%). According to the criteria (intimate epidemiological link and no phylogenetic distance), approximately 5% of patients in the study 'definitely' acquired their *P. aeruginosa* from their water outlets in the intensive care unit. This study found extensive evidence of transmission from the outlet to the patients particularly in the newest hospital (W), which had the highest rate of positive outlets.

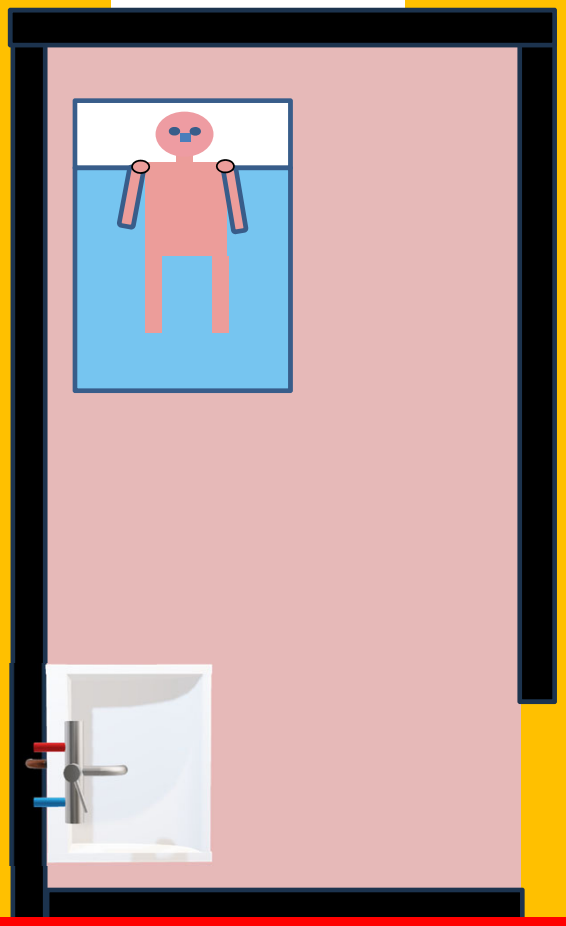
Journal Pre-proof

Sinks in patient rooms in the ICU are associated with higher rates of hospital-acquired infections. A retrospective analysis of 552 ICUs.

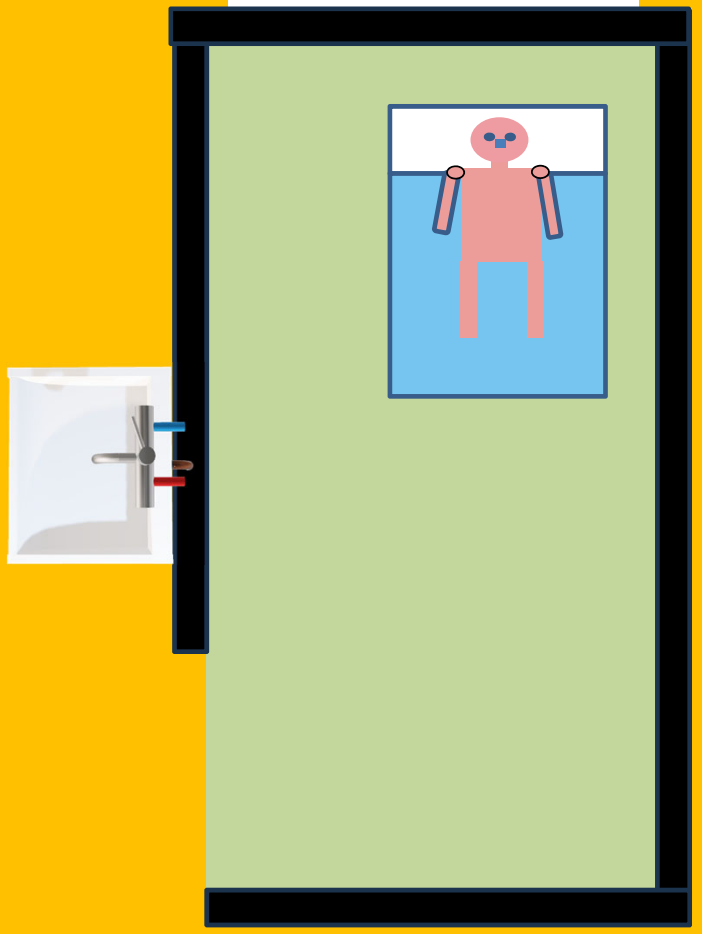
Authors: Giovanni-Battista FUCINI[1,2]; Christine GEFFERS[1,2]; Frank SCHWAB[1,2]; Michael BEHNKE[1,2]; Wolfgang SUNDER[3]; Julia MOELLMANN[3]; Petra GASTMEIER[1,2]

factor for HAI (aIRR 1.21, 95%CI 1.01-1.45). **Conclusions:** Sinks in patient rooms are associated with a higher number of hospital-acquired infections per patient day in the ICU. This should be considered when planning new ICUs or renovating existing ones.

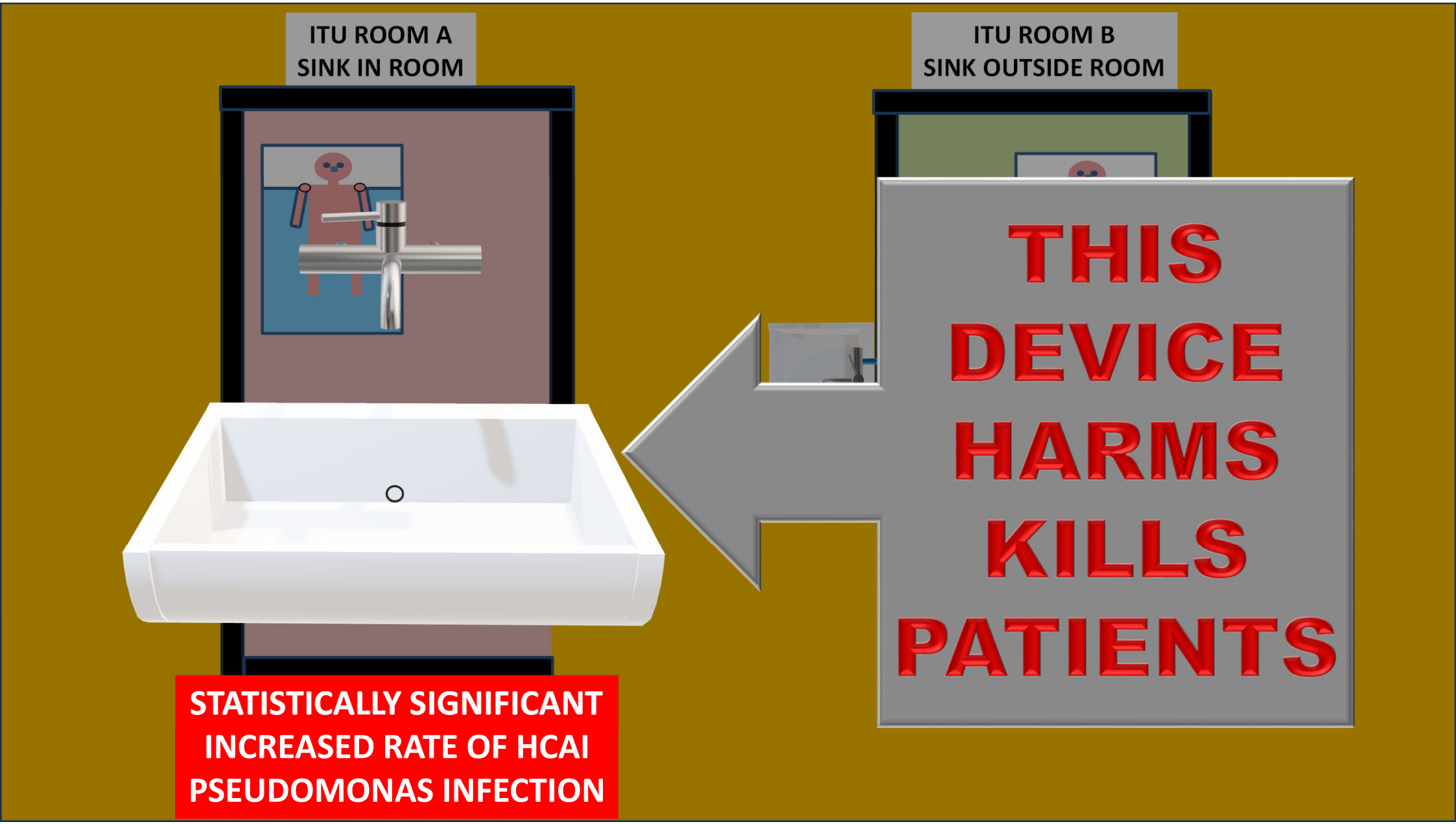
ITU ROOM A
SINK IN ROOM



ITU ROOM B
SINK OUTSIDE ROOM



STATISTICALLY SIGNIFICANT INCREASED RATE OF HCAI PSEUDOMONAS INFECTION


ITU ROOM A
SINK IN ROOM
ITU ROOM B
SINK OUTSIDE ROOM
THIS DEVICE HARMS KILLS PATIENTS
STATISTICALLY SIGNIFICANT INCREASED RATE OF HCAI PSEUDOMONAS INFECTION

Hopman *et al. Antimicrobial Resistance and Infection Control* (2017) 6:59
DOI 10.1186/s13756-017-0213-0

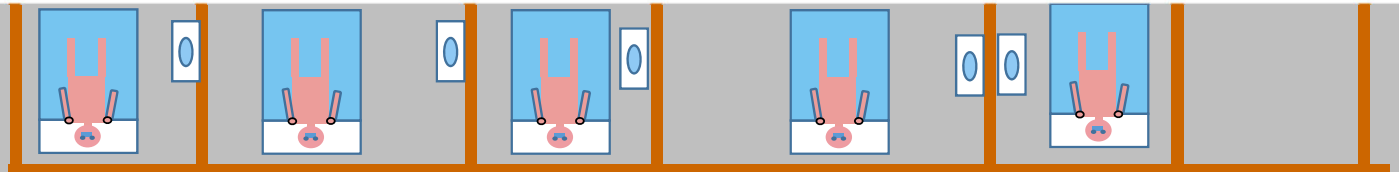
Antimicrobial Resistance
and Infection Control

RESEARCH Open Access

Reduced rate of intensive care unit acquired gram-negative bacilli after 'water-free' patient care

Segmented regression analysis showed that the intervention was followed by a statistically significant Immediate reduction in Gram negative bacillus colonization

Joost Hopman[1*†], Alma Tostmann[1†], Heiman Wertheim[1], Maria Bos[1], Eva Kolwijck[1], Reinier Akkermans[3], Patrick Sturm[1,4], Andreas Voss[1,2], Peter Pickkers[5] and Hans vd Hoeven[5]



RAPID COMMUNICATIONS

Pseudomonas aeruginosa countrywide outbreak in hospitals linked to pre-moistened non-sterile washcloths, Norway, October 2021 to April 2022

Kirsten Gravningen[1] , Oliver Kacelnik[1] , Egil Lingaas[2] , Torunn Pedersen[3] , Bjørn G Iversen[1] , the Pseudomonas outbreak group[4]

1. Norwegian Institute of Public Health, Oslo, Norway
2. Department of Infection Prevention, Oslo University Hospital, Oslo, Norway
3. Norwegian National Advisory Unit on Detection of Antimicrobial Resistance, University Hospital of North Norway, Tromsø, Norway
4. The members of the group are listed under Collaborators

Correspondence: Kirsten Gravningen (kirstenmidttun.gravningen@fhi.no)

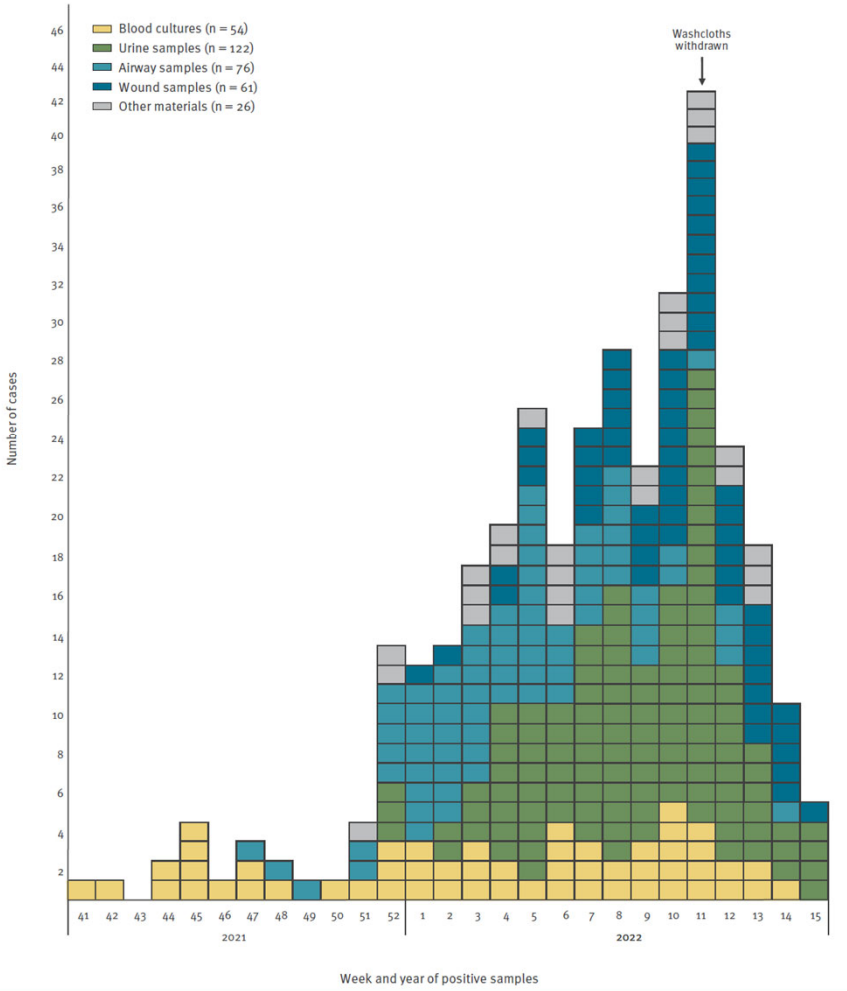
Citation style for this article:
Gravningen Kirsten, Kacelnik Oliver, Lingaas Egil, Pedersen Torunn, Iversen Bjørn G, the Pseudomonas outbreak group. Pseudomonas aeruginosa countrywide outbreak in hospitals linked to pre-moistened non-sterile washcloths, Norway, October 2021 to April 2022. Euro Surveill. 2022;27(18):pii=2200312. https://doi.org/10.2807/1560-7917.ES.2022.27.18.2200312

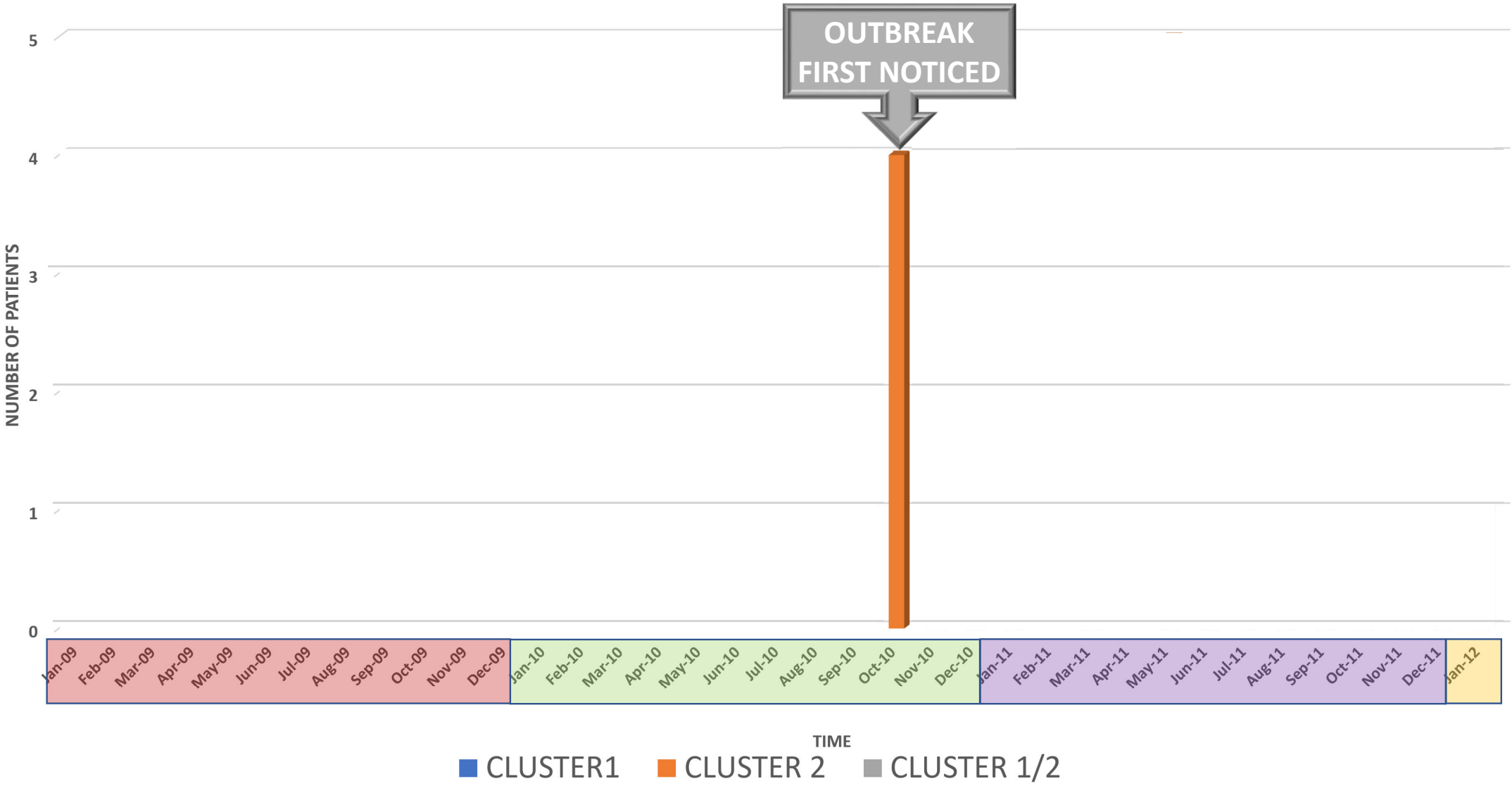
Article submitted on 08 Apr 2022 / accepted on 04 May 2022 / published on 05 May 2022

NO CASES DETECTED IN ENGLAND DESPITE WIPES BEING USED

FIGURE 2

Distribution of *Pseudomonas aeruginosa* ST3875 cases by test date (week) for the first positive sample, by case and sample type, 38 hospitals, Norway, October 2021–April 2022 (n = 339)



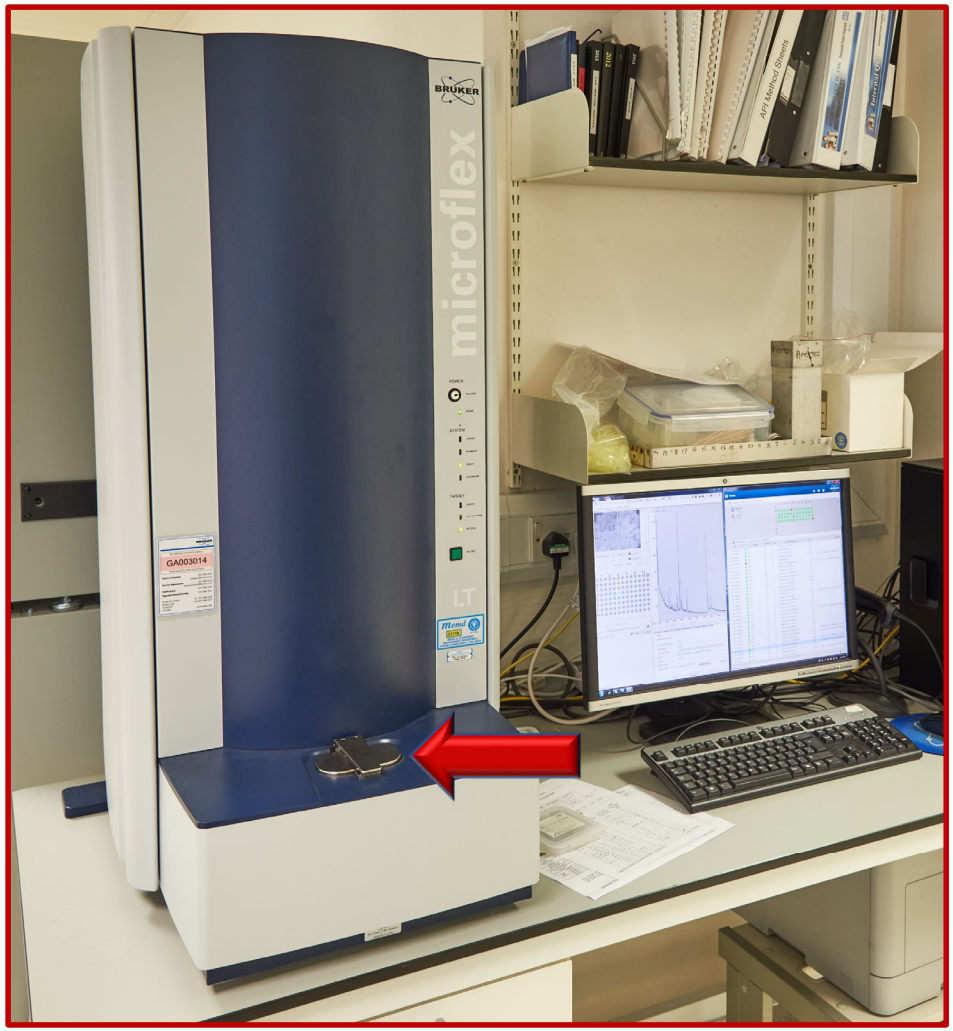

OUTBREAK FIRST NOTICED
NUMBER OF PATIENTS
0
1
2
3
4
5
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Oct-11
Nov-11
Dec-11
Jan-12
TIME
CLUSTER1
CLUSTER 2
CLUSTER 1/2

Results of Typing – *Pseudomonas aeruginosa*

- 6 patients positive over 2 days
- New ITU- amalgamation of 5 separate units

- **TYPE A - 1 ISOLATE**
- **TYPE B - 1 ISOLATE**
- **TYPE C - 2 ISOLATES**
- **TYPE D - 1 ISOLATE**
- **TYPE E - 1 ISOLATE**

MALDI-ToF



BLOOD CULTURE REPORT

BLOOD FROM CENTRAL LINE

Culture report;

Unidentifiable environmental Gram neg rod of dubious clinical significance

Cupriavidus outbreak

Opportunistic Pathogens of Premise Plumbing

Gram negative bacteria

- *Pseudomonas aeruginosa*
- *Pseudomonas putida-P. fluorescens*
- *Burkholderia cepcia* complex *(B. cepacia, B. cenocepacia*, at least 8 other genomospecies)
- *Cupriavidus (Ralstonia) pauculus*
- *Herbaspirillium*
- *Methylobacterium* spp
- *Ralstonia pickettii, Ralstonia mannitolilytica*
- *Sphingomonas paucimobilis, Sphingomonas mucosissima*, other *Sphingomonas* spp
- *Stenotrophomonas maltophilia*
- *Acinetobacter baumannii*, complex *A. calcoaceticus*
- *Alcaligenes xylosoxidans, A. faecalis*
- *Aeromonas hydrophila, Aeromonas* spp
- *Elizabethkingia anophelis, E. meningosepticum*
- *Legionella pneumophila*

Non-fecal coliforms

- *Enterobacter cloacae*
- *Klebsiella* spp
- *Pantoae aggloerans*
- *Rahnella aquatilis*
- *Serratia liquifaciens, Serratia marcescens*

Nontuberculous mycobacteria (NTM or Environmental Mycobacteria)

Other bacteria/actinomyces

- *Microbacterium* spp
- *Tsukamurella* spp
- *Rhodococcus equi, Rhodococcus* spp
- *Gordonae* spp

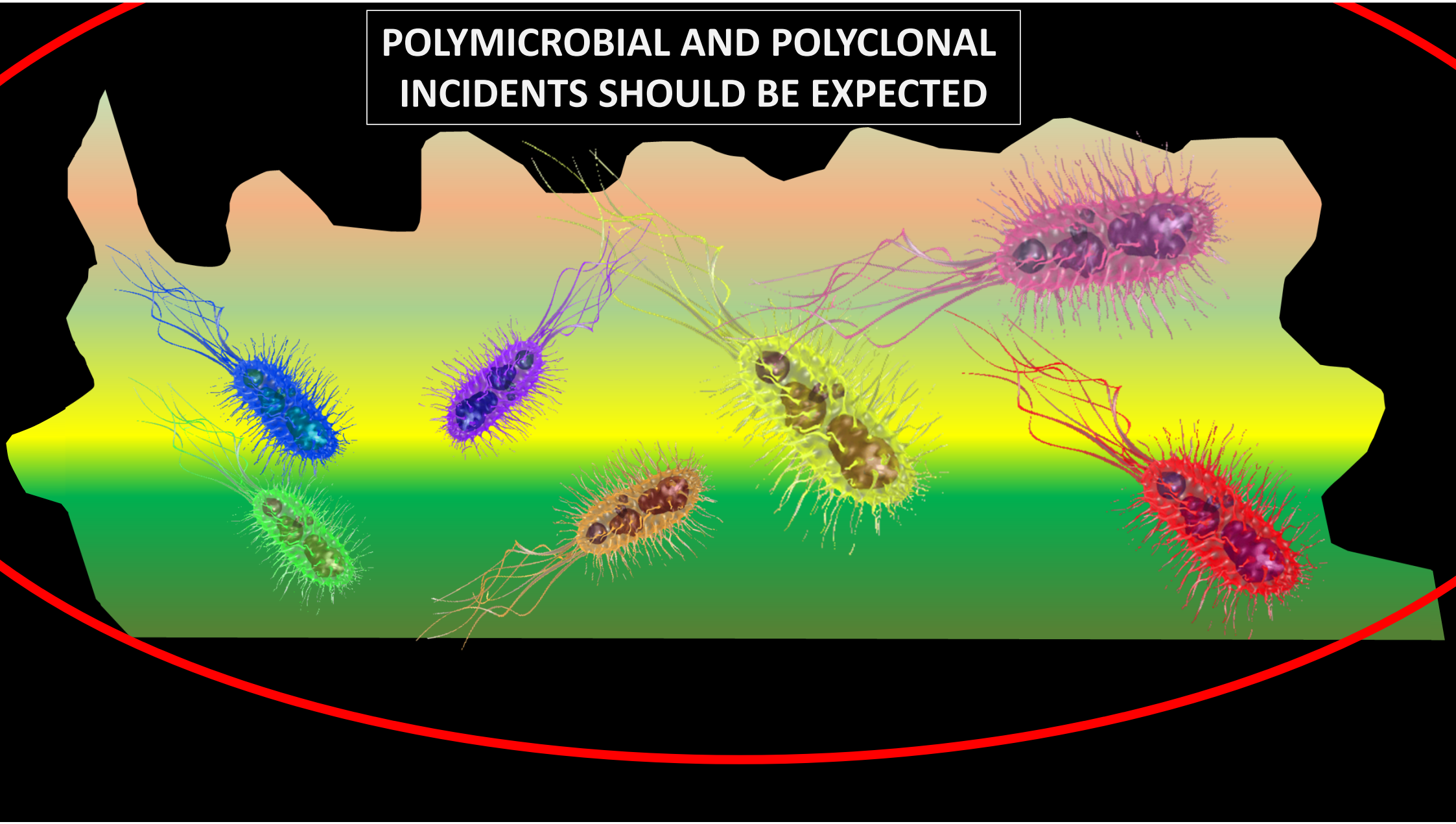
Fungi

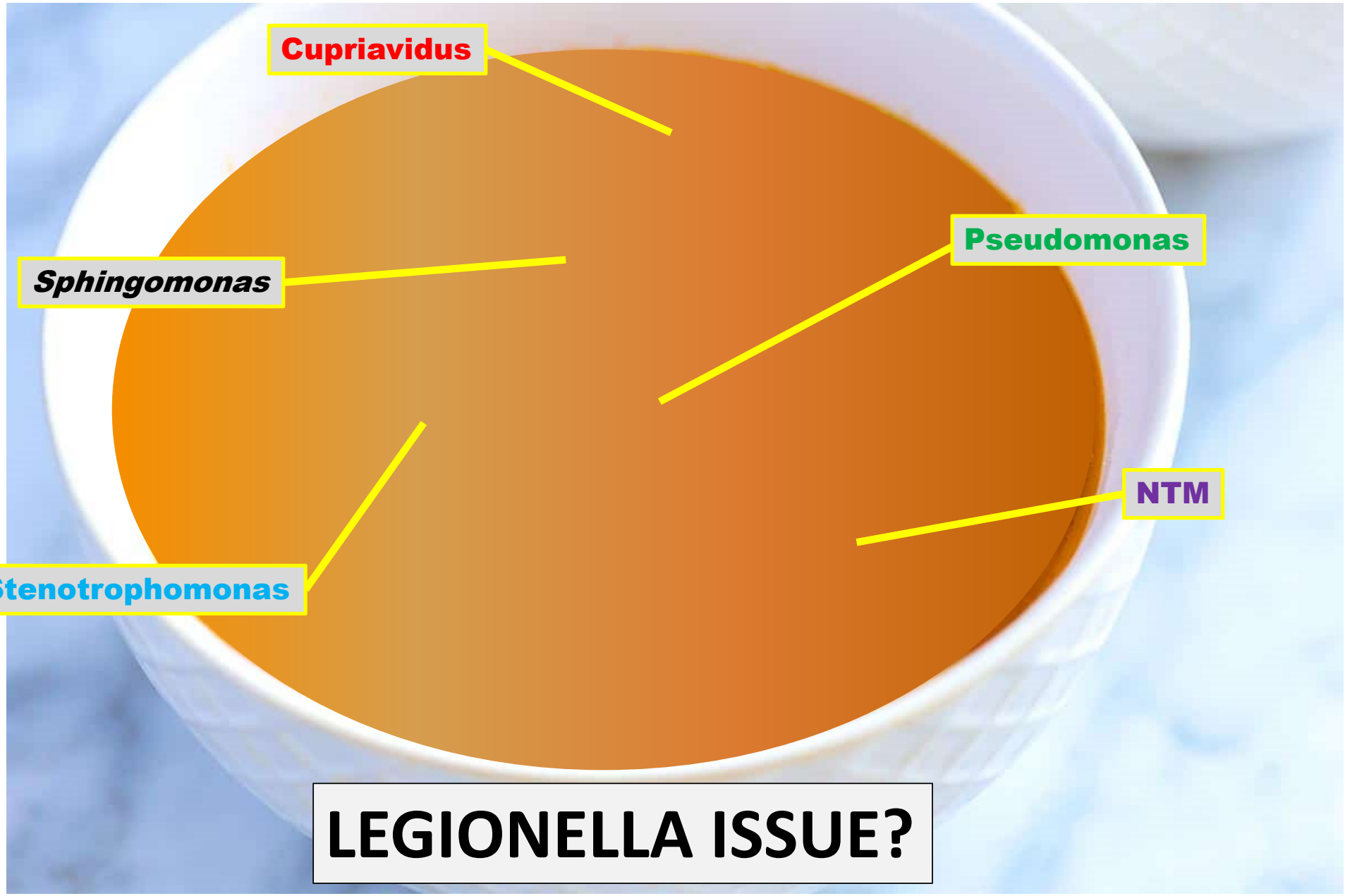
- Yeasts (eg. *Candida parapsilosis, C. tropicalis*)
- *Aspergillus fumigatus, A. niger*
- *Fusarium* spp
- *Exophiala* spp

Protozoa

- *Acanthamoeba* spp
- *Vermamoeba vermiformis*
- *Naegleria* spp

LACK OF ACCREDITED WATER SAMPLING METHODOLOGY FOR MANY OF THESE ORGANISMS

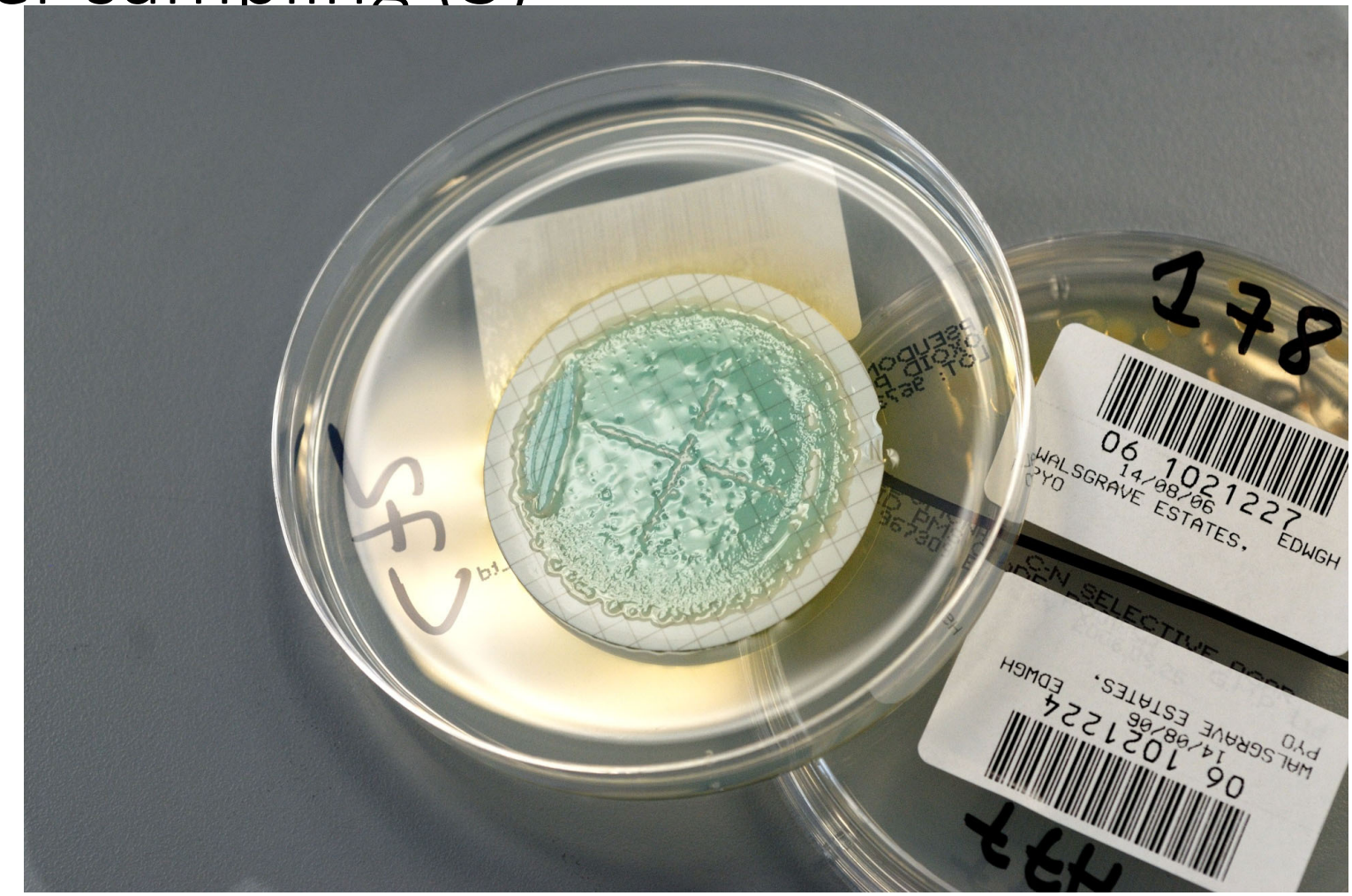

POLYMICROBIAL AND POLYCLONAL
INCIDENTS SHOULD BE EXPECTED

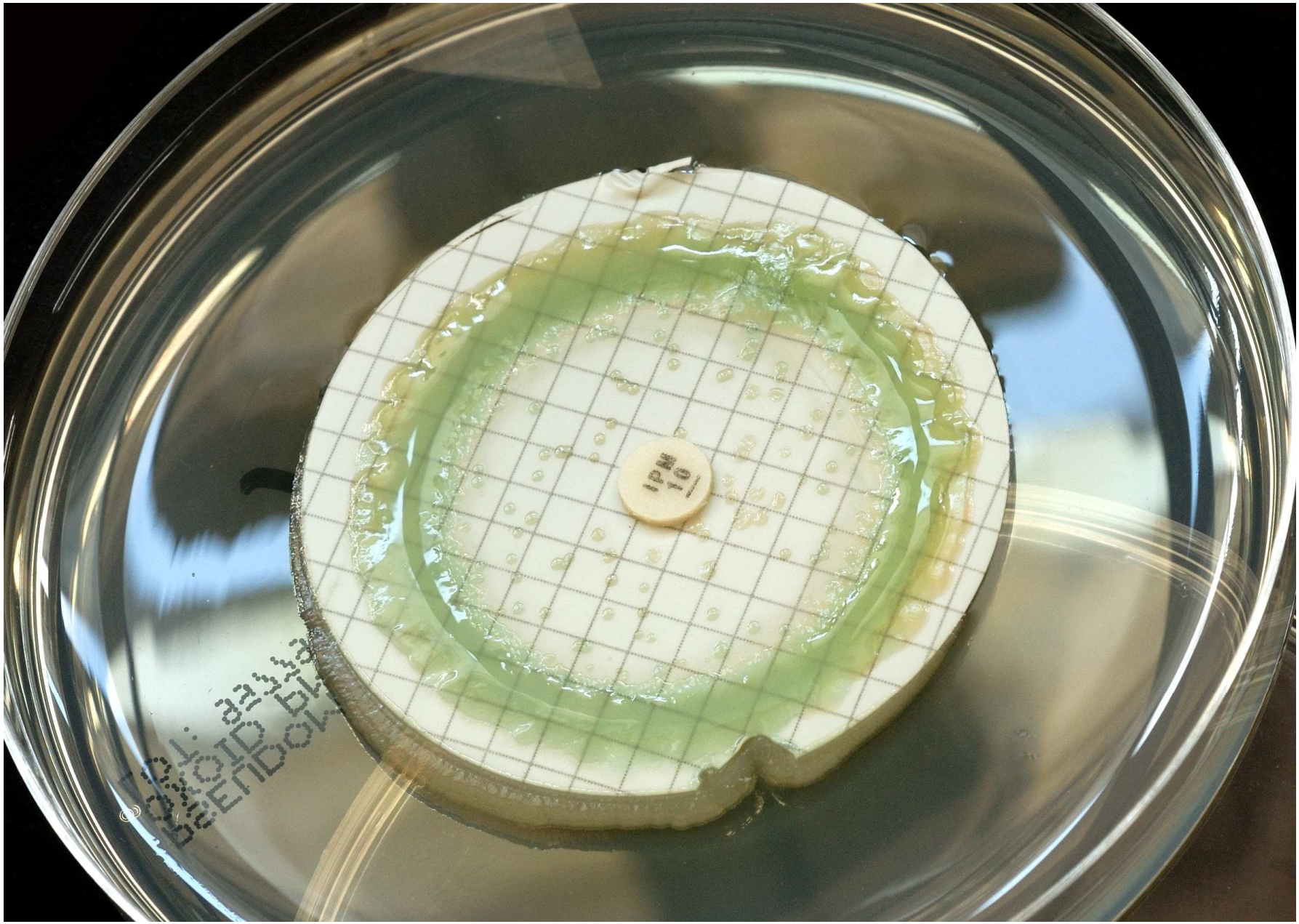

Cupriavidus
Pseudomonas
Sphingomonas
NTM
Stenotrophomonas
LEGIONELLA ISSUE?

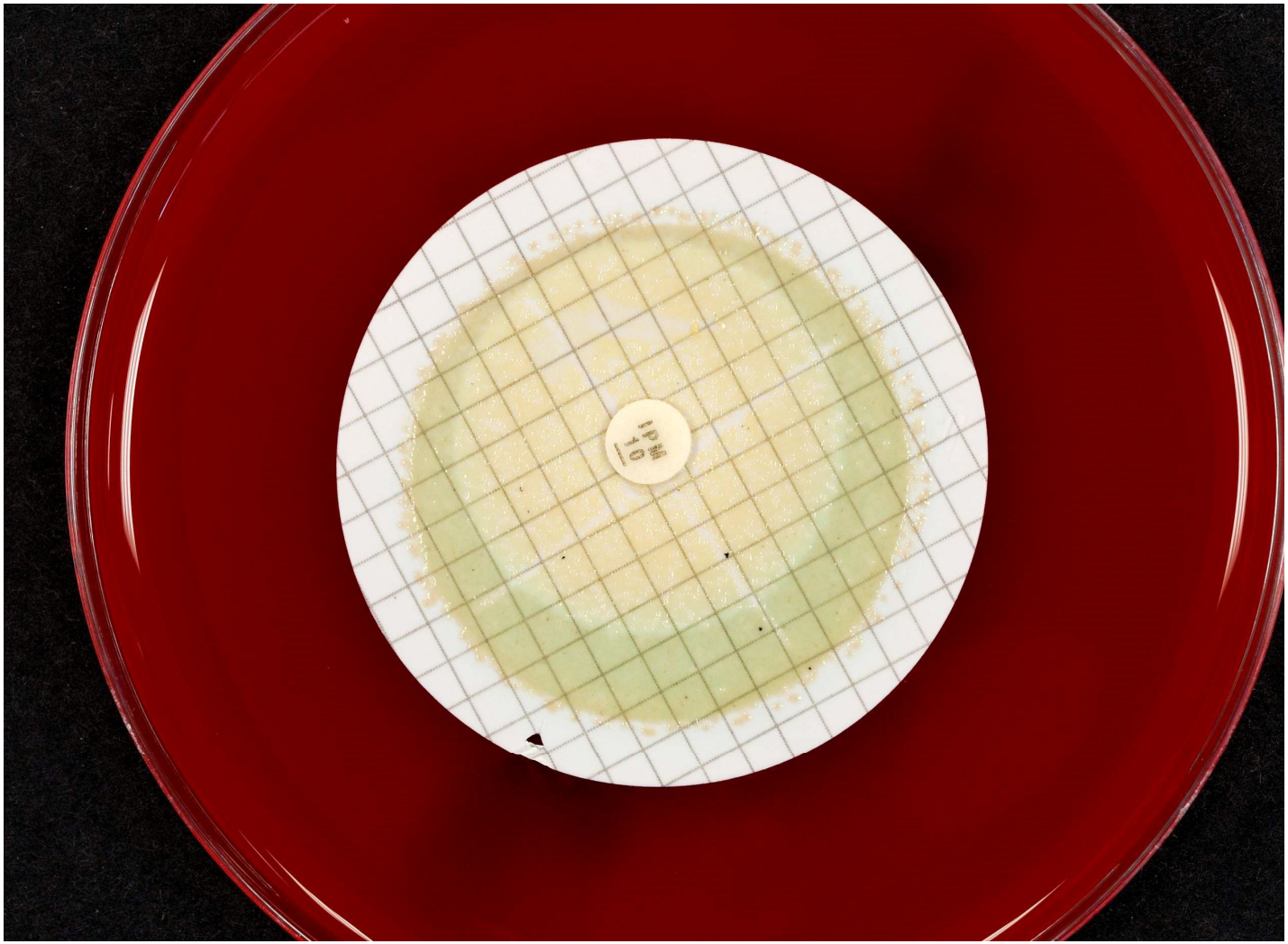
NTM

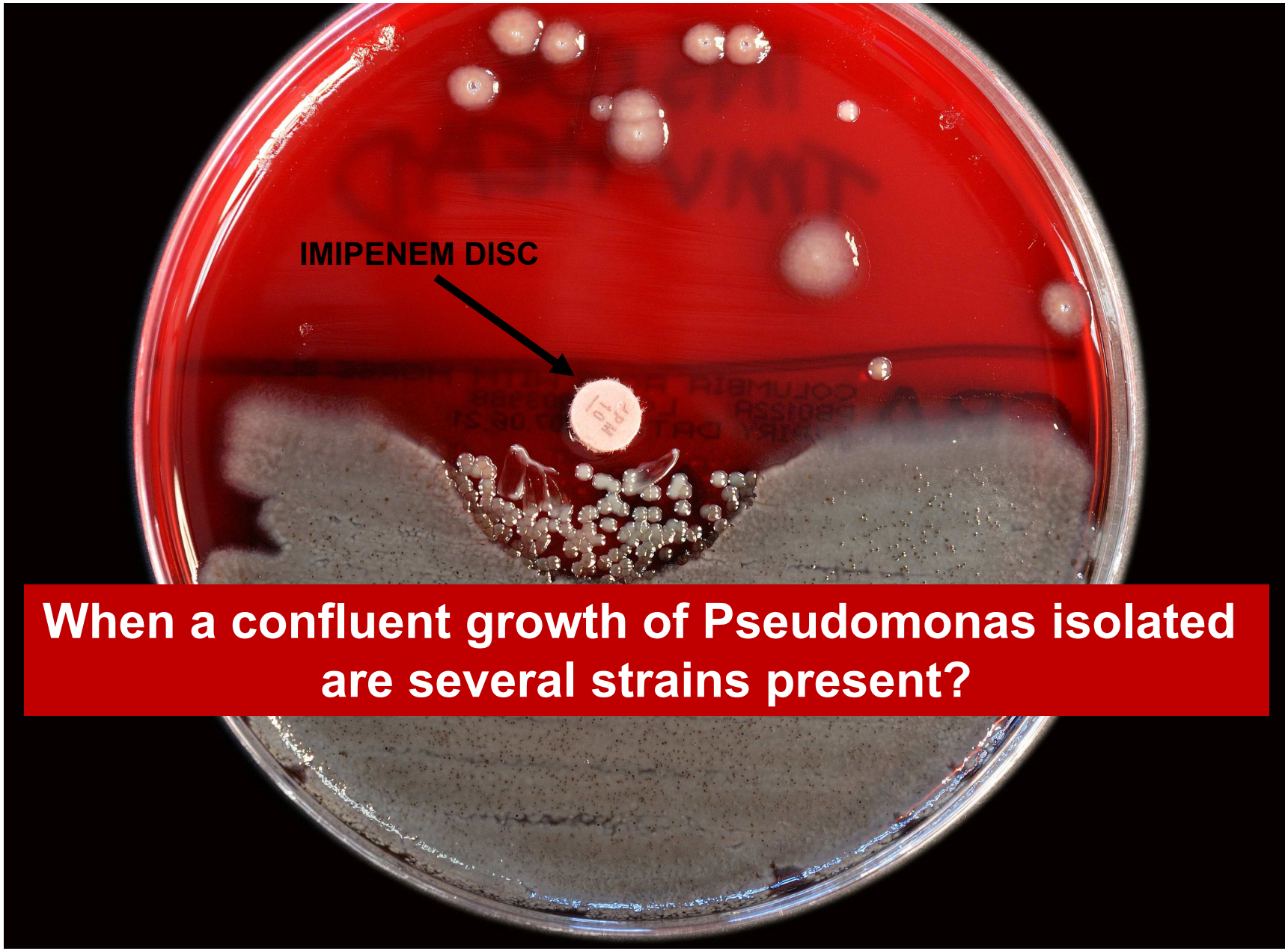
Why Is My Dishwasher Leaving Dishes Dirty After Washing?

Water sampling (3)



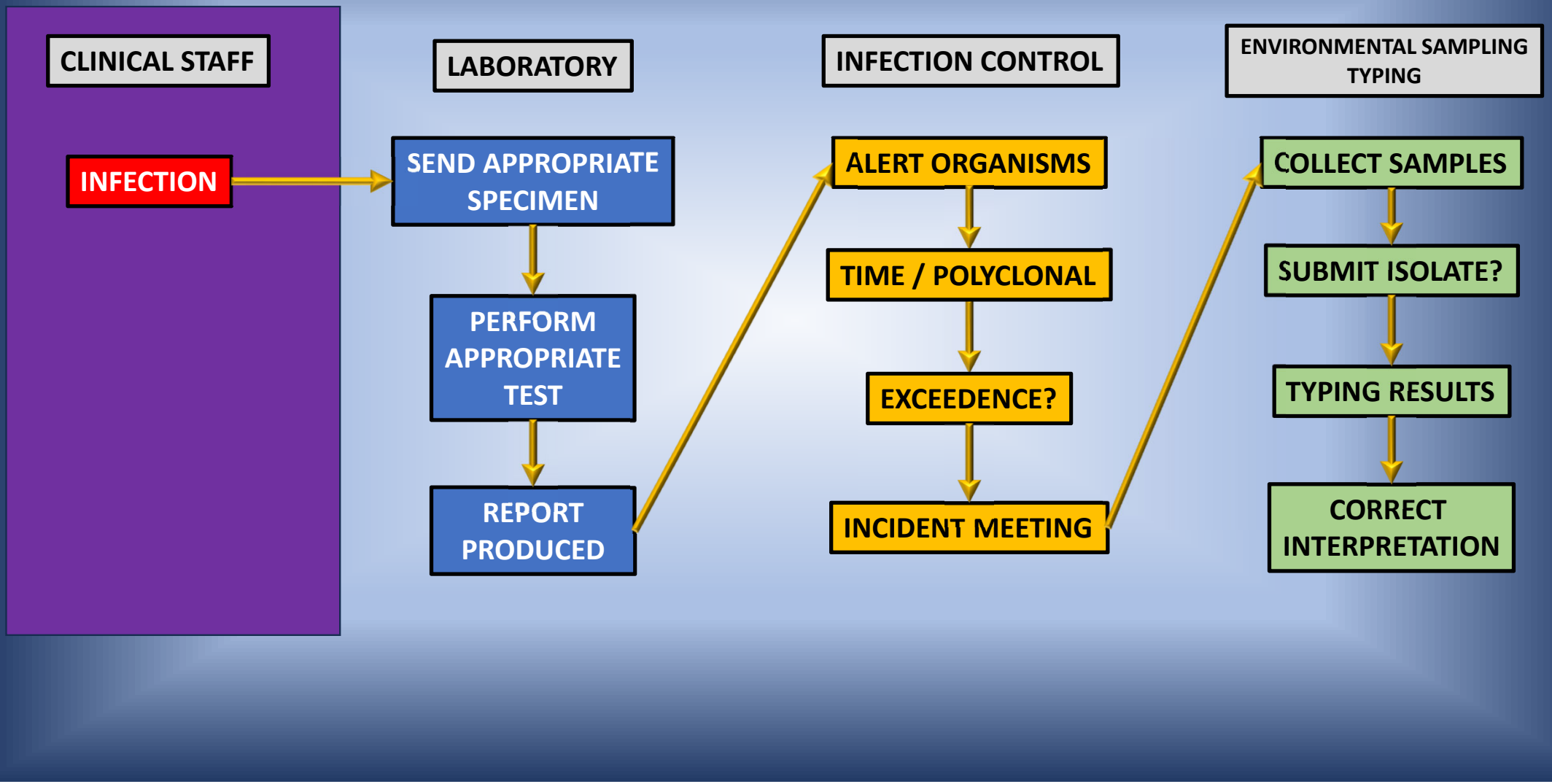

IPM
10

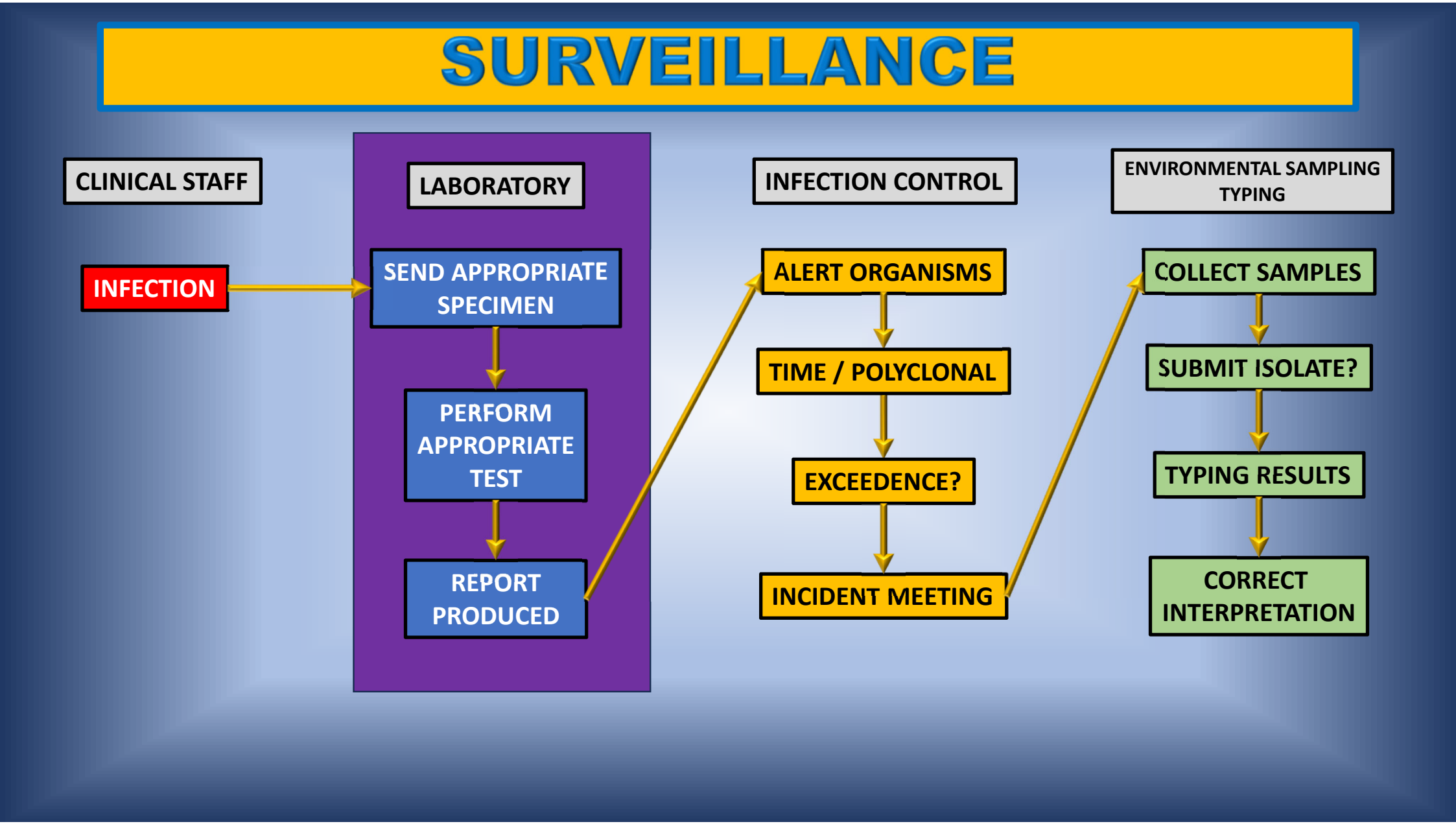

IPM
10

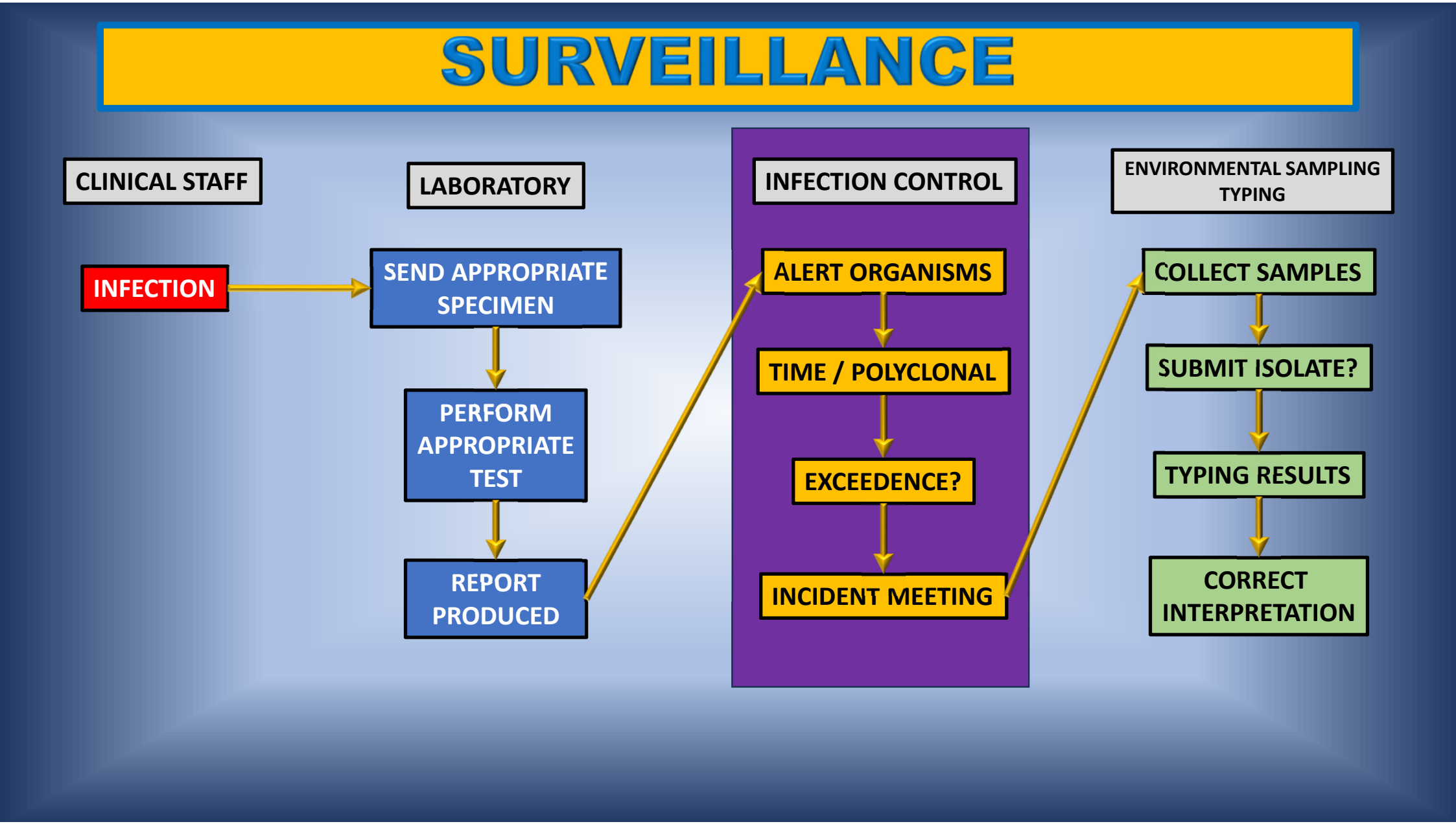


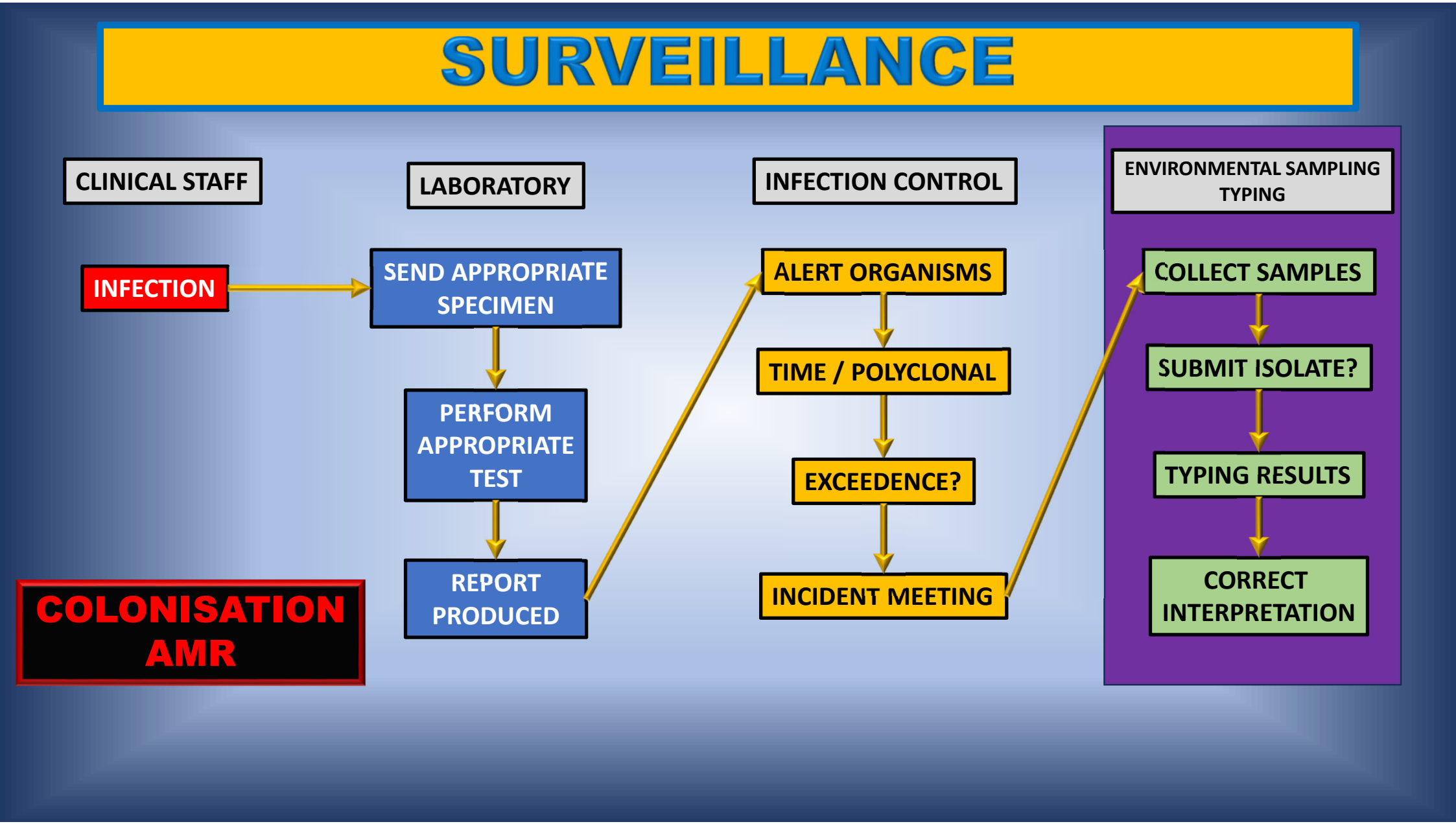
When a confluent growth of Pseudomonas isolated are several strains present?

SURVEILLANCE




SURVEILLANCE
CLINICAL STAFF
INFECTION
LABORATORY
SEND APPROPRIATE SPECIMEN
PERFORM APPROPRIATE TEST
REPORT PRODUCED
INFECTION CONTROL
ALERT ORGANISMS
TIME / POLYCLONAL
EXCEEDENCE?
INCIDENT MEETING
ENVIRONMENTAL SAMPLING TYPING
COLLECT SAMPLES
SUBMIT ISOLATE?
TYPING RESULTS
CORRECT INTERPRETATION


SURVEILLANCE
CLINICAL STAFF
LABORATORY
INFECTION CONTROL
ENVIRONMENTAL SAMPLING TYPING
INFECTION
SEND APPROPRIATE SPECIMEN
PERFORM APPROPRIATE TEST
REPORT PRODUCED
ALERT ORGANISMS
TIME / POLYCLONAL
EXCEEDENCE?
INCIDENT MEETING
COLLECT SAMPLES
SUBMIT ISOLATE?
TYPING RESULTS
CORRECT INTERPRETATION


SURVEILLANCE
CLINICAL STAFF
LABORATORY
INFECTION CONTROL
ENVIRONMENTAL SAMPLING TYPING
INFECTION
SEND APPROPRIATE SPECIMEN
PERFORM APPROPRIATE TEST
REPORT PRODUCED
ALERT ORGANISMS
TIME / POLYCLONAL
EXCEEDENCE?
INCIDENT MEETING
COLLECT SAMPLES
SUBMIT ISOLATE?
TYPING RESULTS
CORRECT INTERPRETATION
COLONISATION AMR

A two-year outbreak of *Pseudomonas aeruginosa* in a burn unit through unrecognized environmental contamination of hydrotherapy equipment

Centre hospitalier universitaire vaudois

F. Tissot[1], P. Basset[1], D. S. Blanc[1], G. Zanetti[1], M. M. Berger[2], Y-A Que[2], P. Eggimann[2], L. Senn[1]
[1]Service of Hospital Preventive Medicine, [2]Intensive Care Service,
Lausanne University Hospital, Switzerland

UNIL | Université de Lausanne
Faculté de biologie et de médecine

Introduction and Purpose

A 30% increase of *P. aeruginosa* infections and/or colonization incidence was observed in the ICU of our institution during two consecutive years, rising from 32.2 / 1000 admissions in 2009 to 41.5 in 2011 and 44.7 in 2012.

Following these observations, an epidemiological investigation was launched to determine whether the source of those additional cases was endogenous or exogenous in order to implement appropriate infection control measures.

Methods

Study setting
Lausanne University Hospital is 1030-bed tertiary-care teaching hospital with 31 ICU beds, including a burn unit with 4 beds and 2 hydrotherapy rooms.

Epidemiological investigation

- **Patients**
  All consecutive patients with *P. aeruginosa* infection and/or colonization hospitalized in ICU between January 2010 and July 2012 were included. Patients' charts were reviewed to assess epidemiological links.
- **Clinical *P. aeruginosa* isolates**
  At least one clinical *P. aeruginosa* isolate per patient was analyzed. In patients with long ICU stays, multiple isolates were investigated.
- **Environmental *P. aeruginosa* isolates**
  Environmental samples were obtained from tap water, faucets and sink traps of all ICU rooms and from the environment of the hydrotherapy rooms.
- **Genotyping method**
  Double locus sequence typing (DLST) targeting *ms*172 and *ms*217 genes was used for genotyping (www.dlst.org).
- **Observations of practices**
  Between April and July 2012, observations by a trained infection control nurse were carried out in the burn unit, especially in the hydrotherapy rooms.
- **Follow-up screenings**
  Clinical isolates from all consecutive patients hospitalized in the ICU from August through December 2012, as well as follow-up environmental samples were collected and genotyped.

Results

Genotyping of clinical isolates
509 clinical isolates from 231 patients were typed:

- 62/231 (27%) had a unique genotype.
- 159/231 (73%) were distributed into 37 different genotypic clusters (median 3 patients per cluster, range 2-22).

The largest cluster, DLST 1-18 (n=22), was restricted to the burn unit and its neighboring unit.

Epidemiological investigation in the burn unit
Patients infected/colonized by DLST 1-18 were hospitalized between May 2010 and June 2012 during overlapping periods.

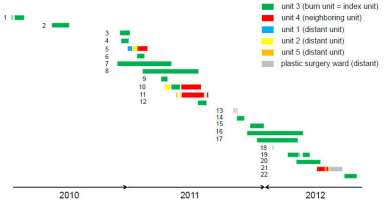


Fig. 1. Distribution of patients infected with DLST 1-18 over time. Colors relate to ICU units. Among 22 patients, 18 (green) were hospitalized in the burn unit. Patients 13 and 21 were hospitalized in a different ward but treated in the hydrotherapy rooms. Patient 11 was not hospitalized in the burn unit but was the roommate of patient 10. For only one patient (5), no epidemiological link could be found.

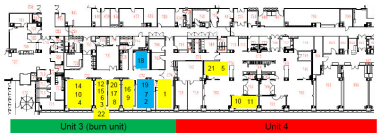


Fig. 2. Location of patients infected with DLST 1-18 strain. Yellow represent regular rooms, blue hydrotherapy rooms. One of the hydrotherapy room also served as a patient room. Each number indicates a patient in chronological order of admission (see Fig. 1). Patient 10 was moved from unit 3 to unit 4 and contaminated patient 11. Patient 18 died on the day of admission and was only hospitalized in the hydrotherapy room.

Environmental investigation
All samples from faucets and tap water were negative.
105 environmental isolates were analyzed and revealed 27 different genotypes recovered mainly from sink traps.
Genotype DLST 1-18 (15 isolates) was found in several locations of the hydrotherapy rooms (Fig. 3).

Fig. 3. Spots contaminated by DLST 1-18 isolate in the two hydrotherapy rooms: floor traps, wet surface under shower mattress and plastic rubber in a damaged corner of the mattress.

Observations of practices in the hydrotherapy rooms
Breaches in good practices standards were observed during the disinfection procedures of shower trolleys and mattresses. Several infection control measures were implemented after these observations.

Corrective infection control measures
1) Replacement of chlorhexidin-based solution by glucoprotamin-based solution for disinfection of shower trolley*
2) Drying of wet surfaces on shower mattress after disinfection**
3) Disinfection of plastic surface under the mattress with glucoprotamin-based solution
4) Elimination of rubber patches used on damaged areas of shower mattresses**
5) Replacement of all shower mattresses by new mattresses
6) Bleach disinfection of sink traps of all rooms of the burn unit

*chlorhexidin was inappropriate for inert surface disinfection and inactive against *Pseudomonas*.
***Pseudomonas* was only recovered on wet surface and in rubber patch

Follow-up screening
From August through December 2012, 69 clinical isolates from 43 patients and 44 environmental isolates from each ICU room were collected and genotyped. DLST 1-18 was recovered from a single patient in October without epidemiological links to the other patients, and never thereafter. DLST 1-18 was no longer recovered from the hydrotherapy rooms.

Conclusions

- A sustained, unrecognized circulation of one epidemic clone in the burn unit was partly responsible for the increased *P. aeruginosa* incidence in ICU during the years 2010 and 2011.
- The use of DLST allowed the genotyping of a large number of isolates and the identification of the outbreak.
- Contamination of hydrotherapy equipment by DLST-18 was the source of the outbreak.
- Adequate cleaning and disinfection procedures of the hydrotherapy rooms with avoidance of persistent wet surfaces stopped the outbreak.

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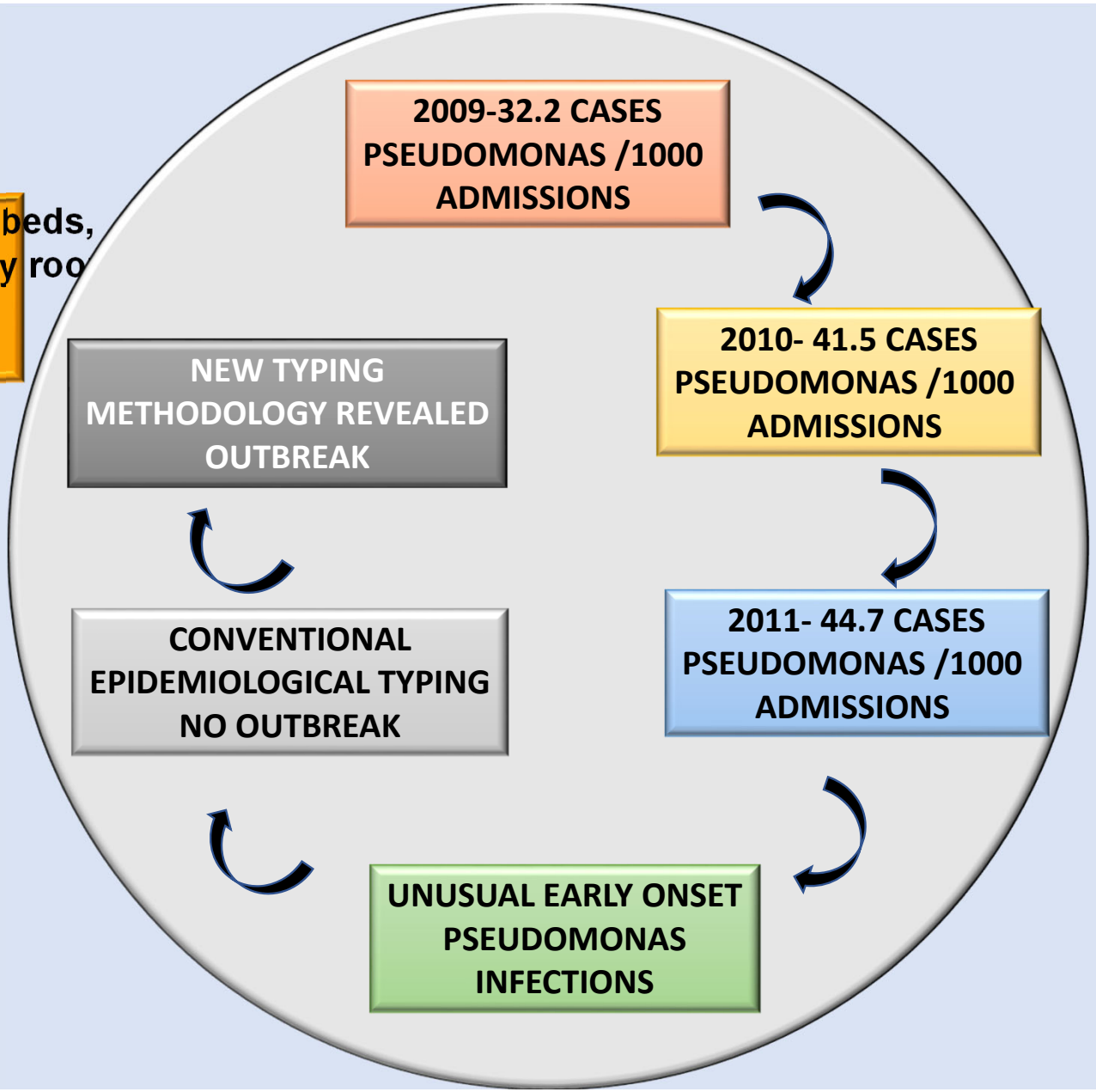
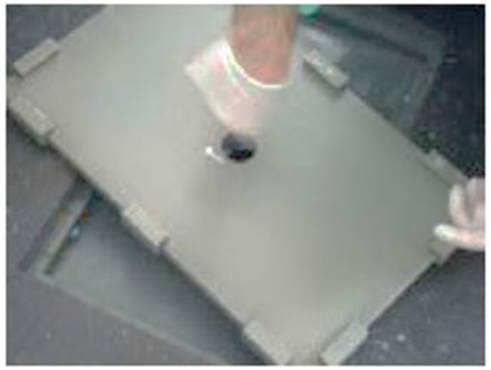
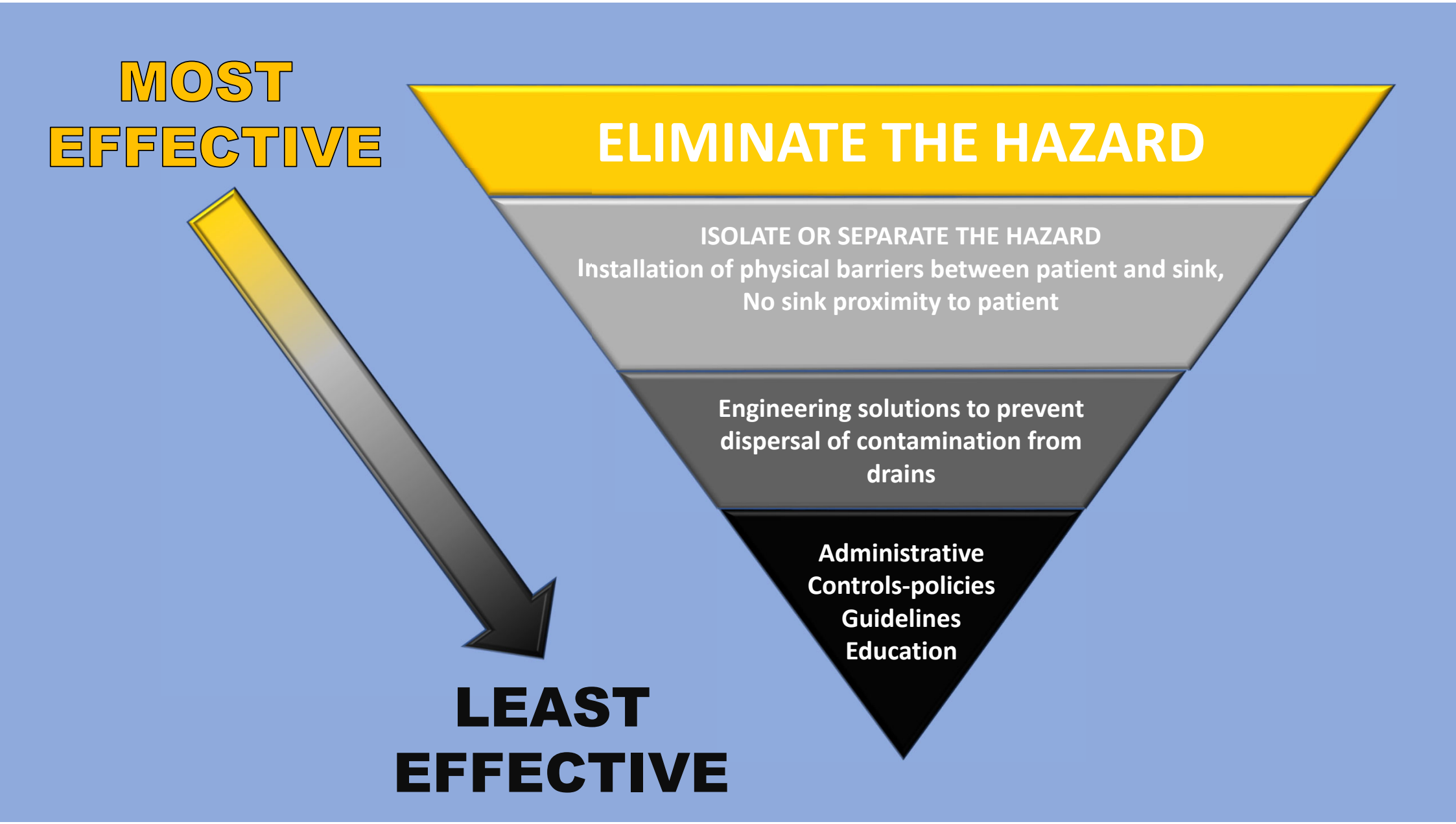
1000-bed tertiary-care centre with 32 adult ICU beds, including four burn ICU beds, one hydrotherapy roo and one isolation room with full hydrotherapy and surgical equipment.



LAUSANNE UNIVERSITY HOSPITAL



DEMANDS
A PROACTIVE APPROACH
TO RISK MITIGATION


MOST EFFECTIVE
ELIMINATE THE HAZARD
ISOLATE OR SEPARATE THE HAZARD
Installation of physical barriers between patient and sink,
No sink proximity to patient
Engineering solutions to prevent dispersal of contamination from drains
Administrative Controls-policies
Guidelines
Education
LEAST EFFECTIVE

AUGMENTED CARE DEFINITION

- NO FIXED DEFINITION
- EVOLUTION SINCE ORIGINAL HTM DEFINITION
- DEFINE PATIENT PATHWAY
- DEFINE WATER QUALITY FOR PATIENT GROUP- NEED TO CONSIDER RISK FROM WASTEWATER

a. ***those patients who are severely immunosuppressed because of disease or treatment: this will include transplant patients and similar heavily immunosuppressed patients during high-risk periods in their therapy;***

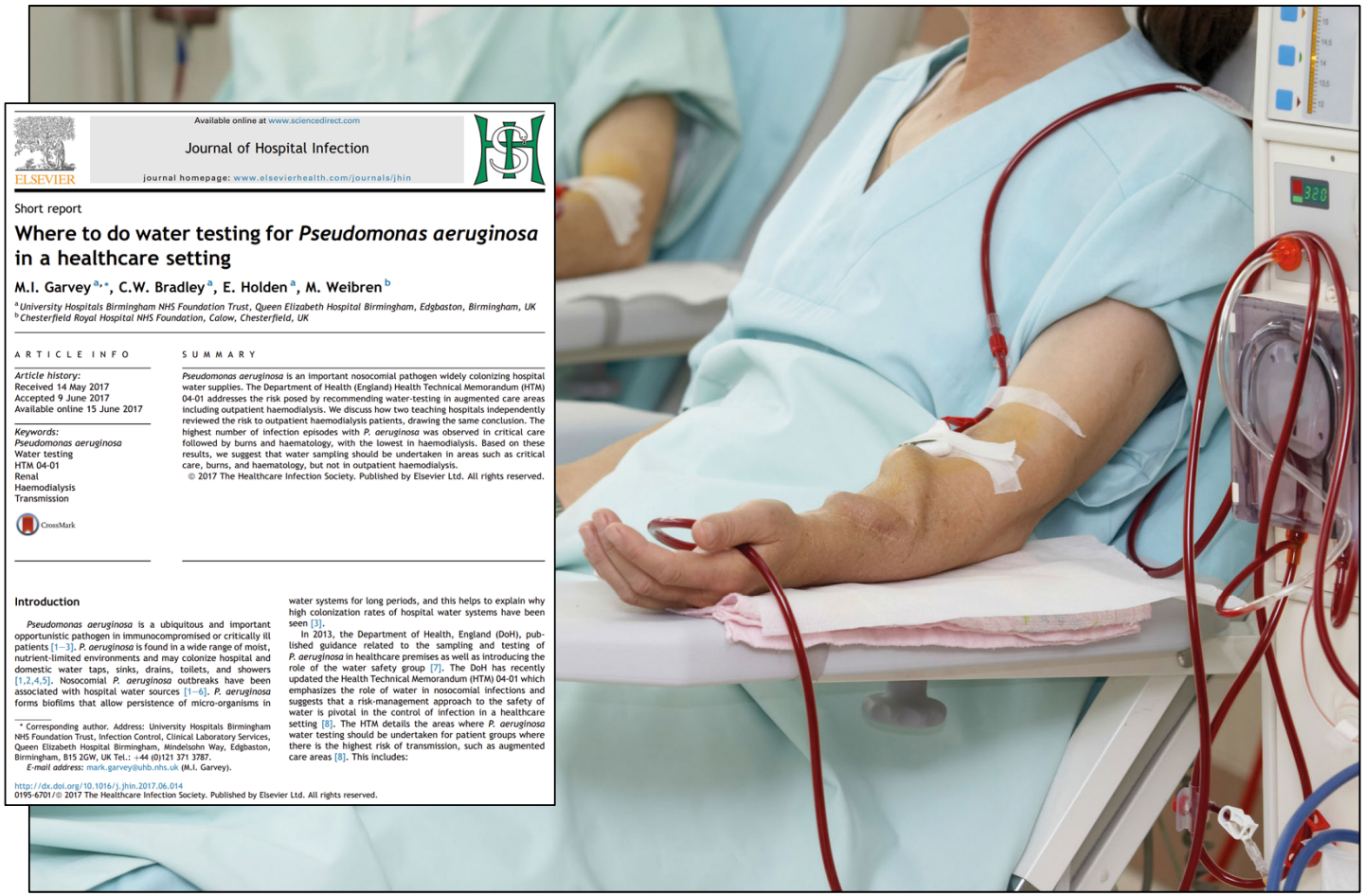
b. those cared for in units where organ support is necessary, for example critical care (adult paediatric and neonatal), renal, respiratory (may include cystic fibrosis units) or other intensive care situations;

c. those patients who have extensive breaches in their dermal integrity and require contact with water as part of their continuing care, such as in those units caring for burns.

NO MENTION OF WASTEWATER SYSTEMS


PREVENT CROSS CONTAMINATION
RAW MEAT
RAW FISH
This sink for pot wash only
This sink for hand wash only
Flash
1500 × 1125


PREVENT CROSS CONTAMINATION
RAW MEAT
RAW FISH
This sink for pot wash only
This sink for hand wash only
Flash
1500 × 1125



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Short report

Where to do water testing for *Pseudomonas aeruginosa* in a healthcare setting

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Transmission

SUMMARY

Pseudomonas aeruginosa is an important nosocomial pathogen widely colonizing hospital water supplies. The Department of Health (England) Health Technical Memorandum (HTM) 04-01 addresses the risk posed by recommending water-testing in augmented care areas including outpatient haemodialysis. We discuss how two teaching hospitals independently reviewed the risk to outpatient haemodialysis patients, drawing the same conclusion. The highest number of infection episodes with *P. aeruginosa* was observed in critical care followed by burns and haematology, with the lowest in haemodialysis. Based on these results, we suggest that water sampling should be undertaken in areas such as critical care, burns, and haematology, but not in outpatient haemodialysis.
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Introduction

Pseudomonas aeruginosa is a ubiquitous and important opportunistic pathogen in immunocompromised or critically ill patients [1–3]. *P. aeruginosa* is found in a wide range of moist, nutrient-limited environments and may colonize hospital and domestic water taps, sinks, drains, toilets, and showers [1,2,4,5]. Nosocomial *P. aeruginosa* outbreaks have been associated with hospital water sources [1–6]. *P. aeruginosa* forms biofilms that allow persistence of micro-organisms in water systems for long periods, and this helps to explain why high colonization rates of hospital water systems have been seen [3].

In 2013, the Department of Health, England (DoH), published guidance related to the sampling and testing of *P. aeruginosa* in healthcare premises as well as introducing the role of the water safety group [7]. The DoH has recently updated the Health Technical Memorandum (HTM) 04-01 which emphasizes the role of water in nosocomial infections and suggests that a risk-management approach to the safety of water is pivotal in the control of infection in a healthcare setting [8]. The HTM details the areas where *P. aeruginosa* water testing should be undertaken for patient groups where there is the highest risk of transmission, such as augmented care areas [8]. This includes:

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GOOD MICROBIOLOGICAL SURVEILLANCE

ABILITY TO BLOCK ROUTES OF TRANSMISSION

WATER FREE PATIENT CARE

BSR/ASHRAE Standard 514P

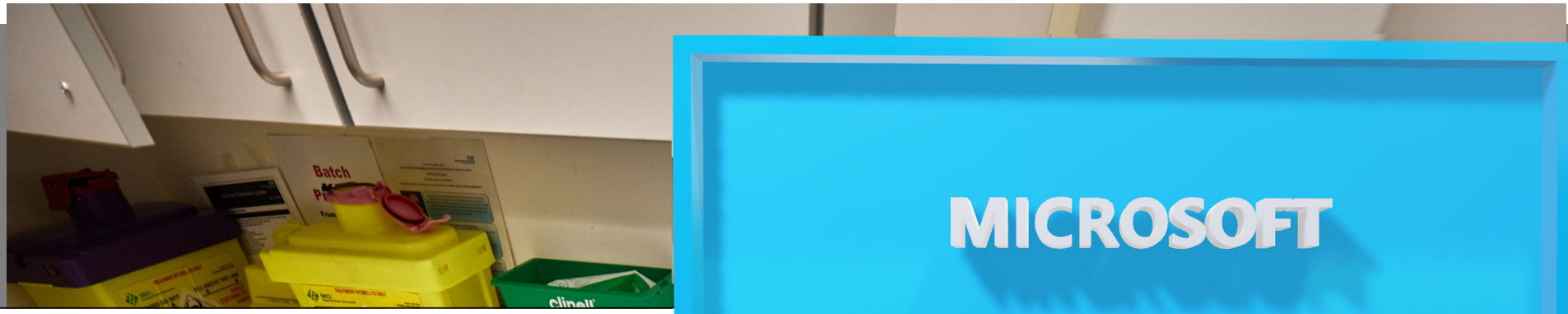
Public Review Draft

Risk Management for Building Water Systems: Physical, Chemical and Microbial Hazards

Second Public Review (February 2023)
(Draft Shows Proposed Independent Substantive Changes to Previous Public Review Draft)

Table H-1 Considerations for Water Safety—Building and General Applications[a,b,c,d,e,f]

Healthcare Environment	Considerations for Water Safety
Protective Environments (PE) *Treatment* (not Patient Room) • Bone Marrow Transplant • Burn Units • Solid Organ Transplant	Patients in protective environments are considered at highest *risk* of infection. Special precautions should be considered, such as: a. routine use of water filtered by *FDA Class II* filters that are validated for *total retention/F838*~~inline or point-of-use filters that are FDA-cleared 510(K) as Class II medical devices for aid in infection control and certified to ASTM F838, *Standard Test Method for Determining Bacterial Retention of Membrane Filters Utilized for Liquid Filtration*, on *water use end points*, especially those (such as showers) that produce *aerosols*~~ b. …
Specialty Care • Cardiology • Gastrointestinal • Pulmonary (includes Bronchoscopy)	a. Specialty care units/areas may have specific procedures and/or devices that use water. b. Consider special-purpose devices that use or may be washed, or rinsed with water, such as heater-cooler devices. These devices should ~~ONLY~~ be cleaned or processed with USP sterile water or water filtered by *FDA Class II* filters that are validated for *total retention/F838*~~sterile water or water filtered by inline or point-of-use filters that are FDA-cleared 510(K) as Class II medical devices for aid in infection *control* and certified to ASTM F838, Standard Test Method for Determining Bacterial Retention of Membrane Filters Utilized for Liquid Filtration, as sterilizing grade~~ on *water use end points*, especially those (such as showers) that produce *aerosols*. c. For medical device reprocessing covered by AAMI TIR34, *Water for the Reprocessing of Medical Devices*, only water meeting the requirements of AAMI TIR34 should be used for washing, rinsing, or reprocessing. Washing, rinsing, or reprocessing should be conducted in accordance with the medical device manufacturer's instructions.~~If devices are covered in AAMI TIR34, the use water specified in TIR34 is recommended.~~



Blue screen of death

ages

Article Talk

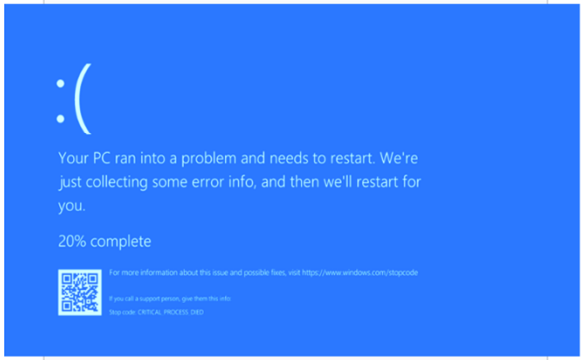
Tools

From Wikipedia, the free encyclopedia

"BSoD" redirects here. For the Person of Interest *episode, see B*

Not to be confused with Black screen of death.

The **Blue Screen of Death** (**BSoD**), **Blue screen error**, **Blue Screen**, **fatal error**, or **bugcheck**, and officially known as a **Stop error**,[1][2][3] is a critical error screen displayed by the Microsoft Windows and ReactOS operating systems in the event of a fatal system error.



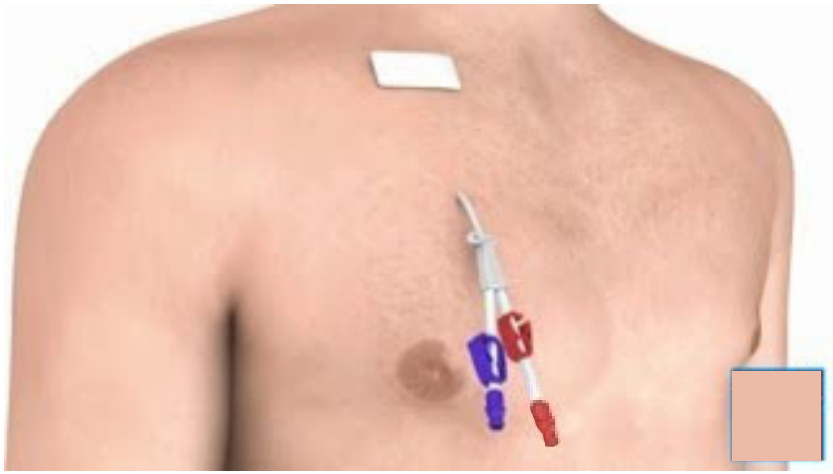
The Blue Screen of Death indicates a system crash, in which the operating system has reached a critical condition where it can no longer operate safely. Possible issues include hardware failure, an issue with or without a device driver, or unexpected termination of a crucial process or thread.

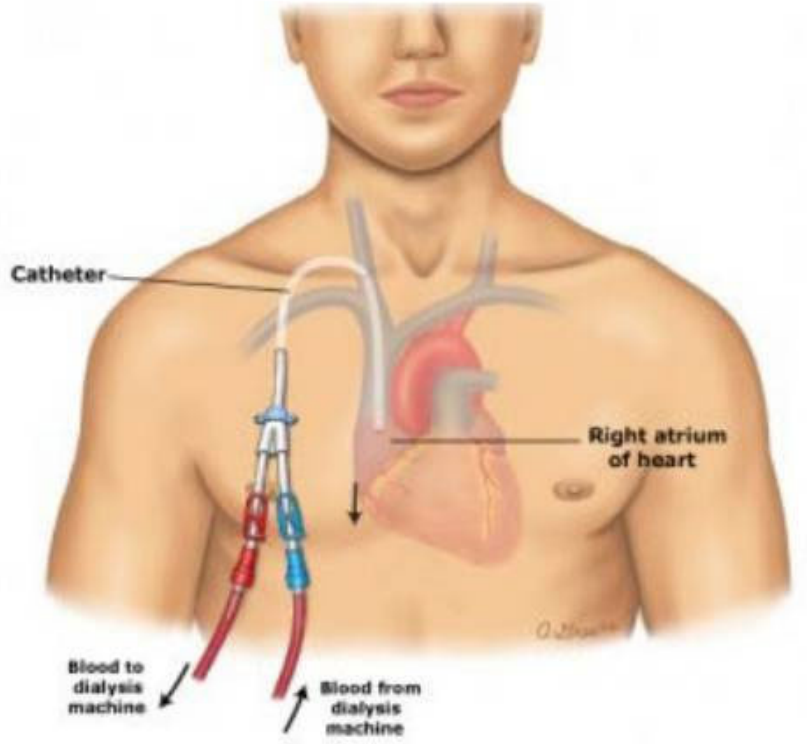
History [edit]

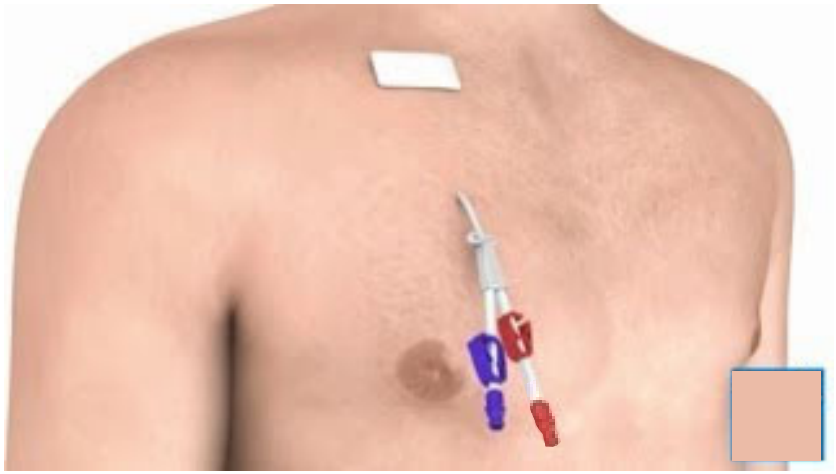
Windows Me.

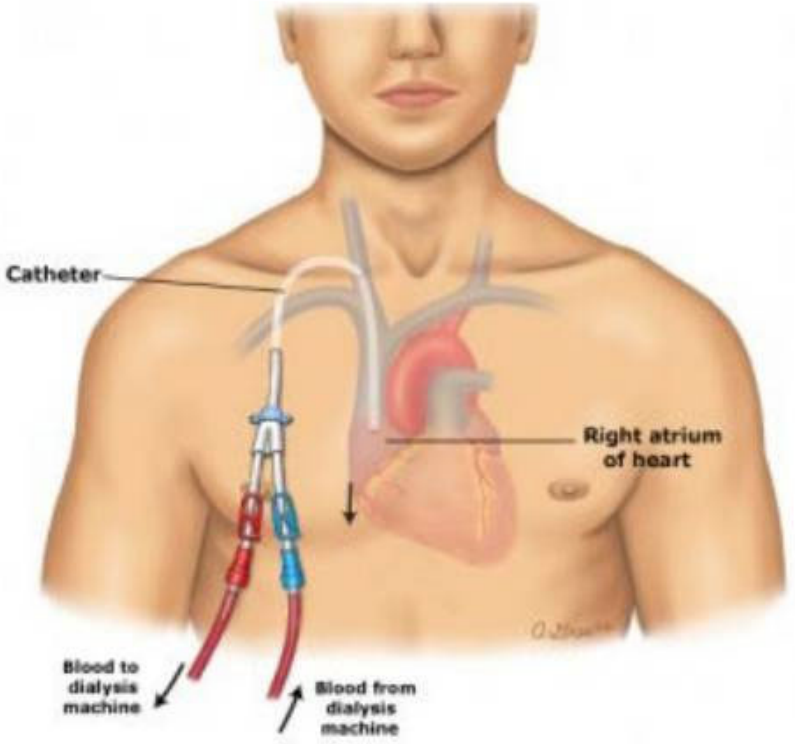

Batch
clinell
If staff use a blue tray. Please clean, dry and put away.
Metoclopramide
MICROBIOLOGY
BLUE SCREEN OF DEATH


Your 5 moments for
HAND HYGIENE
HAND MEDIC
Infectious waste only




Catheter
Right atrium of heart
Blood to dialysis machine
Blood from dialysis machine

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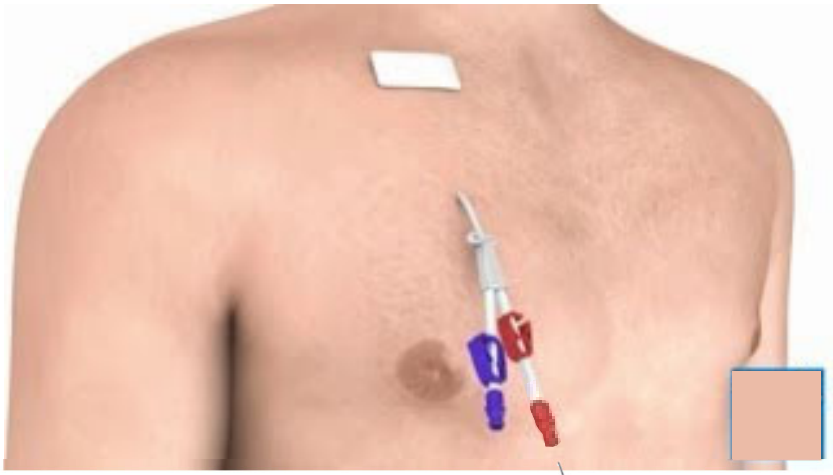

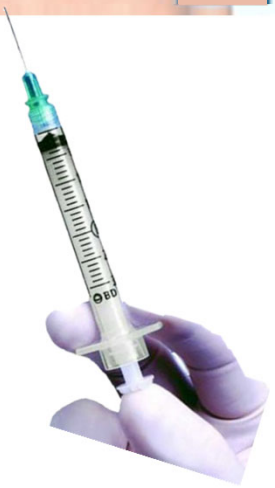

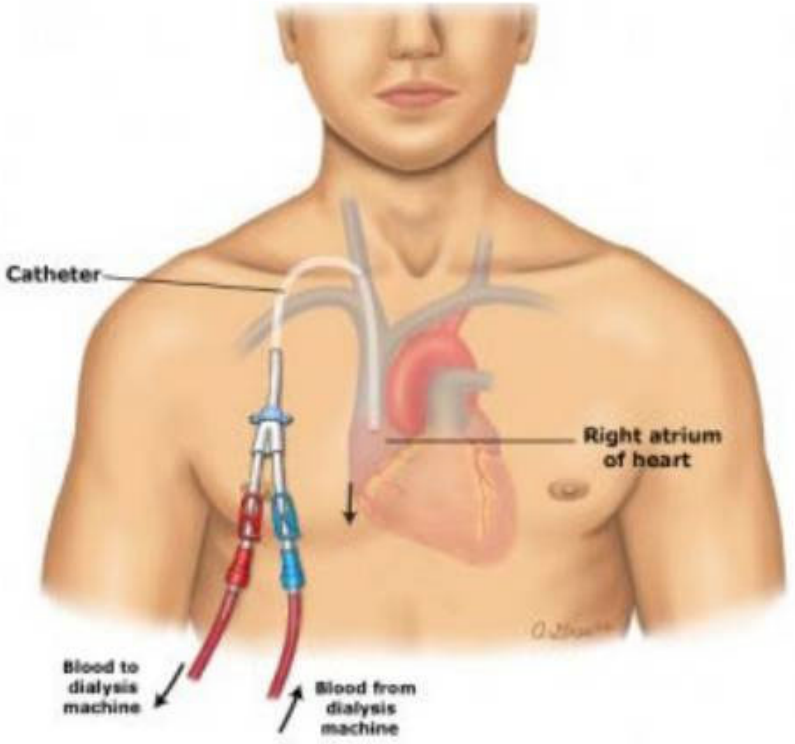
Catheter
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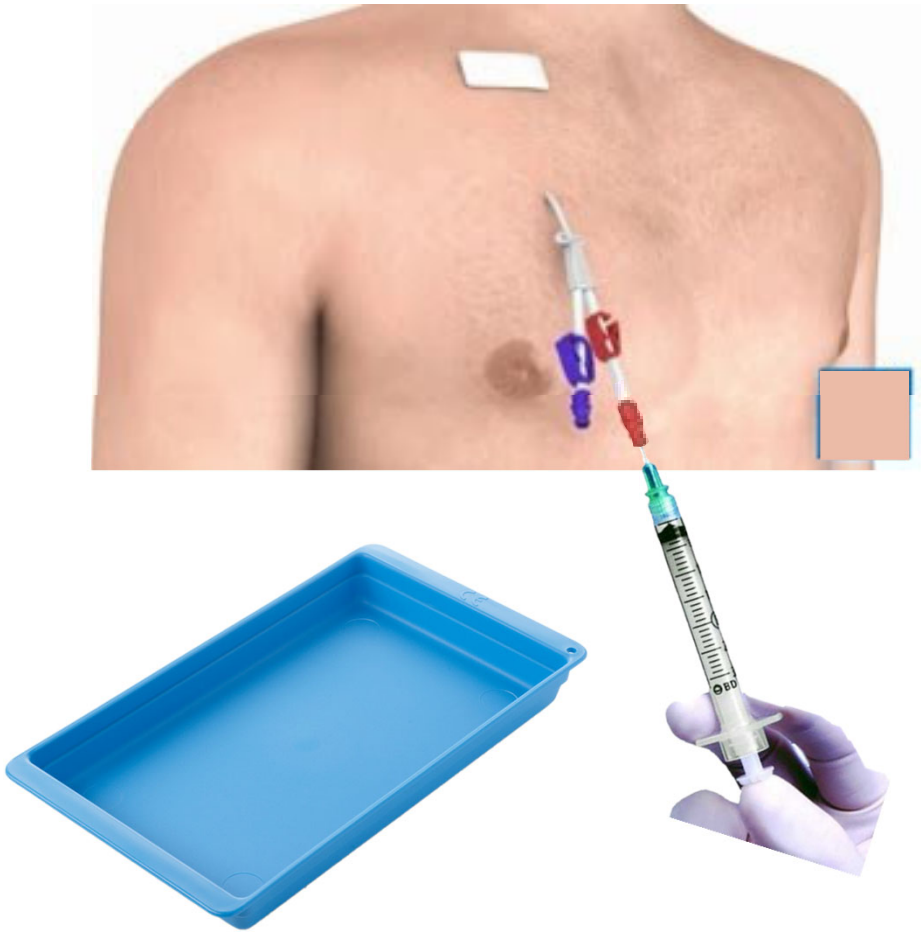
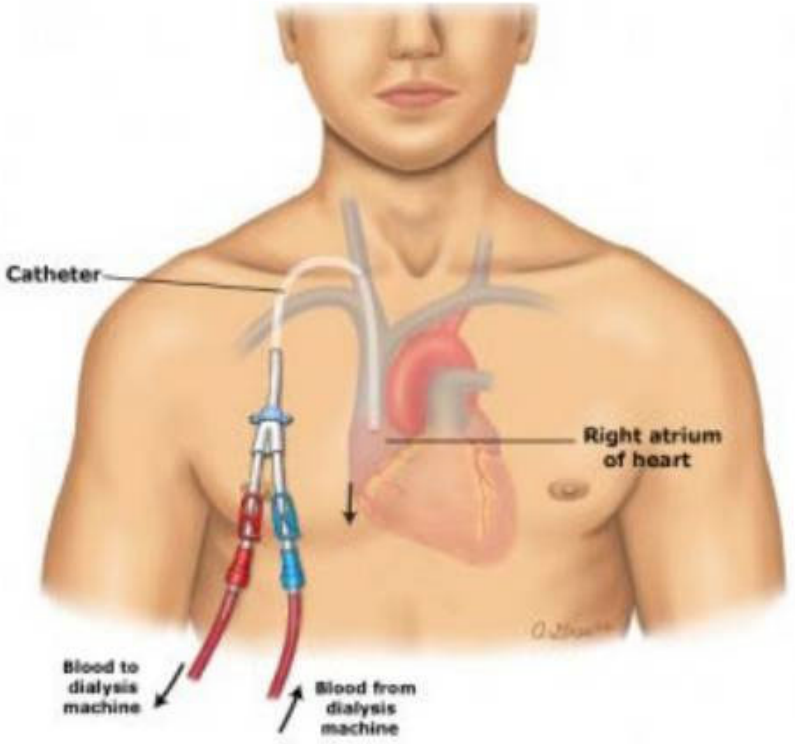
Blood from dialysis machine

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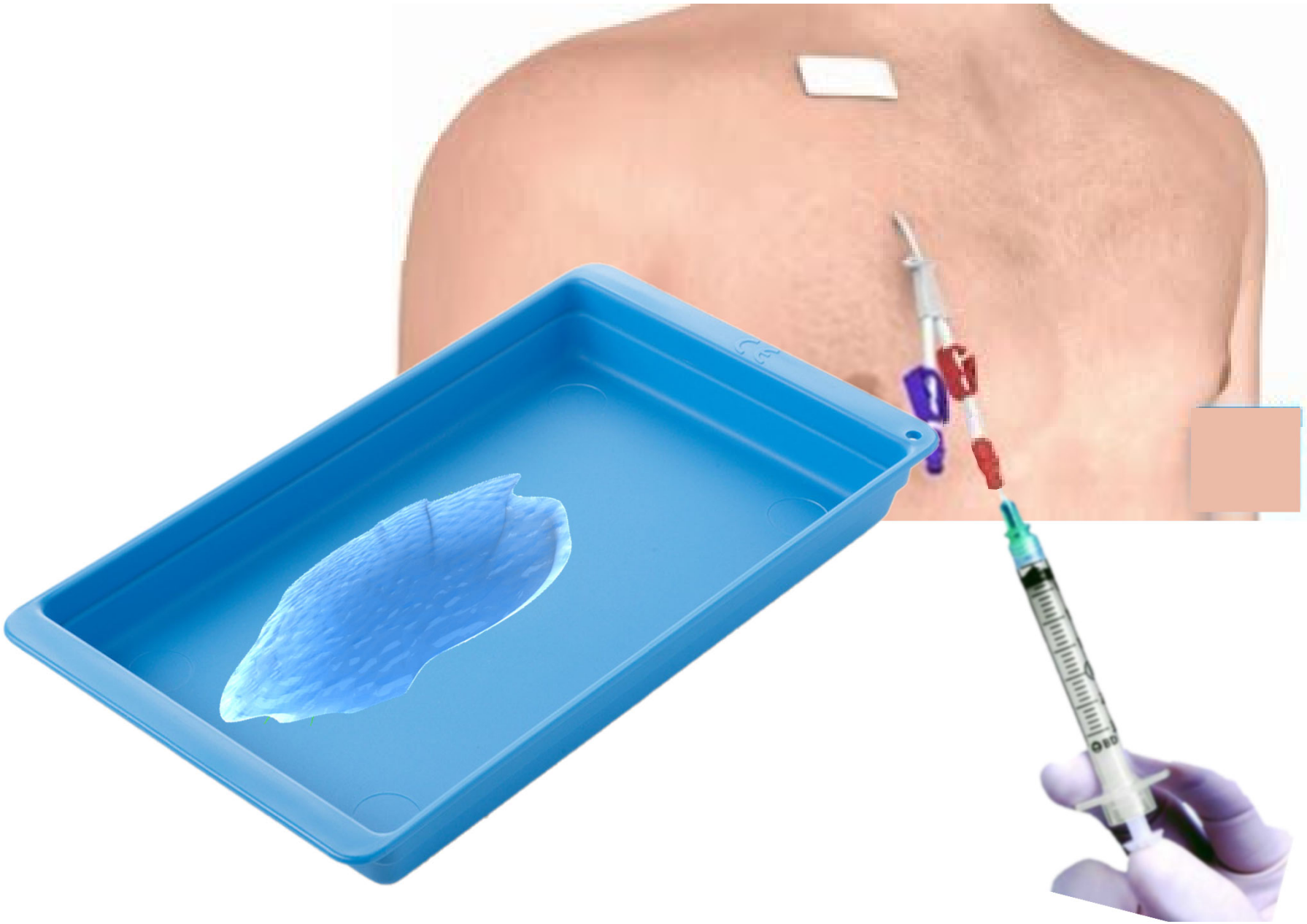
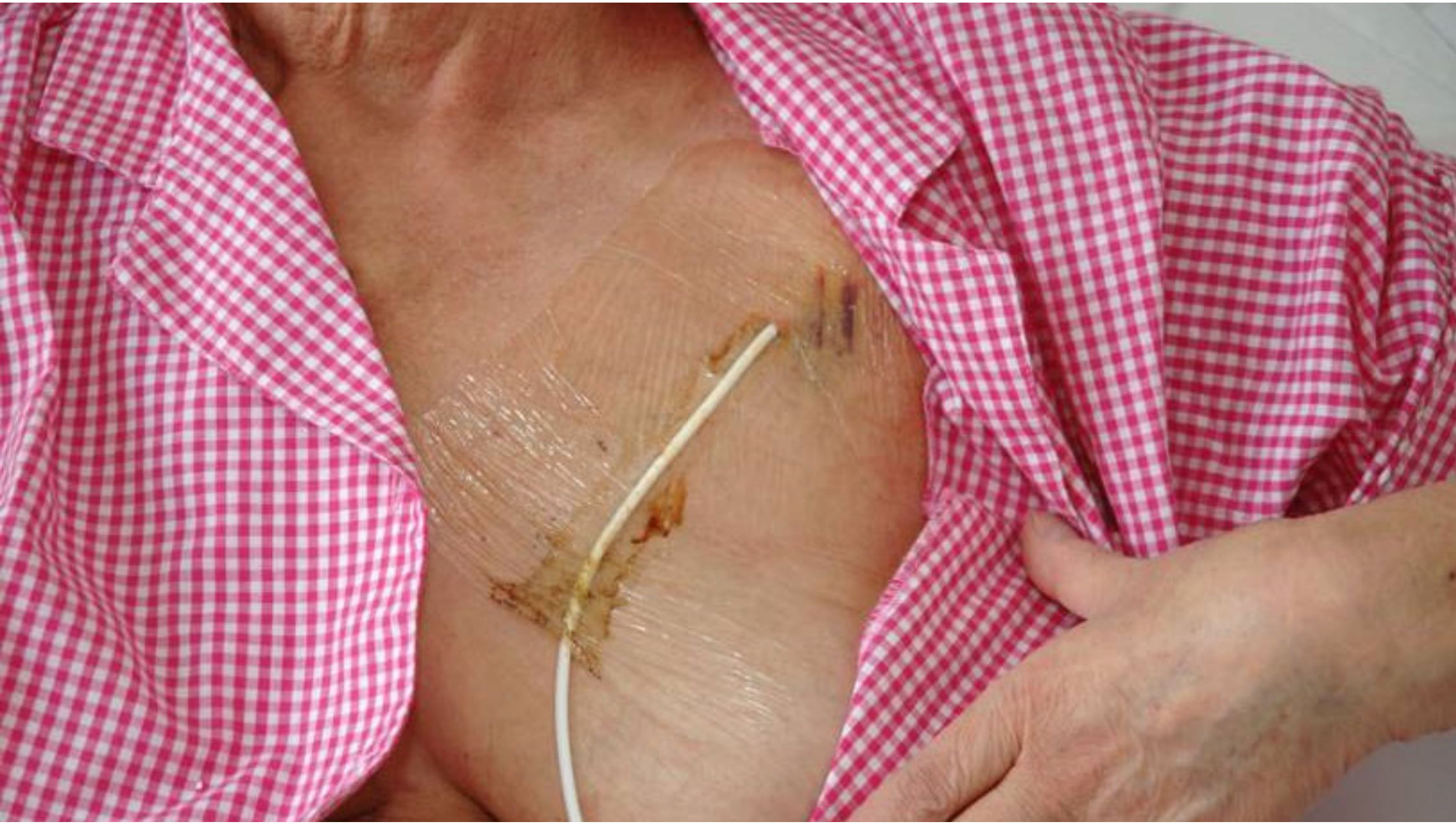
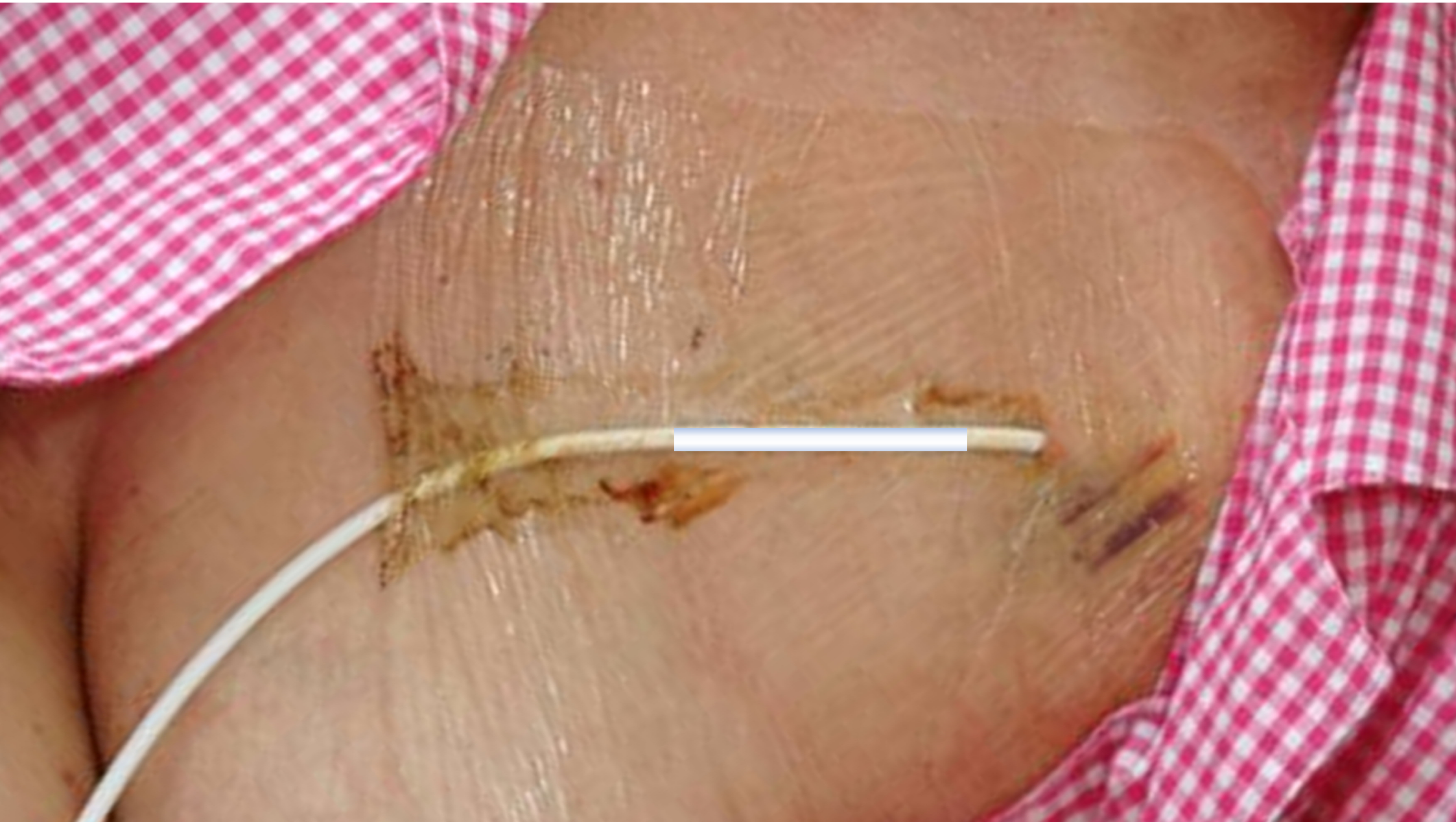
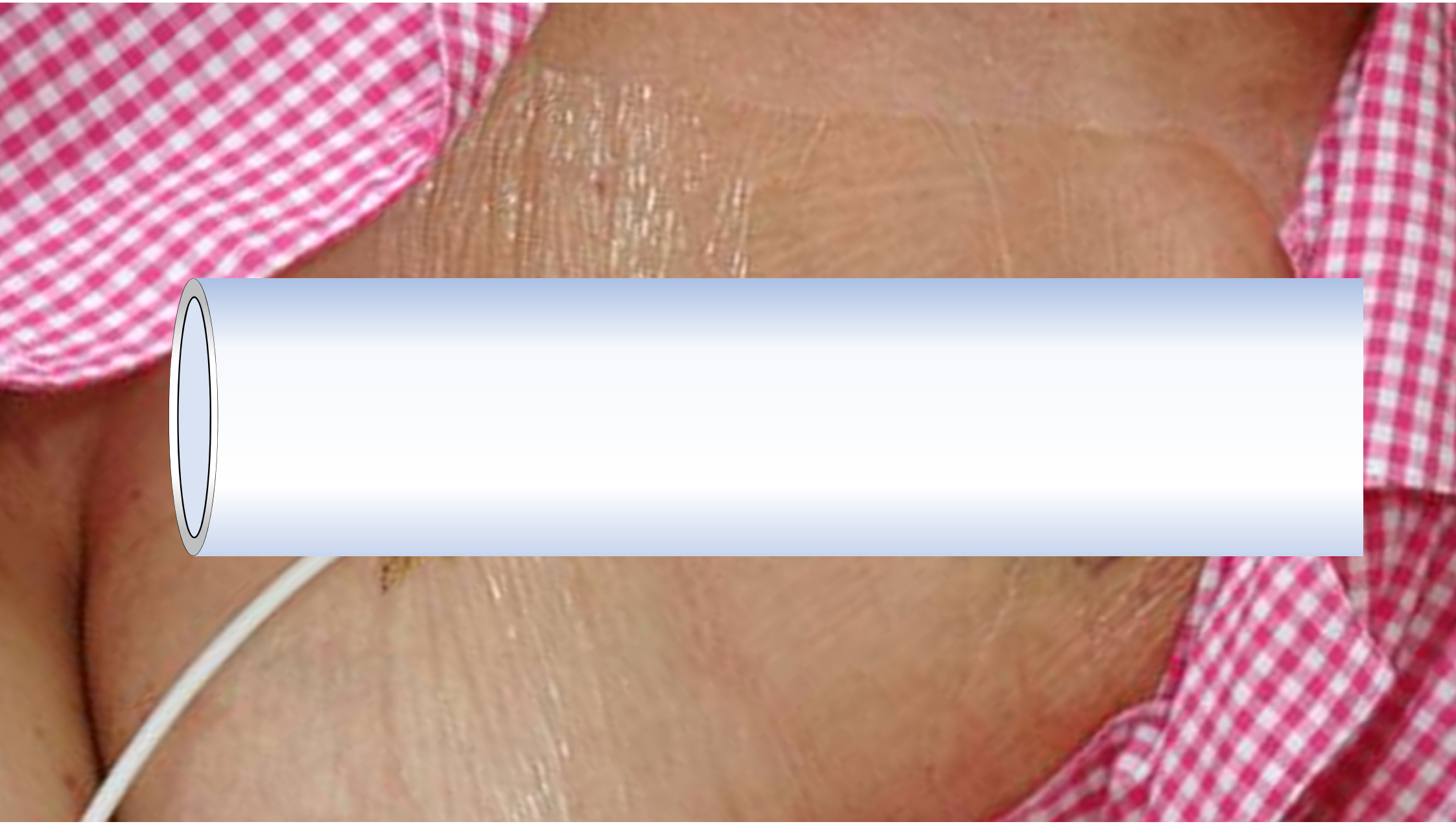
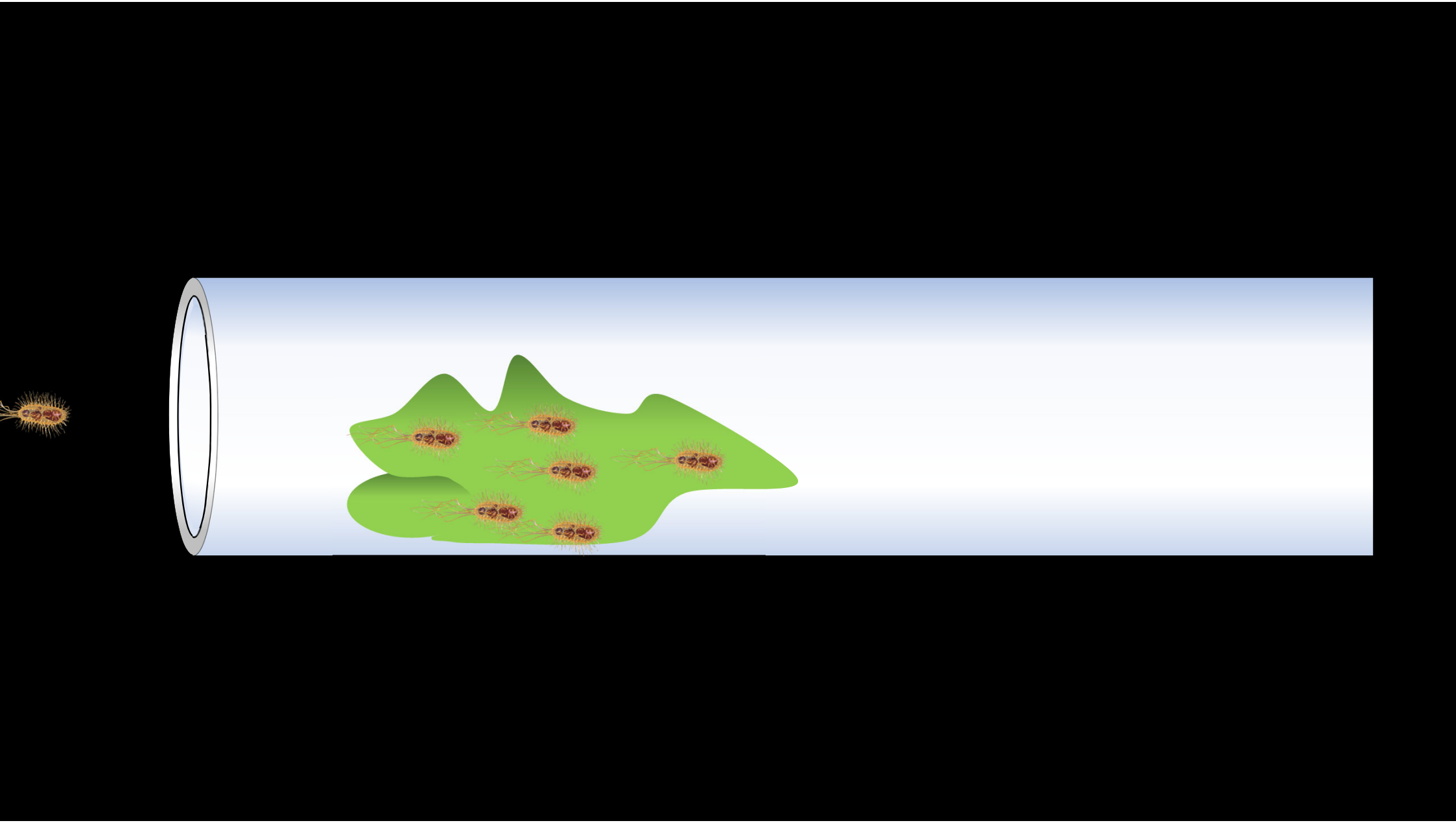
Blood to dialysis machine
Blood from dialysis machine

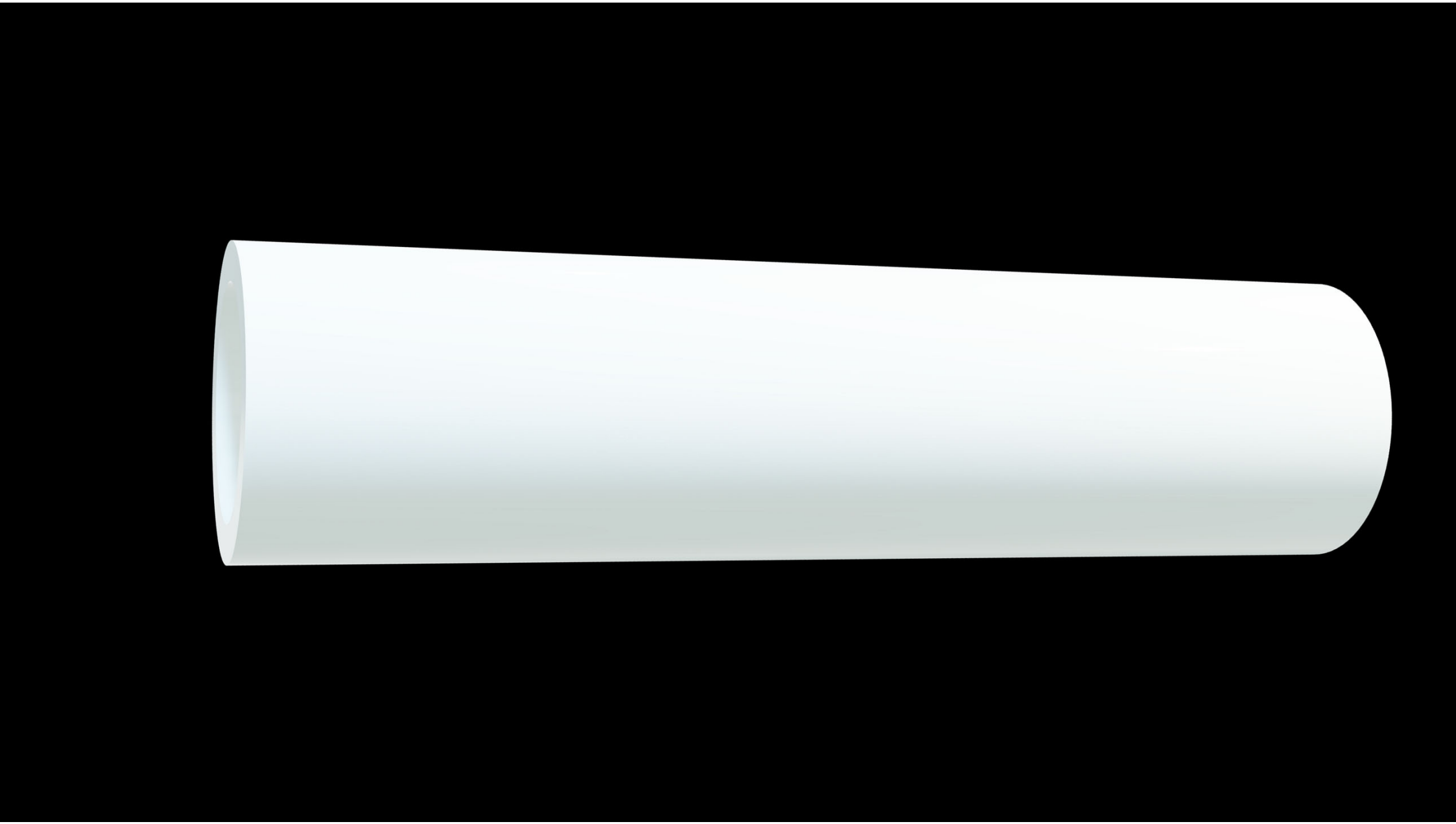


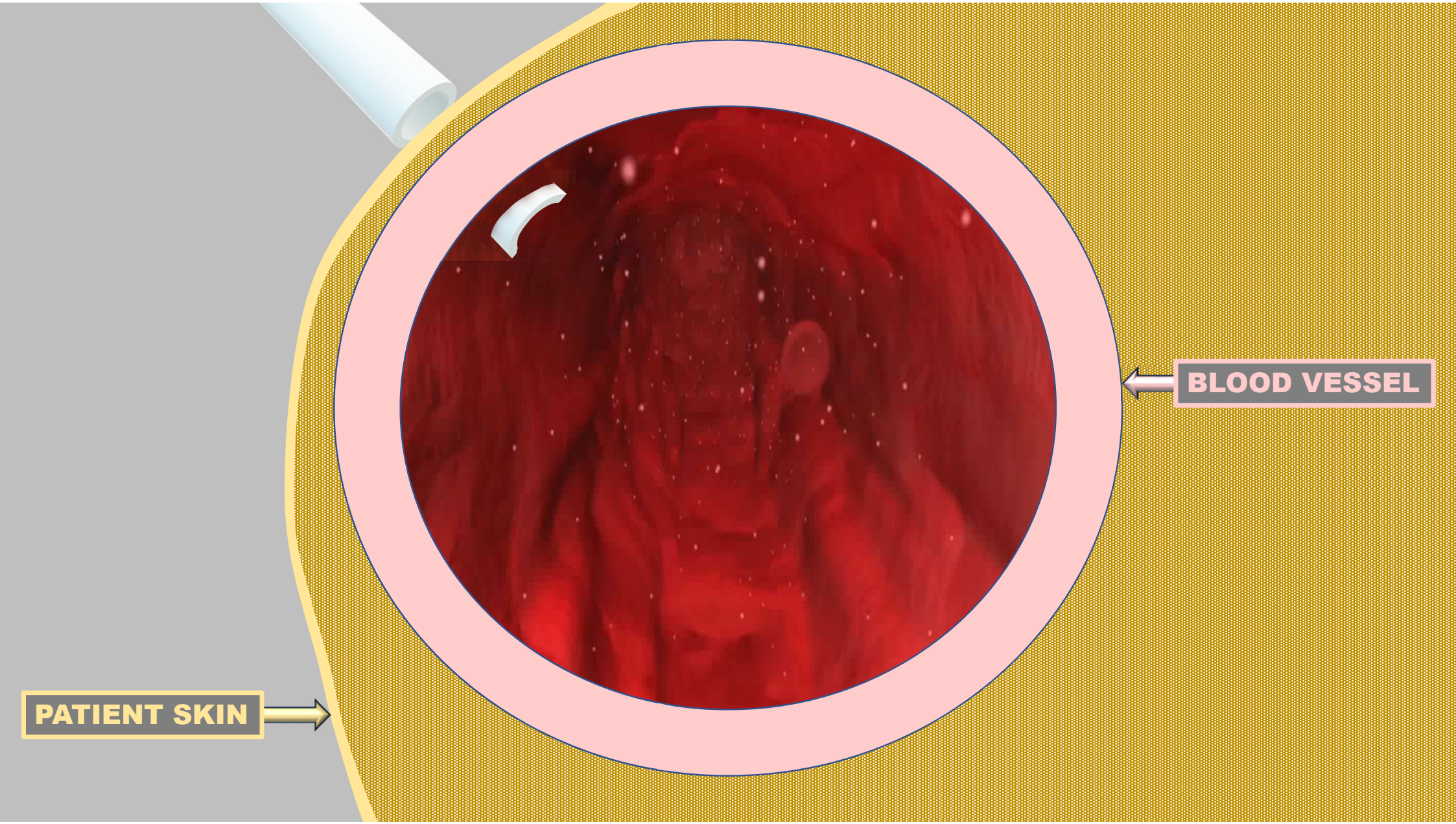











BLOOD VESSEL
PATIENT SKIN

SUMMARY

- The next pandemic is here!
- Periphery of water system should be recognised as a discipline in its own right
- Surveillance systems are insensitive particularly with sensitive common organisms.
- Standard Infection Control Precautions do not mitigate risk from water / wastewater transmission events
- When considering water quality need to consider risk from wastewater
- A proactive approach to risk recognition and mitigation is required