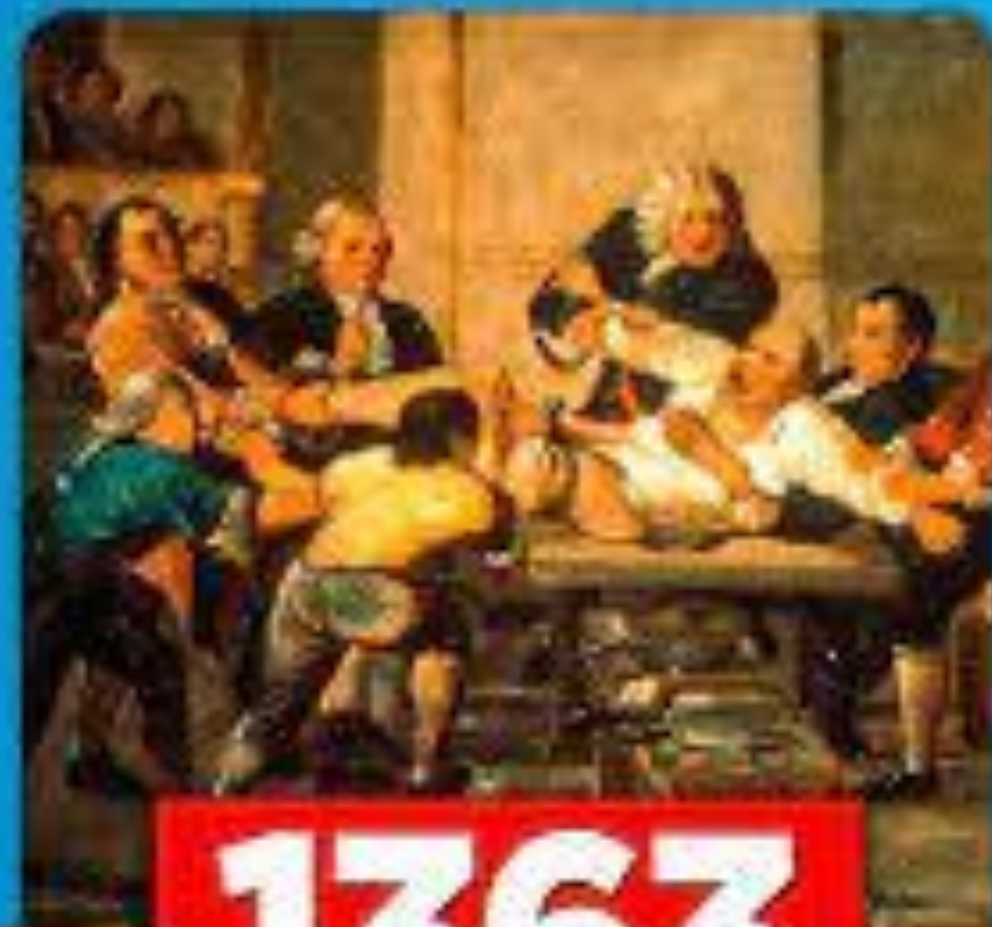


بسم الله الرحمن الرحيم

13'th congress for Infection Control and Sterilization- Medical Devices & Materials 2- 3 Dec 2025



Leila Sadati, Assistant Professor, Department of Operating Room, School of
Paramedical Science, Alborz University of Medical Sciences, Karaj, Iran



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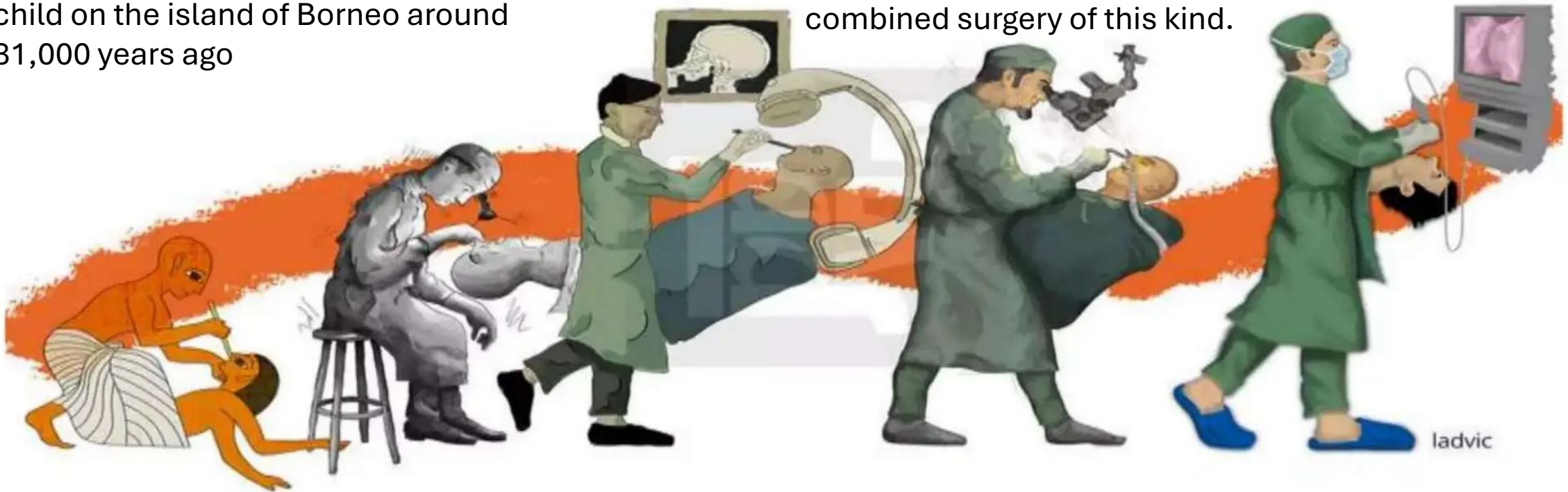
2023

Evolution of Surgery

Stone Age: The oldest known surgery is a leg amputation performed on a child on the island of Borneo around 31,000 years ago



2023: Eduardo Rodriguez performs the first whole eye and partial face transplant is performed at NYU Langone Health—the first-ever whole eye transplant and the first combined surgery of this kind.



Effective factors in Evolution of surgery

The evolution of surgery is marked by a continuous advancement in methods and technologies that have transformed the operating room into a **highly controlled, contamination-resistant environment**. Breakthroughs in anesthesia—such as closed-circuit systems, **advanced airway devices, and real-time monitoring**—have drastically reduced microbial dispersion and improved patient stability. Simultaneously, the invention and refinement of **surgical instruments, robotic platforms**, and smart sterilization systems have elevated procedural accuracy while minimizing infection risks. Enhanced **airflow systems, including laminar flow and HEPA filtration**, now maintain ultra-clean zones, ensuring that airborne microorganisms are effectively eliminated..

1

Advanced sterilization

2

HEPA filters, Laminar airflow

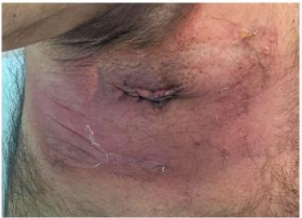
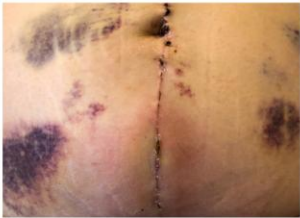
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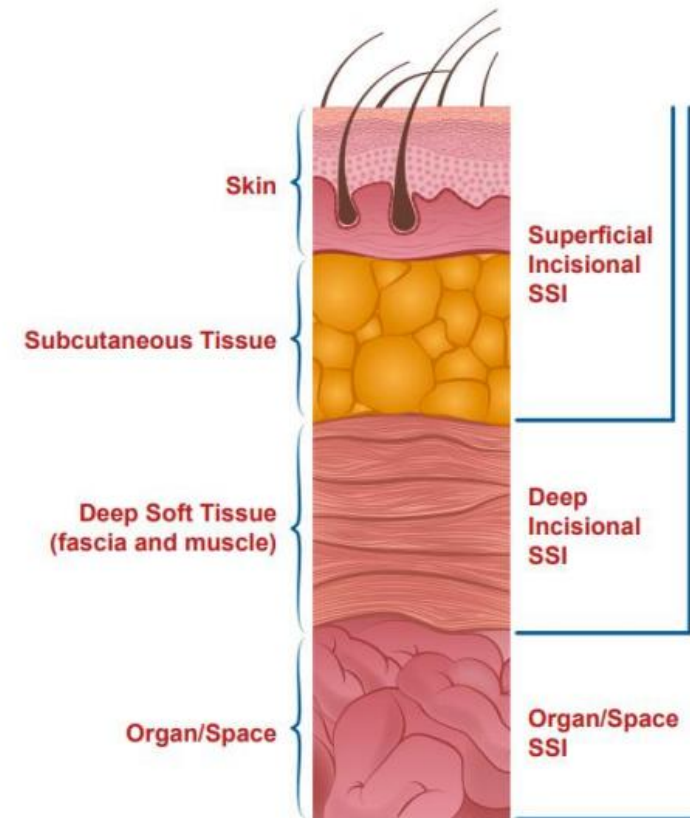
Advanced anesthesia

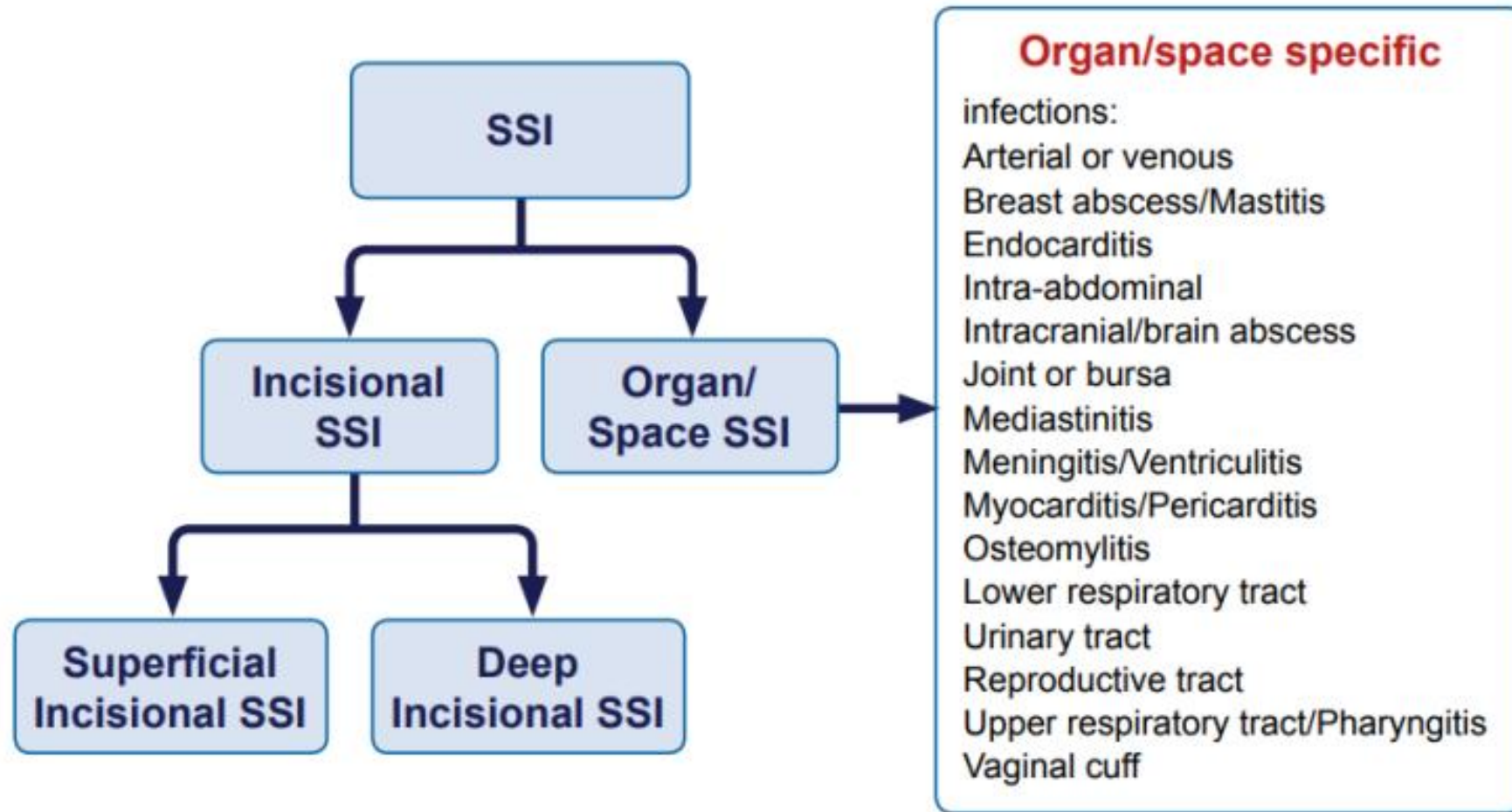
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Surgical instruments

SURGICAL SITE INFECTION

		
Deep SSI at an amputation site with exposed bone Courtesy of Zhavandre van der Merwe	Deep SSI on the breast Courtesy of Zhavandre van der Merwe	Delayed primary intention, closed with retaining sutures Courtesy of Rose Hamm
		
Deep SSI on the foot, with exposed bone and hardware Courtesy of Zhavandre van der Merwe	Deep SSI in the sternum Courtesy of Zhavandre van der Merwe	Deep SSI on the right hip Courtesy of Zhavandre van der Merwe
		
SSI on the chest, with medical adhesive-related skin injury (MARS) Courtesy of Sara Carvalhal	Subcutaneous infection of a midline laparotomy Courtesy of Ewa K Stuermer	Organ space SSI in the abdomen Courtesy of Zhavandre van der Merwe





INFECTION CONTROL

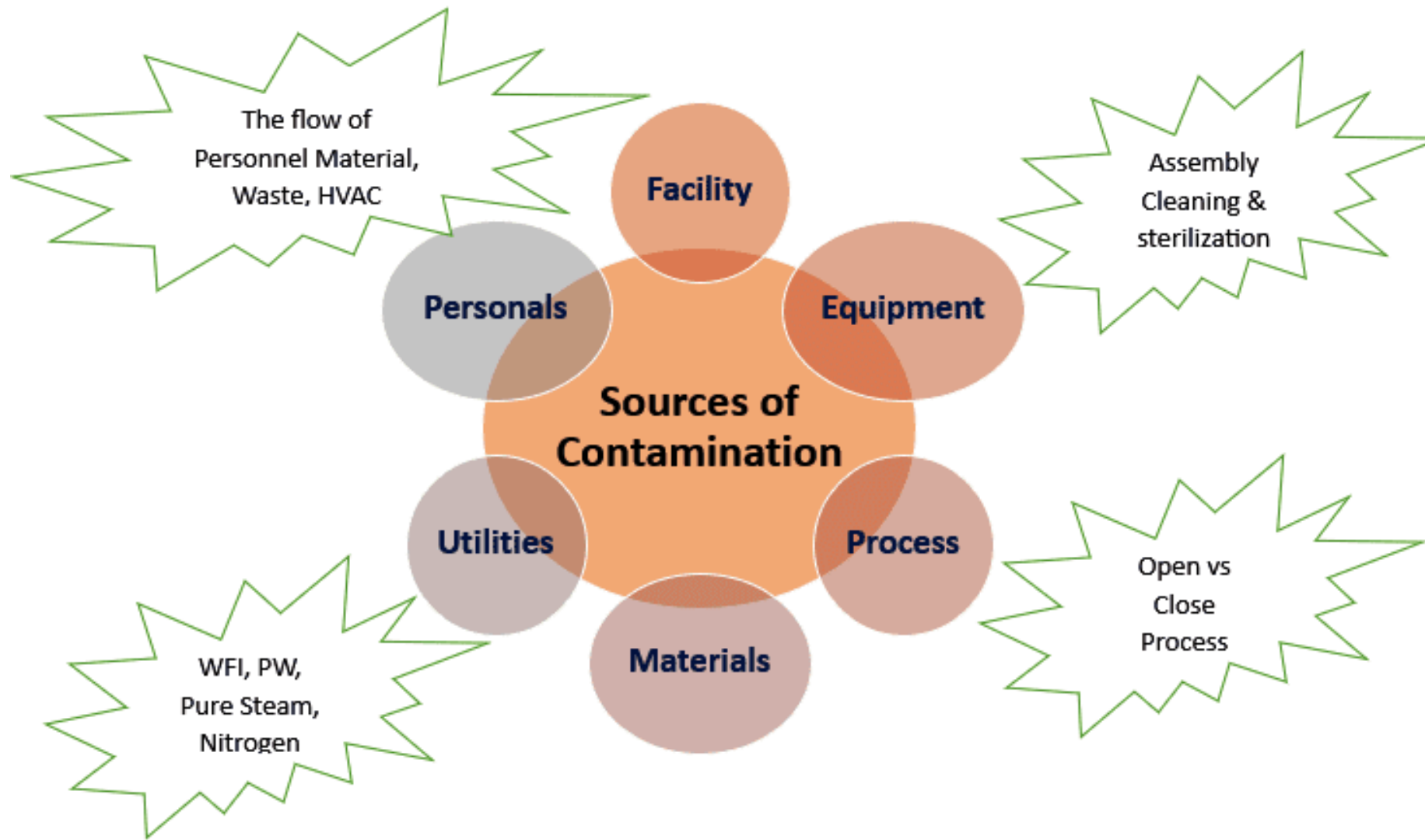


A Crucial Component in
Healthcare Management

Infection Control in Operating Room

Actions to prevent transmission of microorganisms





Sources of Contamination in the Operating Room

1. Surgical Team

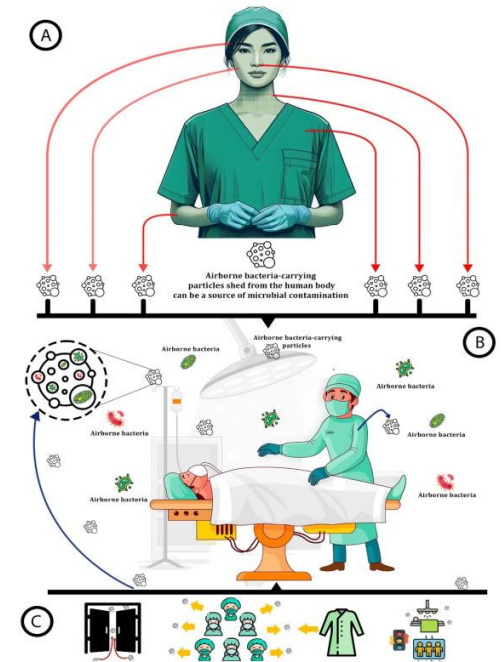
- The primary source of airborne microorganisms
- Skin shedding, movement, talking, and improper gowning increase particle load

2. Patient Factors

- Skin flora, hair, and respiratory droplets
- Contaminated or inadequately prepped surgical sites

3. Surgical Instruments & Equipment

- Incomplete sterilization or improper handling
- Recontamination during setup or intraoperative use



Sources of Contamination in the Operating Room

4. Airflow & Ventilation Systems

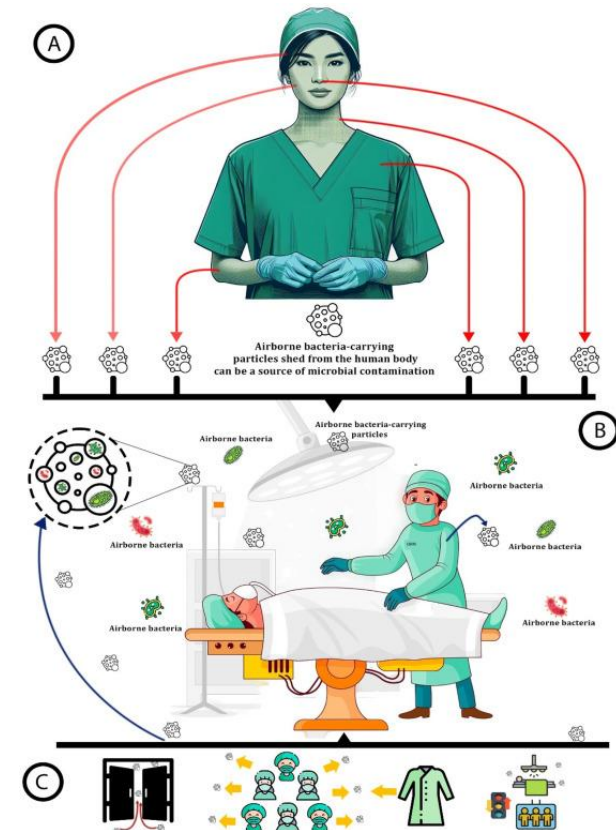
- Turbulent airflow, door openings, and traffic disrupt clean air patterns
- Inefficient filtration increases microbial burden

5. Environmental Surfaces

- Operating tables, lights, monitors, and anesthesia equipment
- High-touch surfaces acting as reservoirs for pathogens

6. Consumables & Materials

- Drapes, gowns, and packaging materials releasing particles
- Improper storage or handling of sterile supplies



Global Burden of Surgical Site Infections (SSI)

- Surgical procedures increased by 40% over 5 years
- 20% of hospital infections originate in the OR
- Surgical infections triple the cost of care



Role of Operating Room in SSI Occurrence

1

SSI affects 2–5% of surgical patients worldwide

2

Operating room environment (air, surfaces, instruments, staff) is a major source of contamination

3

Up to 30% of SSIs linked to airborne or environmental contamination

Direct and Indirect Costs of SSI

- Increased hospital stay and readmission
- Need for antibiotics, wound care, and sometimes reoperation
- Higher financial burden on healthcare system and patients
- Loss of productivity, legal claims, and lowered quality of life

HOW TO REDUCE **SURGICAL SITE INFECTION RISK?**



Joseph Lister (1827–1912)

Joseph Lister was a British surgeon and the pioneer of antiseptic surgery.



He introduced the use of carbolic acid (**phenol**) to disinfect surgical instruments and clean wounds, which greatly reduced infection and post-surgery death rates.

His work laid the foundation for modern infection control and sterile surgical practices. Lister is known as the "**Father of Antiseptic Surgery.**"





Cleaning



Decontamination



Sterilization

Sterilant

Heat

- ✓ Dry heat
- ✓ Flash steam
- ✓ Moist heat (autoclave)

Chemicals

Acids

- ❖ Performic acid
- ❖ Peracetic acid

Aldehydes

- ❖ Formaldehyde
- ❖ Gluteraldehyde

Gases

- ❖ CO_2
- ❖ EtO
- ❖ ClO_2
- ❖ O_3
- ❖ H_2O_2



Radiations

- ☐ Gamma
- ☐ Plasma based UHUV
- ☐ High energy electron beam
- ☐ Non-ionizing UV

Hydrogen peroxide plasma sterilizer

Low temperature

H_2O_2 plasma sterilizer
Type: SQ-DS 60L

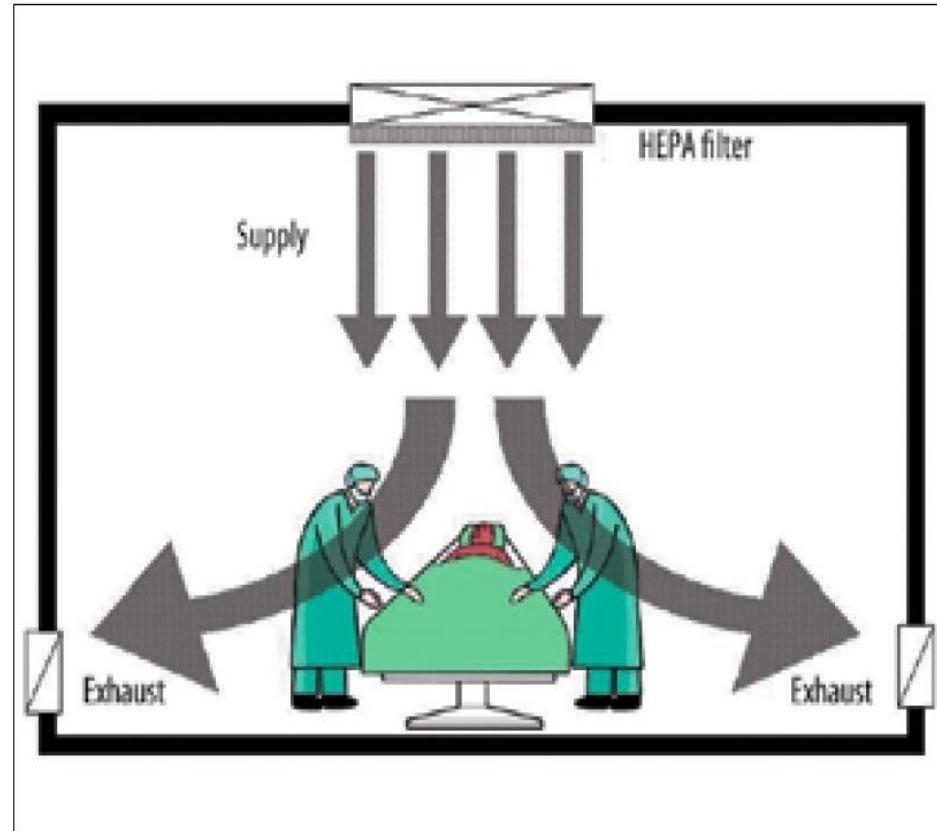


Digital Sterilization Monitoring

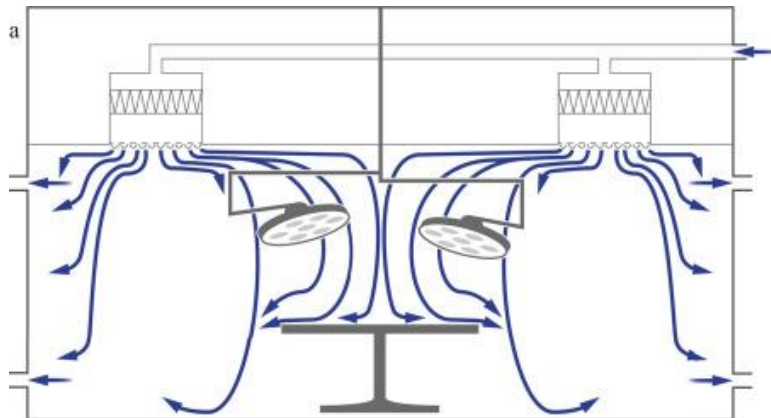
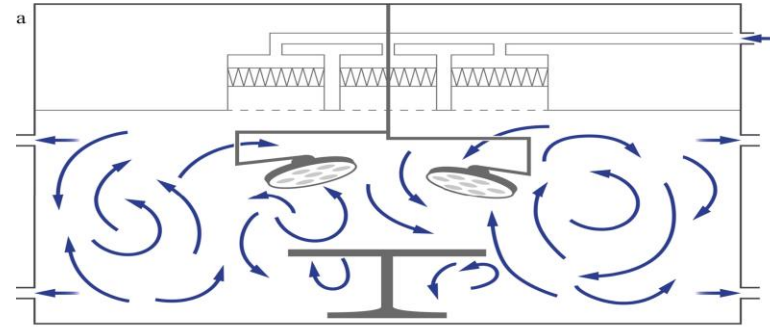
- Uses sensors and software to monitor sterilization parameters in real-time
- Tracks temperature, pressure, and exposure time in autoclaves
- Generates digital records for traceability and legal documentation
- Alerts staff immediately when sterilization fails or is incomplete
- Ensures compliance with infection prevention standards (e.g., CDC, WHO)



VENTILATION



VENTILATION

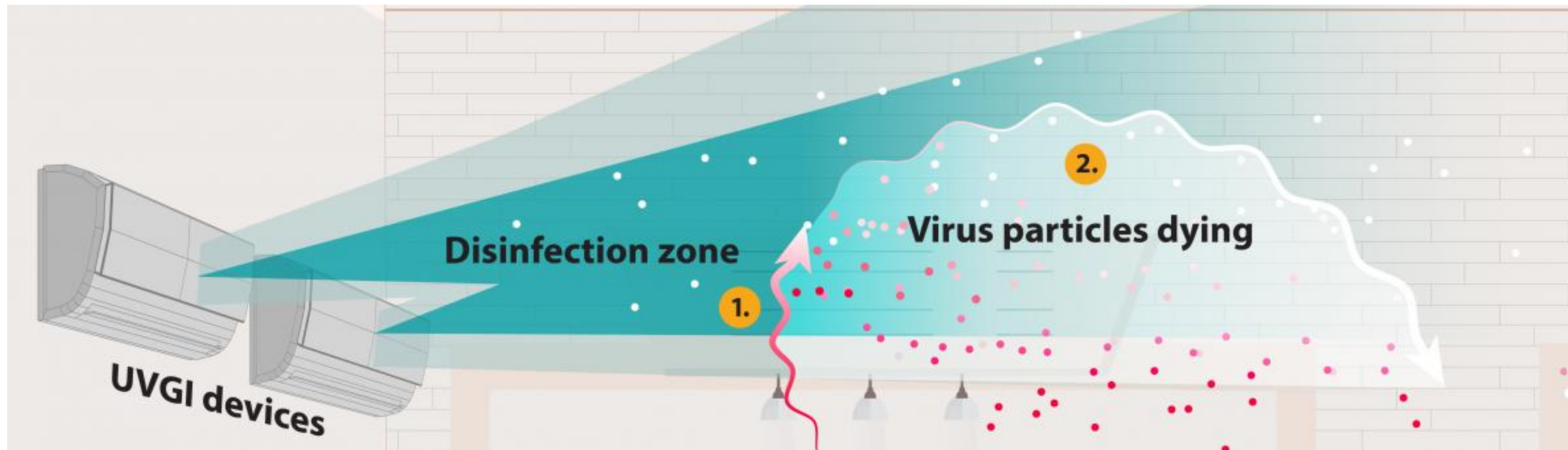


Air Changes per Hour (ACH)

Standard OR: 15–25 ACH for infection prevention

Higher ACH reduces airborne microbial load, lowers risk of surgical site infections (SSI), and improves removal of smoke, dust, and volatile chemicals.

Space Function	Pressure Relationship to Adjacent Areas
Operating Room	Positive
Airborne Infectious Isolation (All) Room	Negative
Recovery Room	N/R



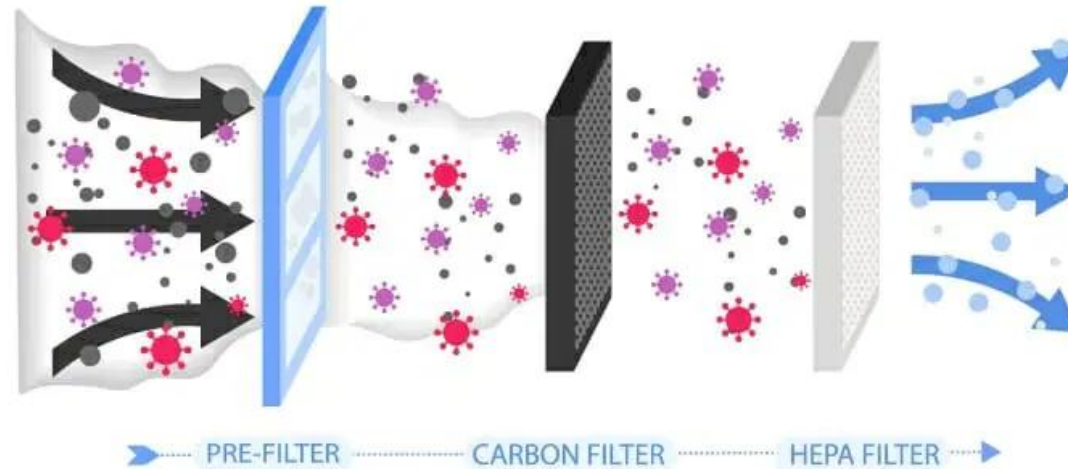
253.7 nm (UV-C)

HEPA Filters

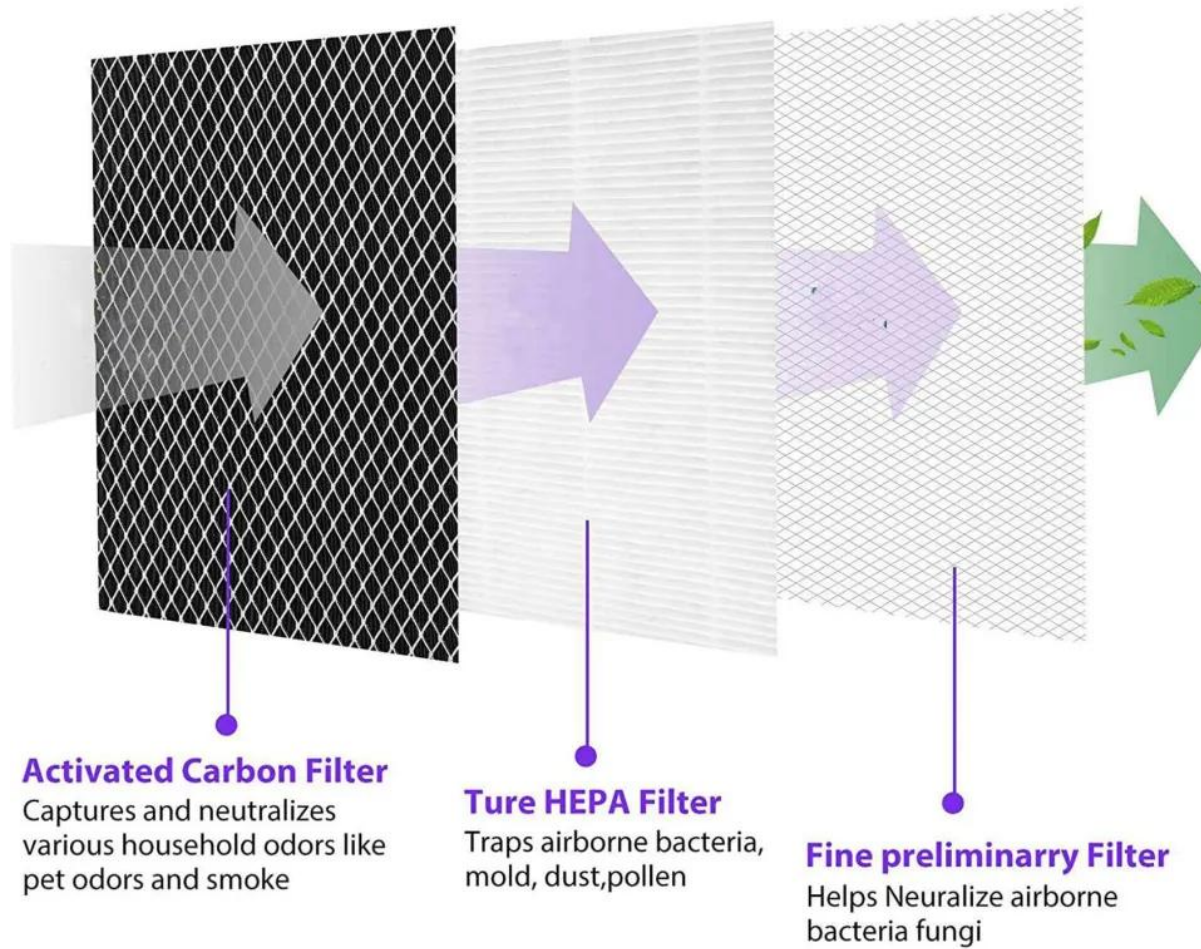
High-Efficiency Particulate Air (HEPA) filters remove $\geq 99.97\%$ of particles $\geq 0.3 \mu\text{m}$

Trap dust, microbes, and surgical smoke particles

Essential component of OR ventilation systems



3 STAGE FILTER



Single-Use Medical Instruments and Their Role



Single-Use Medical Instruments and Their Role

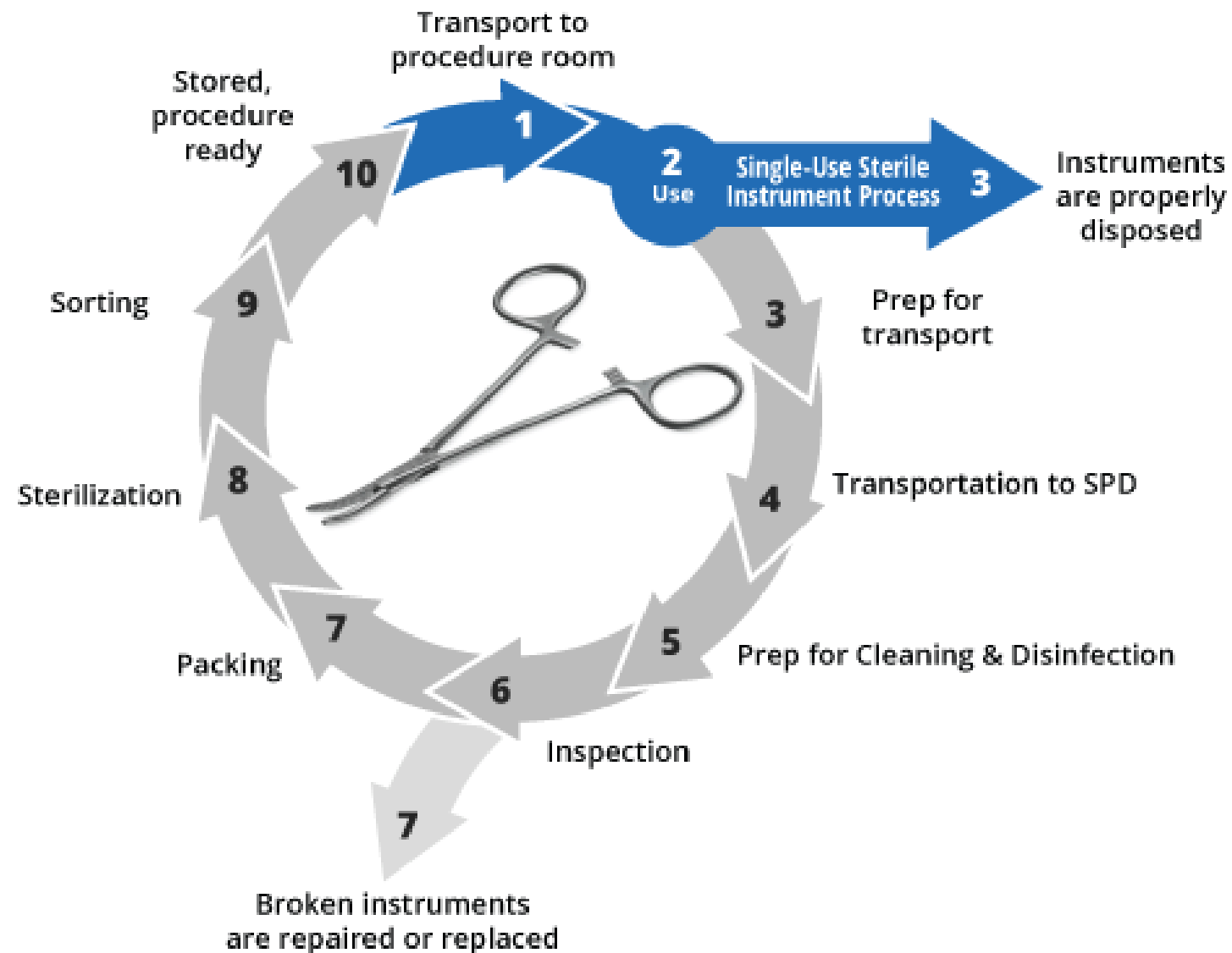
- Single-use instruments are designed to be used once and then discarded.
- They eliminate the risk of cross-contamination between patients.
- No need for sterilization — saves time, cost, and resources.
- Reduce risk of surgical site infections (SSI) and hospital-acquired infections.
- Ensure consistent safety and sterility with every use.
- Especially useful in high-risk procedures and infection-sensitive environments like operating rooms.



فراوری مجدد وسایل پزشکی یکبار مصرف		
ممنوع	توصیه نمی شود	دارای مجوز
فرانسه	بریتانیا	آلمان
	ایتالیا	سوئد
	جمهوری چک	بلژیک
	استرالیا	هلند
	اسپانیا	پرتغال
	ایرلند	دانمارک
	مجارستان	اسلواکی
		فنلاند



Reprocessing Steps



Instruments That Should Never Be Reprocessed

Example

Single-use scalpels and blades
Disposable laparoscopic trocars and cannulas
Certain endoscopic instruments with complex lumens
Plastic or polymer-based instruments that deform under heat or chemicals

Risks

Surgical Site Infections
(SSI)

Guidelines

Always follow manufacturer instructions
and FDA/CDC recommendations

Table 1. Difficult-to-Clean Devices

- | | |
|--|--------------------------------------|
| • Cannulae in septorhioplasty set | • Trivex system |
| • Cornary suctions | • Drills |
| • All ear trays, suctions, and very fine, delicate instruments | • Gamma nail sets |
| • Flexible scopes, gastroscopes, and bronchoscopes | • Saws |
| • Defibrillator paddles | • Extract All set |
| • Lenses | • Kerrison Rongeurs |
| | • Spring-loaded drill guides |
| | • Bipolar forceps with delicate tips |
| | • Tympanomastoid set |
| | • Orthopedic reamers |

These medical devices are just a few of those identified as being the most difficult to clean.

Source: Azizi J, Basile RJ. Doubt and proof: the need to verify the cleaning process. *Biomed Instrum Technol* 2012 Spring; Suppl:49-54. doi: 10.2345/0899-8205-12.1.49. Used with permission.

Formalin



Formalin (formaldehyde) is classified as a Group 1 carcinogen by IARC

Formalin tablets
**do not provide true
sterilization**
of instruments
Use may give a
false sense of safety,
increasing infection risk

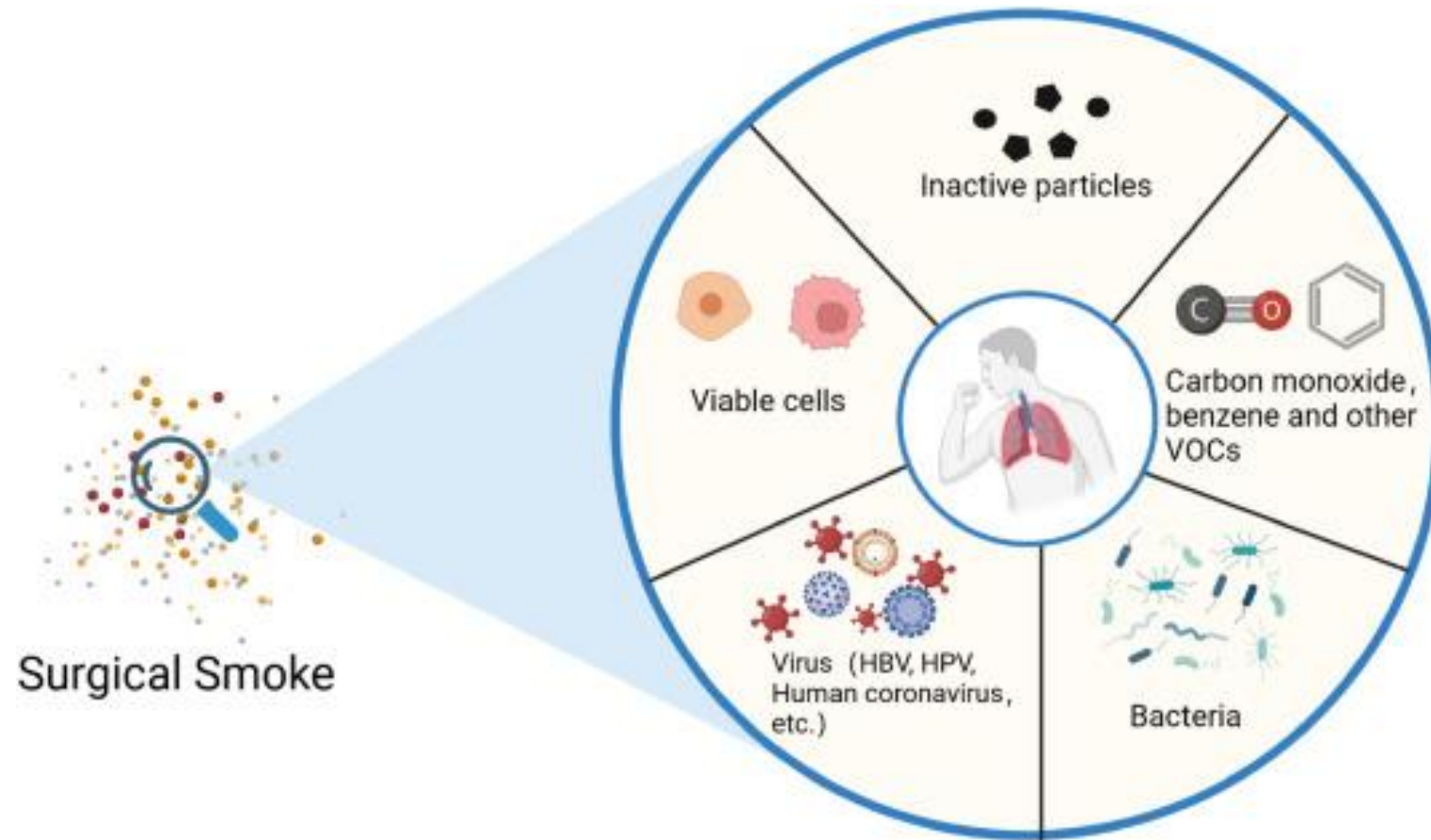


Prolonged exposure can
cause **respiratory, eye,
and skin irritation**



Chemical Composition of Surgical Smoke

- Surgical smoke contains vaporized tissue, blood, and cellular debris
- Contains harmful chemicals: benzene, toluene, formaldehyde, and acrylamide
- May carry viable viral and bacterial particles
- Generated by electrocautery, laser, and ultrasonic devices



Smoke Evacuation and Air Quality Evidence



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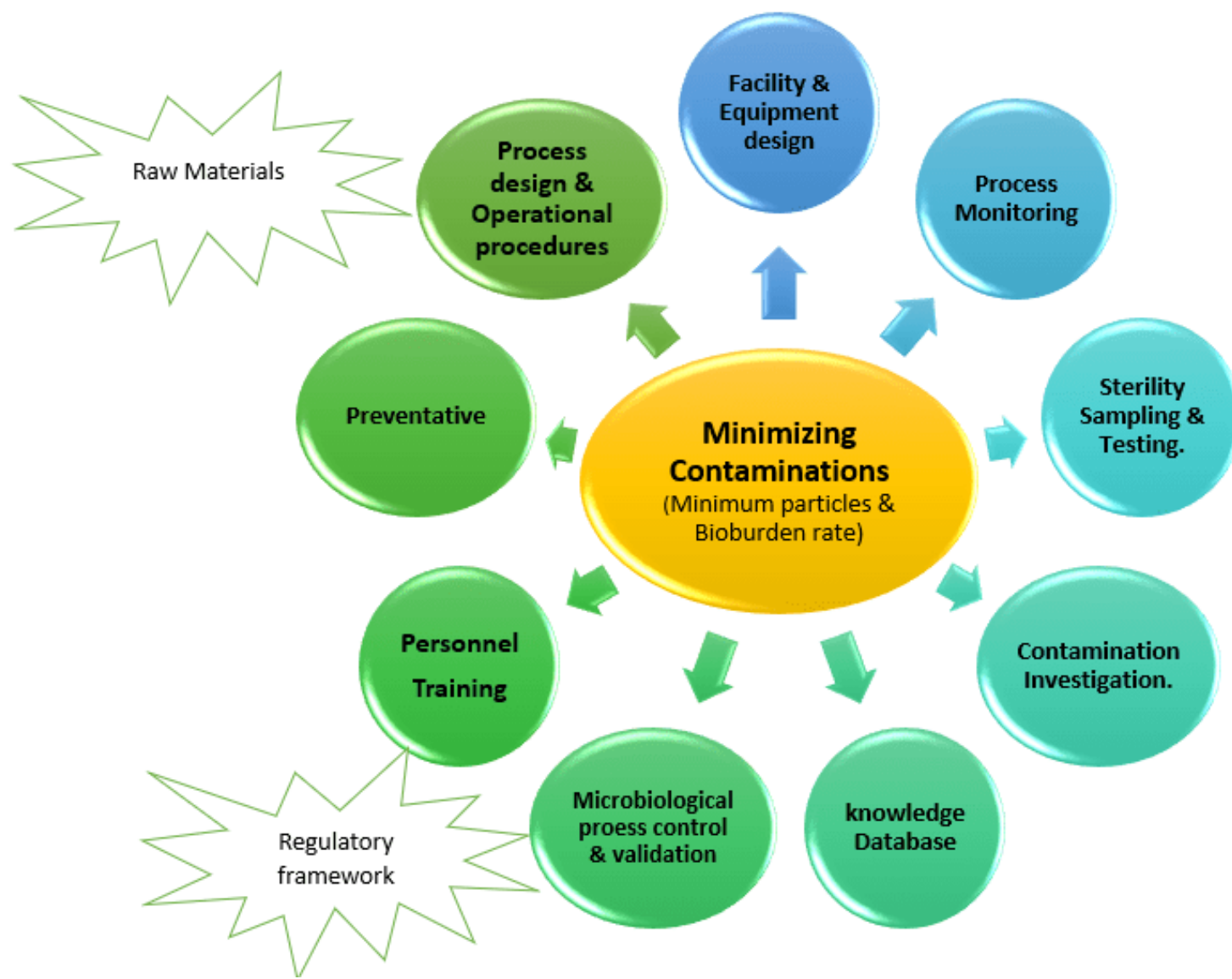
Most surgical site infections (SSI) are preventable

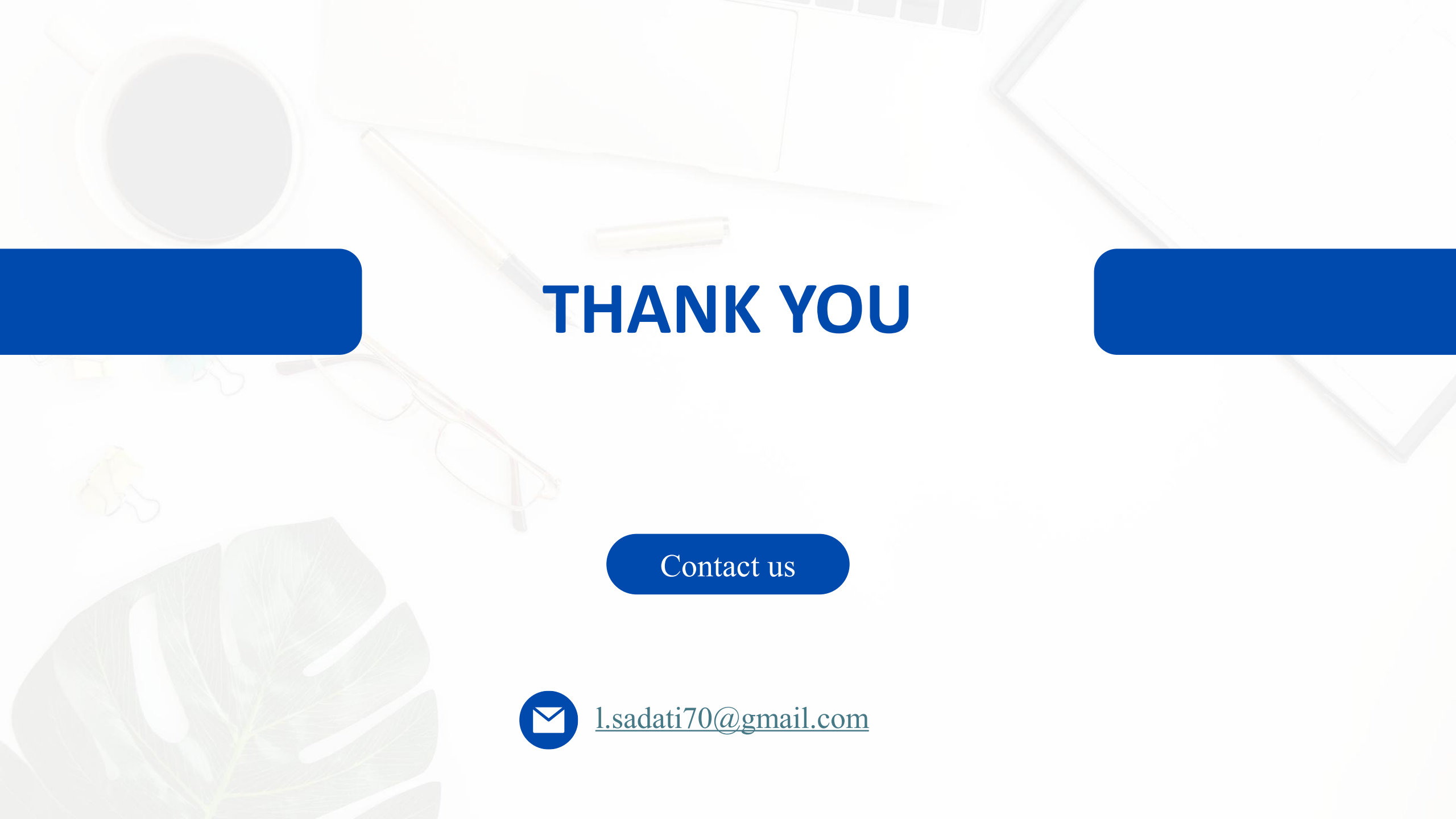
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OR Infection Control Checklist

- Hand hygiene and proper PPE use
- Sterilization of instruments and disposable use adherence
- Air quality: HEPA filters, UV-C, and adequate ACH
- Smoke evacuation and safe handling of surgical smoke
- Continuous monitoring and documentation of infection control measures







THANK YOU

Contact us



l.sadati70@gmail.com