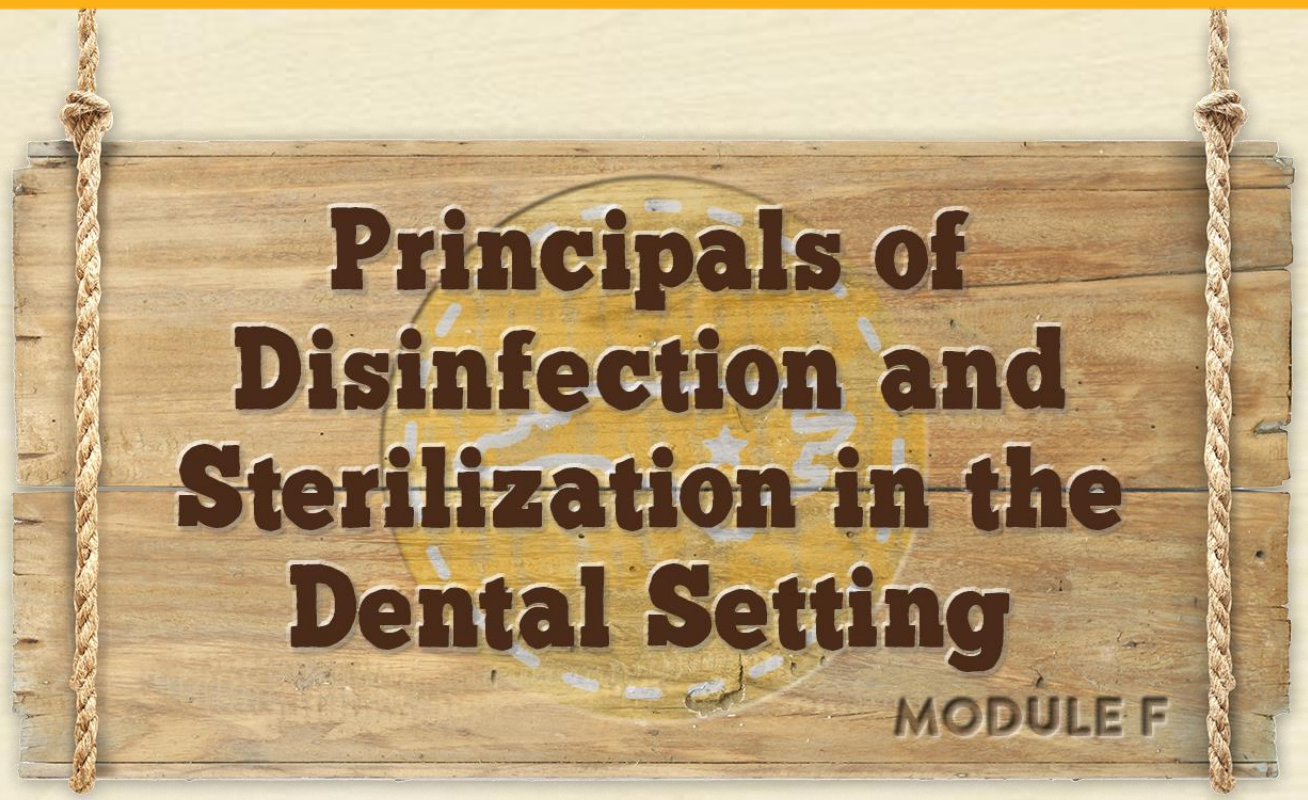
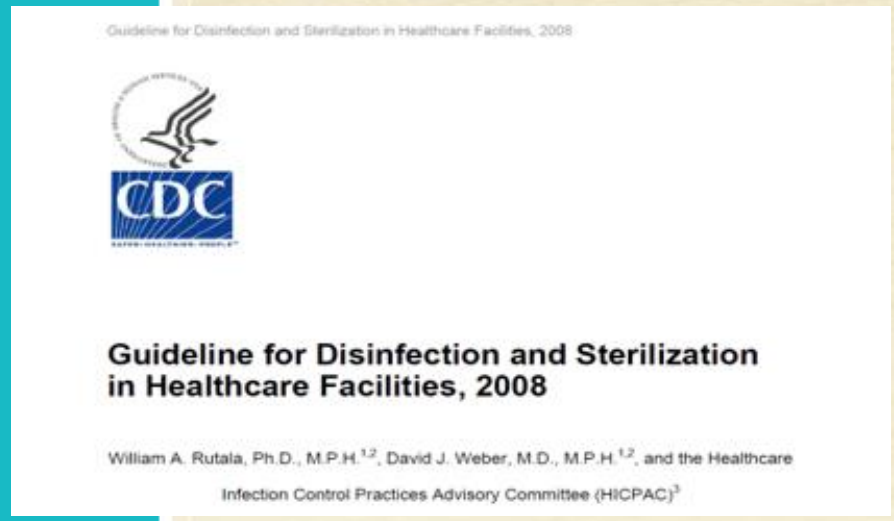
Module F


Principals of Disinfection and Sterilization in the Dental Setting
MODULE F

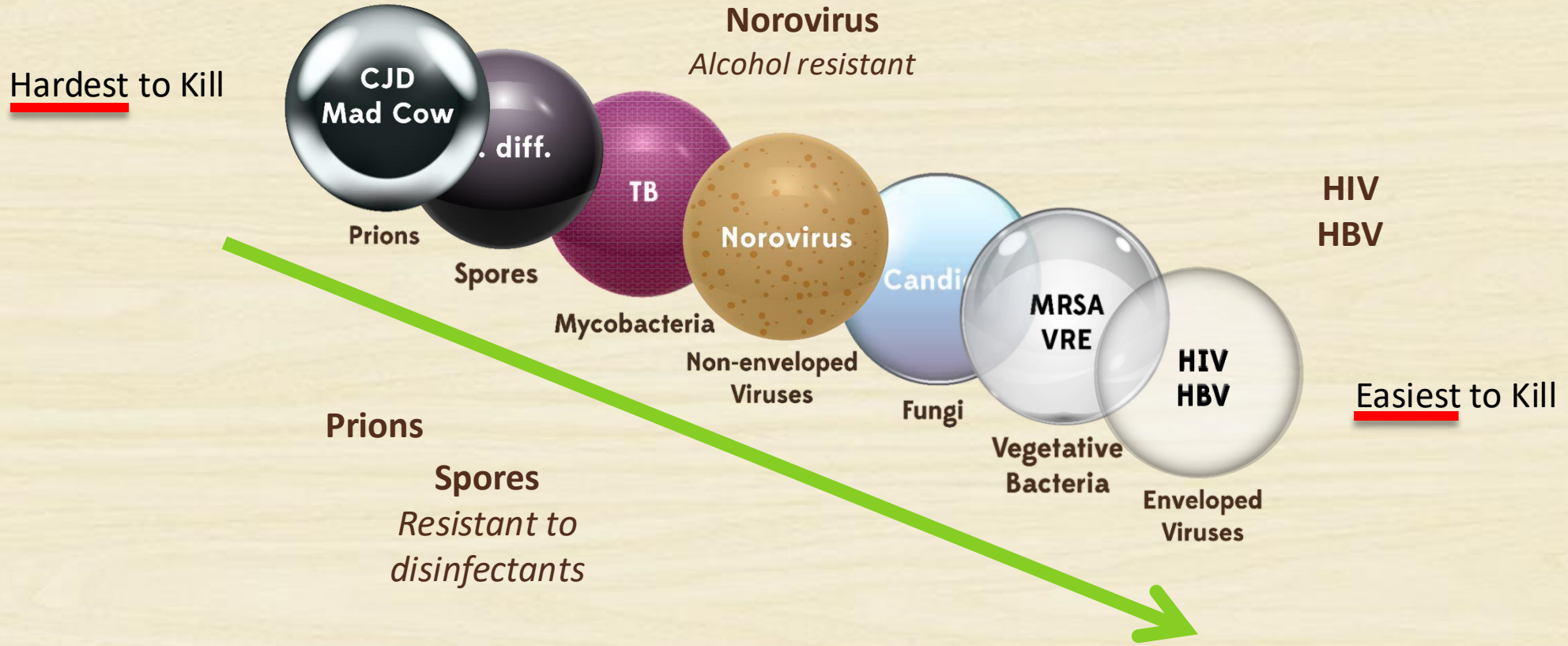

Sterilized Desert

Objectives



- Describe the principles of disinfection and sterilization
- Provide an overview of current methods for disinfection and sterilization
- Discuss training and quality control methods and required documentation

Objectives

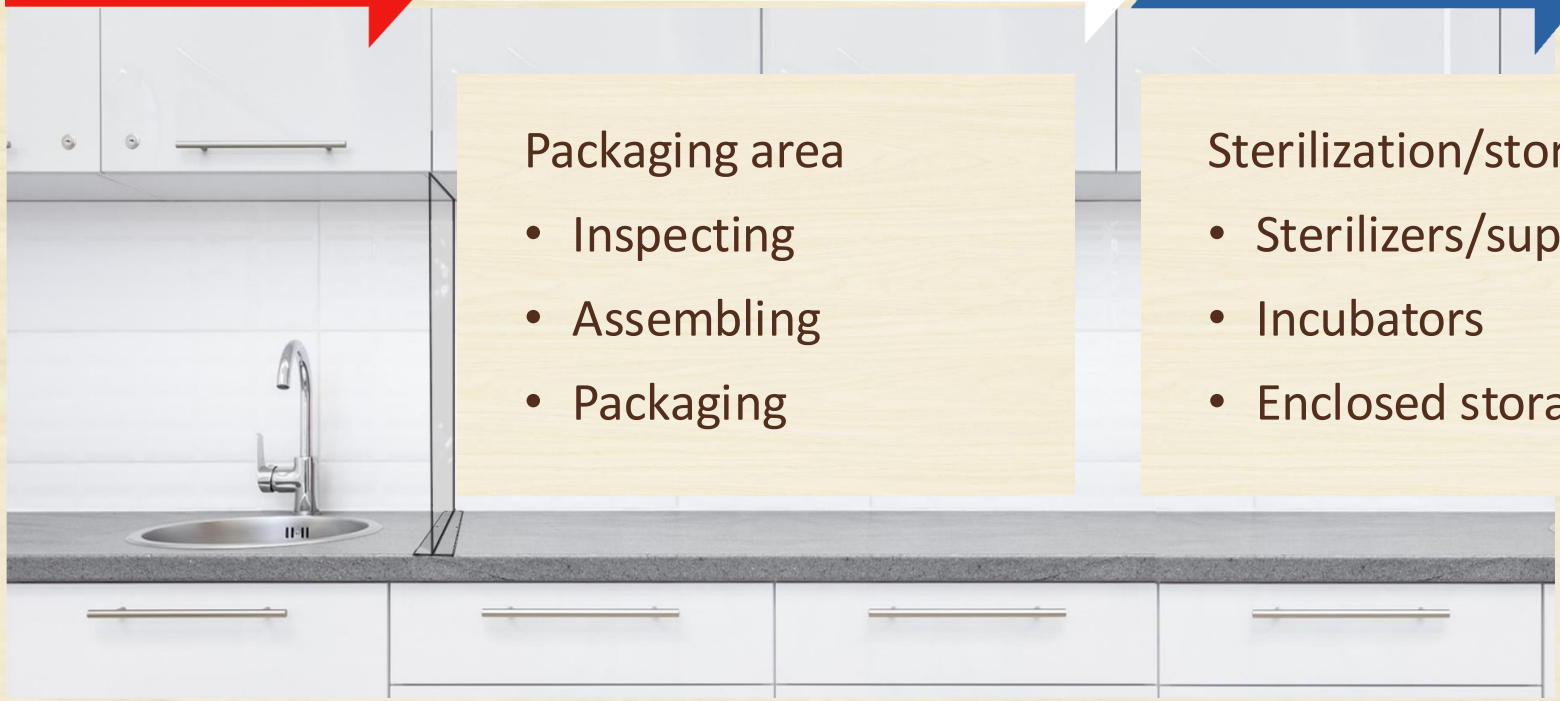


Principles


(3 Cleaning Zones)
Clean
Clean
Sterilize
Red Light = Non Sterile
Blue Light = Sterile

Principles

Decontamination → **Packaging** → **Sterilize**



Packaging area

- Inspecting
- Assembling
- Packaging

Sterilization/storage area

- Sterilizers/supplies
- Incubators
- Enclosed storage

Principles

Management of reusable contaminated items:

- Handle as little as possible
- Use appropriate PPE
- Remove gross soil or debris at the point of use (gauze sponge moistened with water/disinfectant wipe for example)
- Immediately contain and transport to the decontamination area or soiled utility room where cleaning procedures can be accomplished away from patient care

Principles

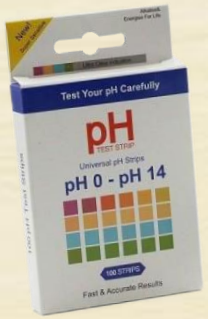
Transport of contaminated items:

- Must be contained. The type of container depends on the item being transported:
  - Puncture-resistant, leak-proof, closable containers must be used for devices with edges or points capable of penetrating container or skin
  - Must have a bio-hazard label or be red in color (never via gloved hands alone)
- Items should be kept moist during transport by adding a towel moistened with water (not saline) or a foam, spray or gel product specifically intended for this use
- Avoid transporting contaminated items in a liquid
- Reusable collection containers for holding contaminated items should be made of material that can be effectively decontaminated
- Use separate collection containers for contaminated versus re-processed or clean items

Principles

Factors influencing the efficacy of disinfection and sterilization

- How well the object is cleaned/type and amount of material
- Testing of the disinfectant
  - Solution concentration
  - Exposure time
- Design of object
- Temperature and pH of disinfectant

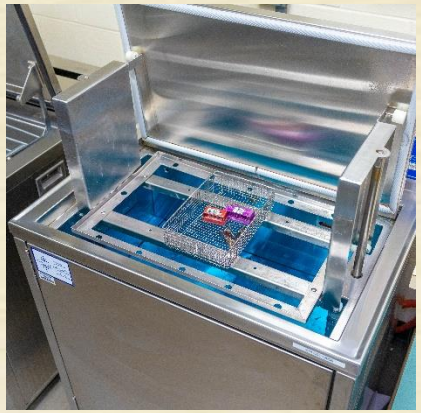


Cleaning Instruments - *Manual*

- Medical equipment/devices MUST be pre-cleaned prior to high level disinfection or sterilization.
- Contaminants such as dirt, blood or other body fluids, if present, can act as a barrier.
- If manual cleaning is performed:
  - Use work practice controls to reduce the chance of injury from sharp objects
  - Never reach into trays or container holding sharp instruments that cannot be seen
  - Use a long-handled brush to keep the scrubbing hand away from sharp instruments
  - Wear puncture-resistant, heavy-duty gloves

After cleaning, instruments should be rinsed with water to remove chemical detergent residue.

Cleaning Instruments - *Automated*



Automated cleaning equipment

Ultrasonic cleaner

Instrument washer

FDA regulated instrument washer

Benefits:

- Improve efficacy of cleaning process
- Reduce handling of sharp instruments
- Reduce risk of employee exposure

Follow manufacturer's recommendations:

- Dilution
- Temperature
- Water hardness
- Use

After cleaning, rinse with water

Knowledge Check

Which of the following statements is true?

A. Manual cleaning of objects is safer than automated cleaning

✓ B. Pre-cleaning is the most important factor in reprocessing objects

C. Objects do not need to be pre-cleaned if they are going to be sterilized

D. Household dishwashers can be used for pre-cleaning of instruments.

Methods Used for Disinfection and Sterilization

Spaulding Classification

Spaulding Classification of Surfaces:

Critical – Objects which enter normally sterile tissue or the vascular system and require sterilization

Semi-critical – Objects that contact mucous membranes or non-intact skin and require high-level disinfection, which kills all but high-levels of bacterial spores

Non-critical – Objects that contact intact skin but not mucous membranes, and require low-level disinfection

Processing Critical Instruments

- **Critical** Items:
  - Penetrate or enter normally sterile tissue or spaces, including the vascular system (Surgical instruments, cardiac catheters, IV devices, urinary catheters)
  - High risk of transmitting infection if handled improperly
  - Must be sterilized between uses or used as single-use disposable devices

Critical

Goal: Sterility = devoid of all microbial life

Processing Critical Instruments

Four activities involved in the sterilization and disinfection of critical objects

- Sterilization/Disinfection
  (Steam, dry heat, liquid chemical)
- Monitoring
- Packaging
  (Wrapping, record keeping, loading)
- Storage

Critical

Sterilization

- Steam sterilization *(most common in dental setting)*
- Hydrogen peroxide gas plasma
  - Ethylene oxide
  - Ozone
- Vaporized hydrogen peroxide
  - Steam formaldehyde

- *high temperature*
- *low temperature*

Steam Sterilization

Advantages

- Non-toxic
- Cycle easy to control and monitor
- Inexpensive
- Rapidly microbicidal
- Rapid cycle time
- Least affected by organic/inorganic soils
- Penetrates medical packing, device lumens

Steam Sterilization

Disadvantages

- Deleterious for heat labile instruments
- Inappropriate for heat-sensitive instruments
- Inappropriate for moisture-sensitive instruments
- Dulling
- Rusting
- Potential for burns

Steam Sterilization

Steam under pressure (autoclaving)

- Gravity displacement:
  - Exposure: 30 minutes
  - Temperature: 121oC
- Pre-vacuum:
  - Exposure: 4 minutes
  - Temperature: 132oC

2 types of steam sterilization

Steam Sterilization

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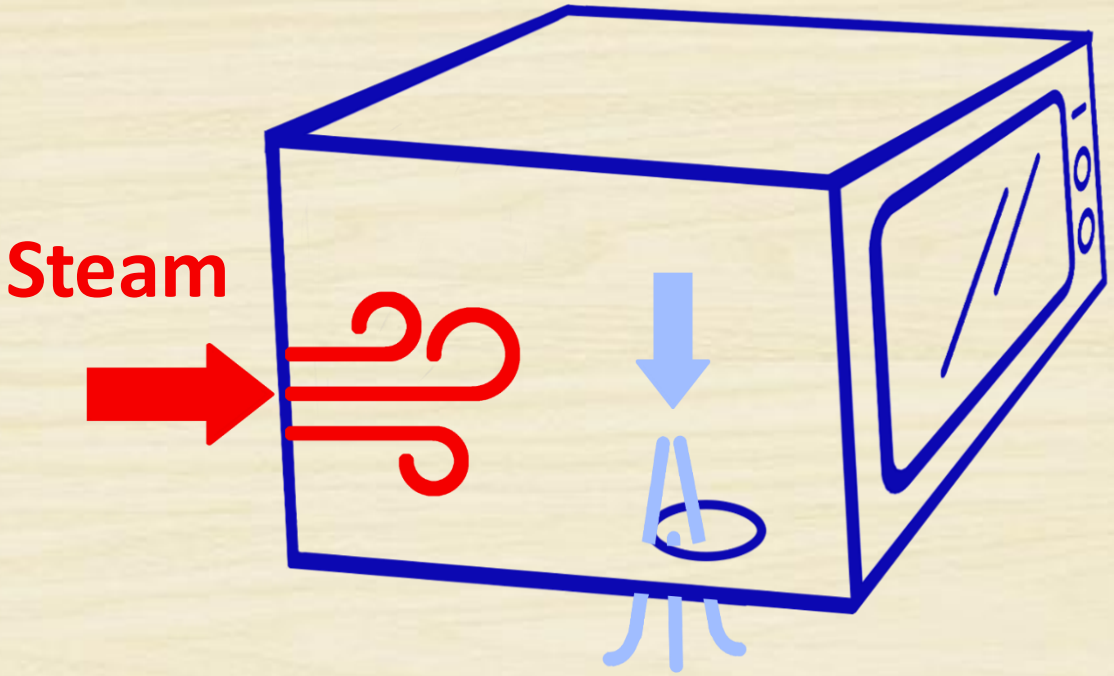
2 types of steam sterilization



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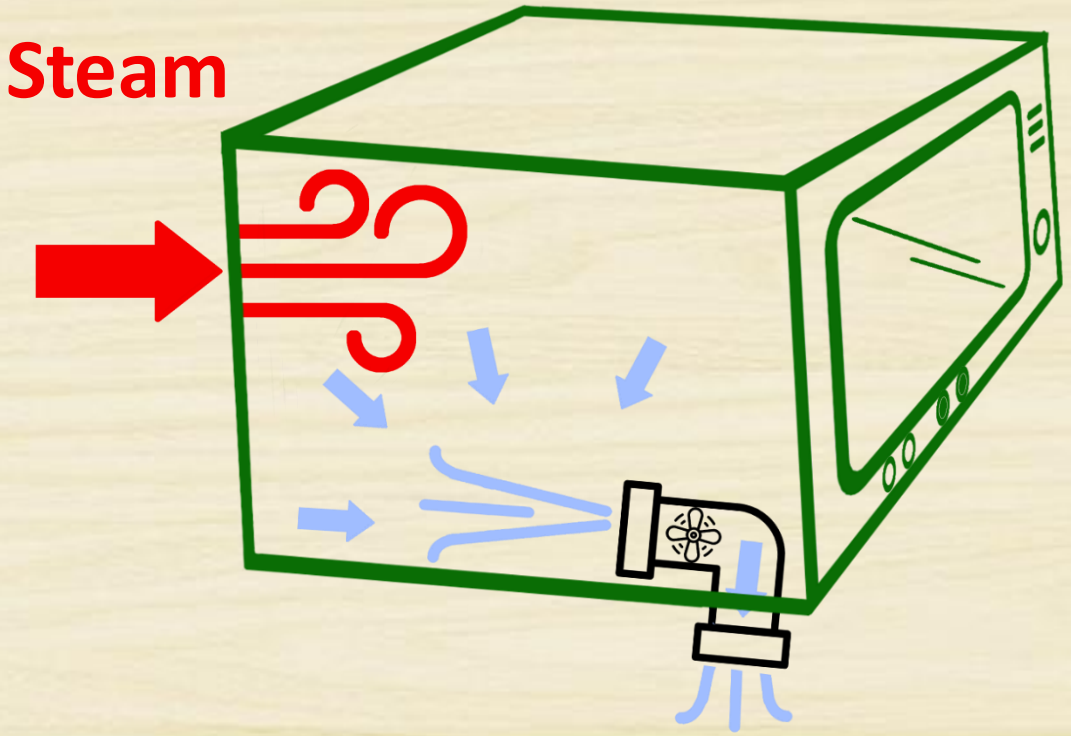
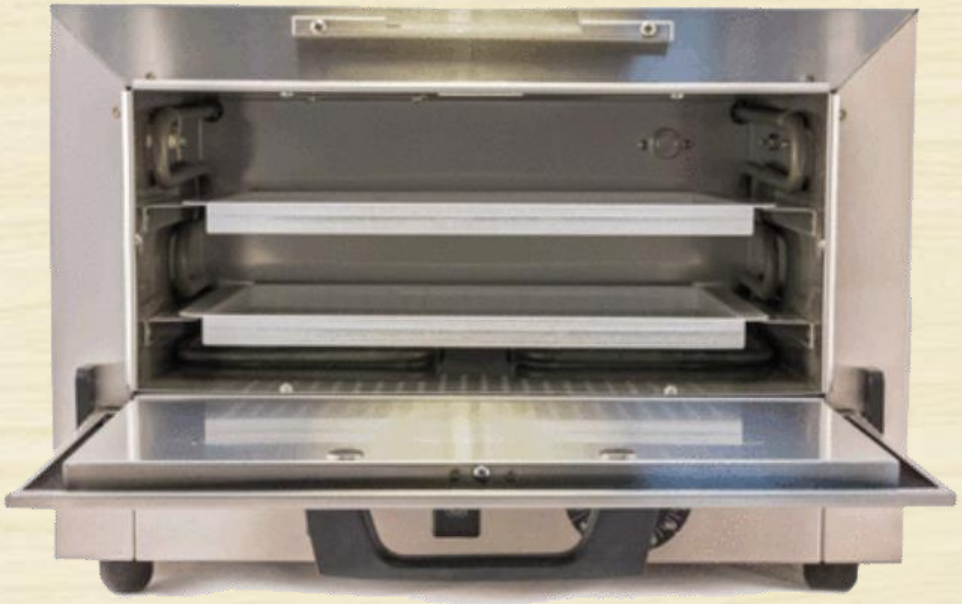
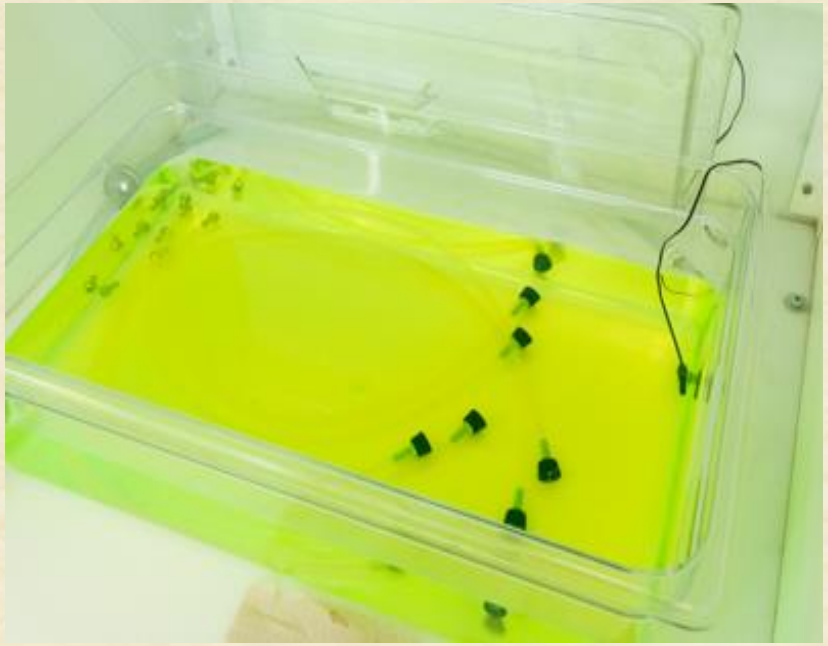


Dry Heat Sterilization

- Transfers heat energy from air inside the oven to the instruments
- Requires higher temperatures
- Good for items that are likely to dull or rust in the autoclave,
- Good for powders, cellulose and ink
- Packaging must be able to withstand high temperatures



Liquid Chemical Sterilants/Disinfectants



- Only for heat-sensitive critical and semi-critical devices
- Exposure can be harmful to providers and patients
- Can not be stored
- Heat tolerant or disposable alternatives are available

Sterilization Review

- Steam is preferred for critical items not damaged by heat
- Follow the operating parameters recommended by the manufacturer
- Use low temperature sterilization technologies for reprocessing critical items damaged by heat
- Items immersed in chemo-sterilizer solutions should be used immediately

Knowledge Check

Patient care equipment and devices should be disinfected/sterilized based on:

1. Items intended use
2. What the item is going to come in contact with
3. The number of patients you have scheduled for the day
4. What the dental provider tells you to do

Choose

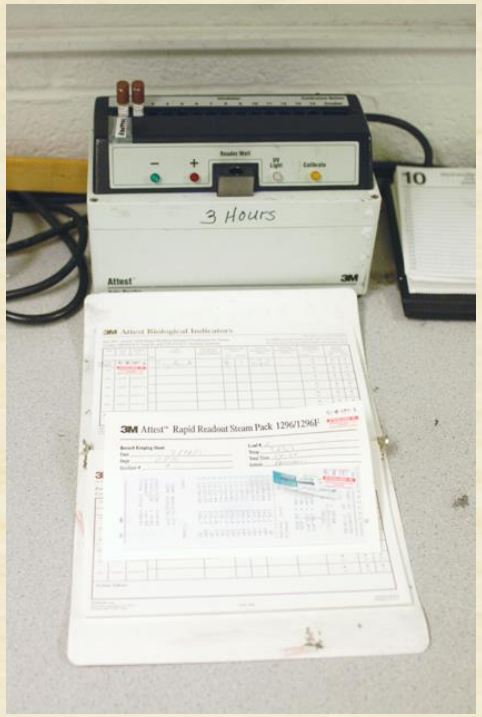
A. 1 and 4

B. 2 and 4

✓ C. 1 and 2

D. 3 and 4

Monitoring



- Centers for Medicare and Medicaid Services (CMS)
- 10A NCAC 41.0206 (NC Rule .0206
- The Joint Commission (TJC)

Sterilization Monitoring

Sterilization monitored routinely by combination of physical, chemical, and biological parameters

- Physical - cycle time, temperature, pressure
- Chemical - heat or chemical sensitive inks that change color when germicidal-related parameters reached
- Biological - Bacillus spores that directly measure sterilization

Monitoring

Sterilization Monitoring

Sterilization monitored routinely by combination of physical, chemical, and biological parameters

- Physical - cycle time, temperature, pressure
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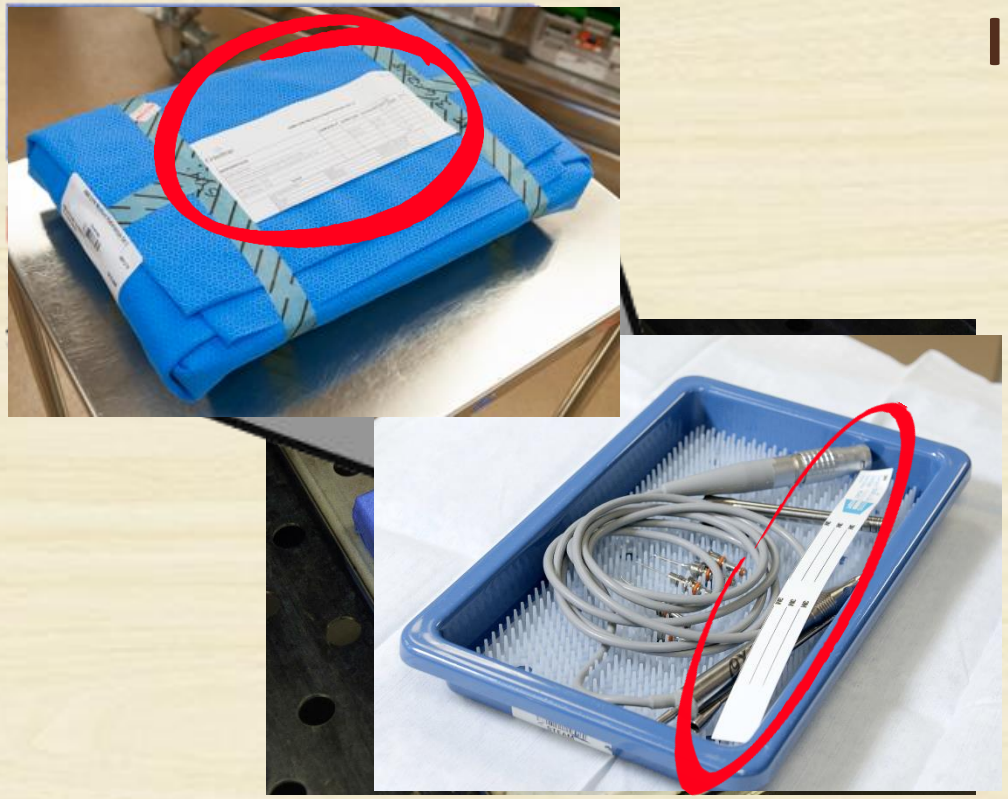
Monitoring

Monitoring Of Sterilizers



Internal Chemical Indicator

- Validates the sterilant penetrated the pack or tray
- Advantage of the pack control monitor is that it is inside each pack in multiple locations
- Detect local problem

Monitoring Of Sterilizers

Biological Monitors

- Steam
  Geobacillus stearothermophilus
- Dry heat
  B. atrophaeus (formerly B. subtilis)
- Ethylene oxide (ETO)
  B. atrophaeus

Monitoring of Sterilizers

IF biological indicator is positive (after sterilization cycle)

Follow CDC and AORN procedures

Monitoring of Sterilizers

Steam sterilization

=

After single

Next test

- Remove
- Retest
- Recall implantable items
- Return to service

Monitoring of Sterilizers

Steam sterilization

=

Next test

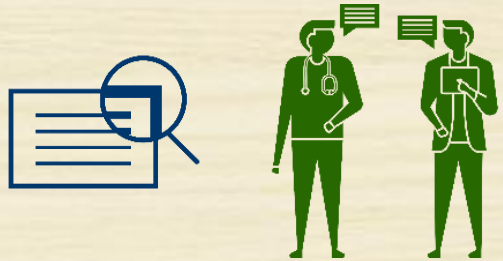
- Do not use until inspected
- Run 3X
- Reprocess
- Recall items if still positive
- Defective procedures possible

Monitoring of Sterilizers

Steam sterilization

If patient care items were used before retrieval, the infection preventionist should assess the risk of infection in collaboration with the physician, and if needed, consult an outside reprocessing specialist.

If item was used



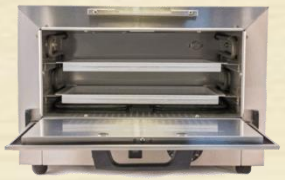
Assess risk

Monitoring of Sterilizers

Steam sterilization

There is a minimal risk associated with items in a load that show spore growth, especially if the item was properly cleaned and the time, temperature and pressure was achieved (as demonstrated by a chemical indicator and monitoring documentation).

Monitoring of Sterilizers



Other Sterilization Methods

After single

- Treat as non-sterile all items that have been processed in that sterilizer, dating from the last sterilization cycle in which there was a negative biological indicator.
- Retrieve the items and reprocess.

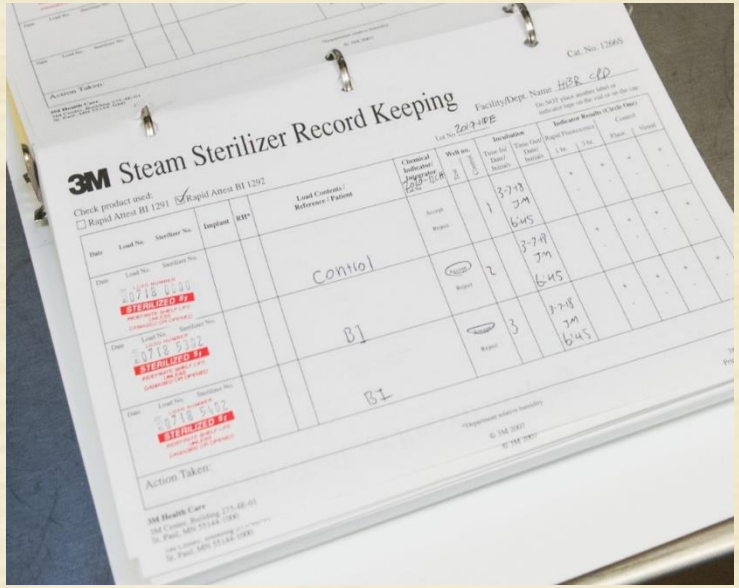
Monitoring Review

- Monitor each load with physical and chemical (internal and external) indicators.
- Use biological indicators to monitor effectiveness of sterilizers at least weekly with spores intended for the type of sterilizer.
- Use biological indicators for every load containing implantable items
- Policy for management of positive BI indicator

Record-Keeping

Maintain sterilization records (physical, chemical and biological) for each sterilization cycle record

- the type of sterilizer and cycle used
- the load identification number
- the load contents
- the exposure parameters (time and temperature)
- the operator's name or initials
- the results of physical, chemical, and biological monitoring

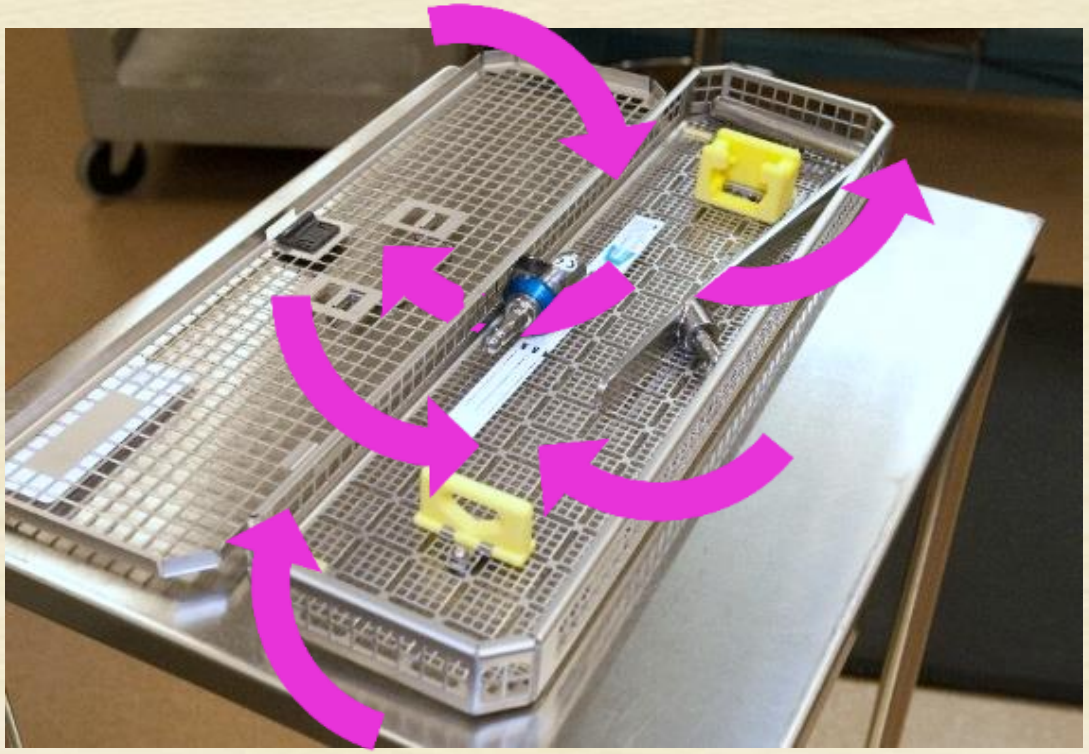


Packaging

Packaging

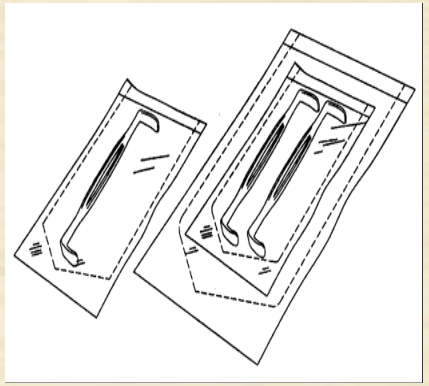
Packaging

Loading



Loading

- Place items/packages correctly and loosely into the sterilizer so as not to impede penetration of the sterilant
- Peel packs and non-perforated containers should be placed on their edge
- Peel packs:
  - Be used, filled and opened according to the pouch manufacturer's instructions
  - Be of a size and strength to accommodate the item being packaged
  - Be closed so that all pouch seals are smooth (i.e., without folds, bubbles or wrinkles)
  - Be written only on the non-porous side of the pouch



Packaging

Consult manufacturer's recommendations

Summary Methods

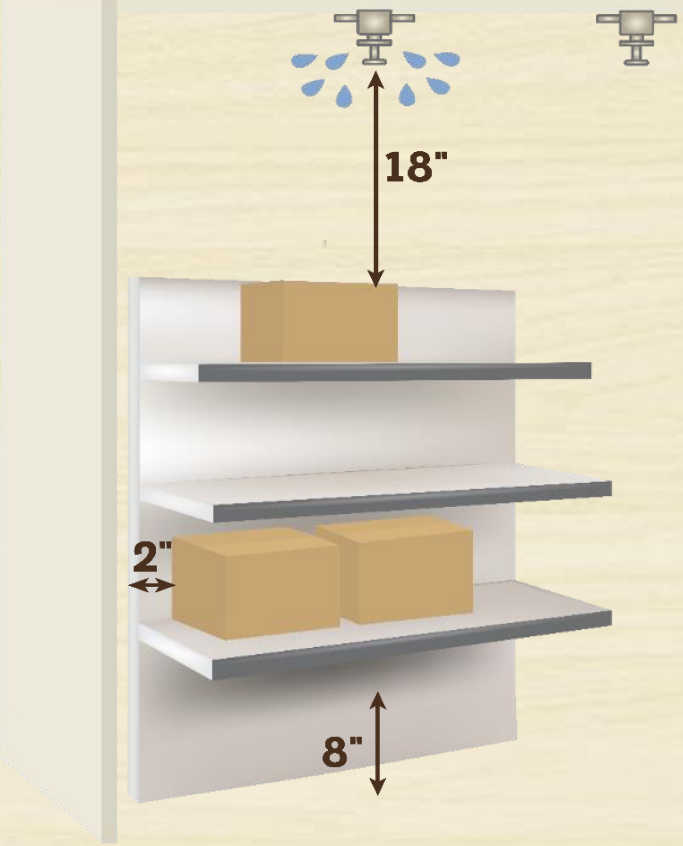
- Steam is preferred for critical (and semi-critical) items not damaged by heat
- Always follow manufacturer's operating instructions
- Use an "FDA cleared" container, wrapping or packaging system that is compatible with the type of sterilization process used
- Do not overload the chamber

Storage Of Sterile Items

Ensure the sterile storage area is a well-ventilated area that provides protection against dust, moisture, and temperature and humidity extremes.

Sterile items should be stored so that packaging is not compromised.

Label sterilized items with a load number that indicates the sterilizer used, the cycle or load number, the date of sterilization, and if applicable the expiration date.



Storage

Storage Of Sterile Items

Shelf life =

Storage

Storage Of Sterile Items

Shelf life =




- **Event-related** shelf life recognizes that the product remains sterile until an event causes it to become contaminated (e.g. moisture).
- Packages should be evaluated before use for loss of integrity. Repack and reprocess if compromised.
- If **time related** storage of sterile items is used, label the pack at the time of sterilization with an expiration date. Once this date expires, reprocess the pack.

Storage

General Guidelines

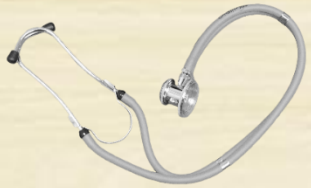
- All patient care items must be stored at least 8” off the floor
- Open rack storage should have a bottom shelf (plexi-glass for example)
- Stored at least 18” below the ceiling or the sprinkler head (according to fire code)
- Stored at least 2” inches from outside wall
- Items should be stored in areas of limited traffic
- Stored in an area with controlled temperature and humidity
- Outside shipping containers and corrugated cartons should not be used as storage containers
- Items should not be stored under sinks or exposed water/sewer pipes
- Windowsills should be avoided
- Closed or covered cabinets are preferred

Spaulding Classification

Spaulding Classification of Surfaces:

Critical – Objects which enter normally sterile tissue or the vascular system and require sterilization

Semi-critical – Objects that contact mucous membranes or non-intact skin and require high-level disinfection, which kills all but high-levels of bacterial spores



Non-critical – Objects that contact intact skin but not mucous membranes, and require low-level disinfection

Semi-critical

Semi-critical Instruments

- **Semi-Critical** Items:
  - Contact mucous membranes or non-intact skin (mouth mirrors, cheek retractors, **hand pieces**,*reusable dental impression trays and amalgam condensers)
  - Risk of transmitting infection if handled improperly
  - CDC notes because most semi critical items used in dentistry are heat-tolerant, they also should be sterilized by using heat
  - If heat sensitive item should at a minimum be processed using high-level disinfection or used as single-use disposable devices

Semi-critical

Goal: High-level disinfection = free of all microorganisms except high numbers of bacterial spores

Semi-critical Instruments

- **Semi-Critical** Items:

hand pieces*

*Although dental handpieces are “by definition” considered a semi-critical item, they should always be heat-sterilized between uses

High-level Disinfectants

Germicide	Concentration
Glutaraldhyde (Cidex)	≥ 2.0%
Ortho-phthaladehyde (Cidex OPA)	0.55%
Hydrogen Peroxide* (Sporox)	7.5%
Hydrogen Peroxide and peracetic acid* (Peract)	1.0% / 0.08%
Hydrogen Peroxide and peracetic acid* (Endospore +)	7.5% / 0.23%
Hypochlorite (free chlorine)* (Sterilox ©)	650-675 ppm
Accelerated hydrogen peroxide (Resert XL)	2.0%
Peracetic Acid (Steris 20)	0.2%
Glutaraldehyde and Isopropanol (Aldahol III)	3.4% / 26%
Glutaraldehyde and phenol/phenate (Sporicidin)	1.21% / 1.93%

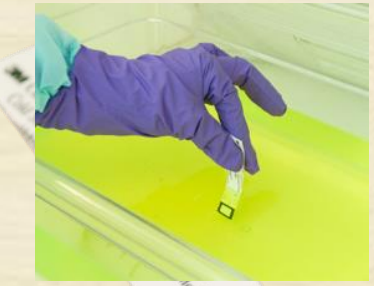
Semi-critical

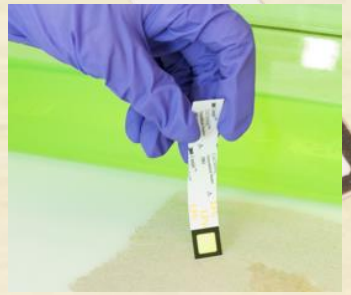
Exposure time ≥8 -45 min (US) and temperature 20-25°C;
*May cause cosmetic and functional damage

Processing Semi-critical Instruments

Manufacturer's instructions for dilution and quality control testing must be followed.

- Submerge the test strip into the solution prior to each use to monitor minimum effective concentration (MEC)
- Remove excess by standing upright on paper towel
- Read results according to manufacturer's instructions *(recommended time period and change in color of the test strip)*
- Document findings





Semi-critical

Must use correct test strip for solution!

Spaulding Classification

Spaulding Classification of Surfaces:

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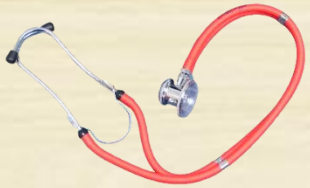


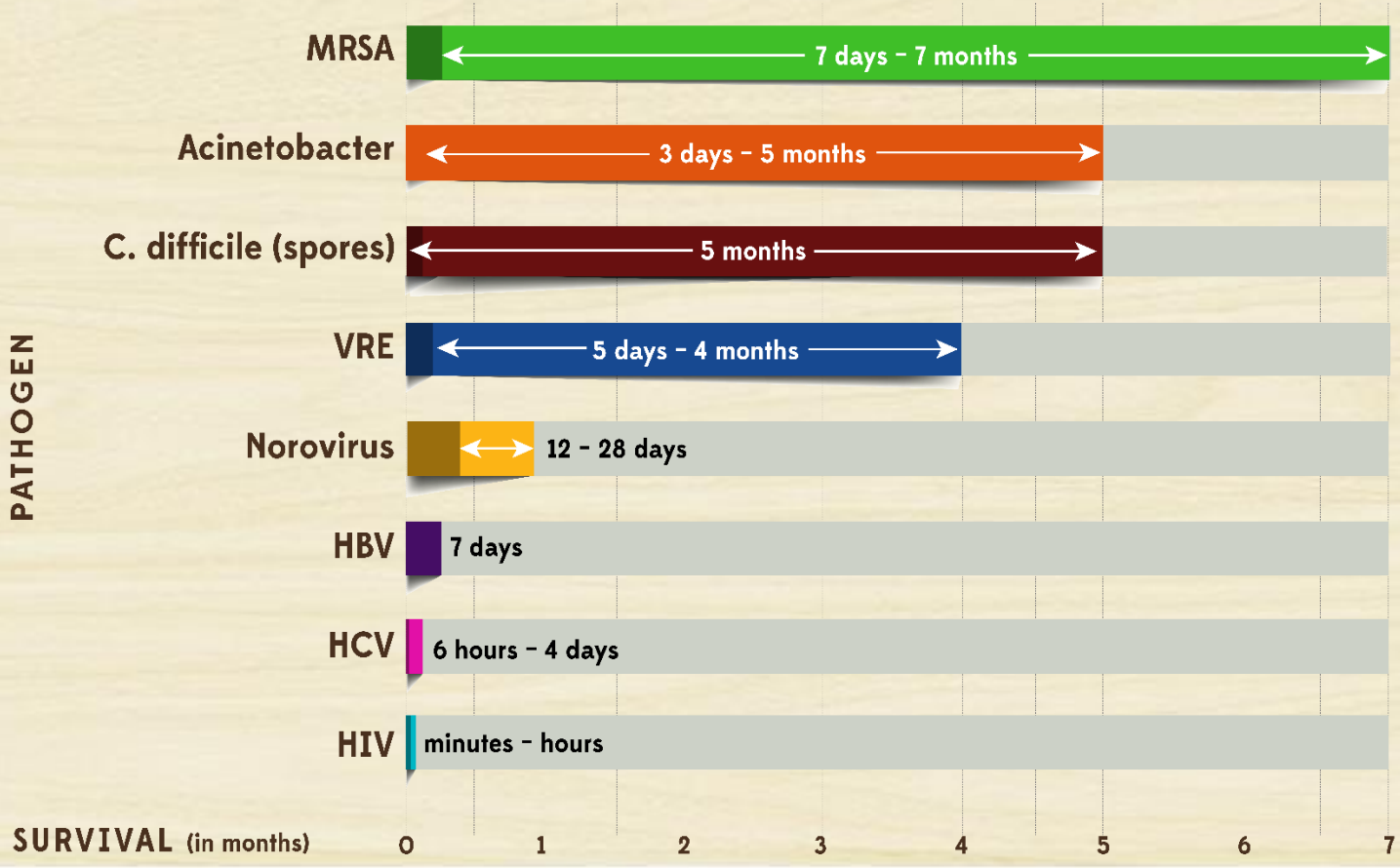
Non-critical – Objects that contact intact skin but not mucous membranes, and require low-level disinfection

Non-critical

Non-critical Instruments

- **Non-Critical** Items:
  - Objects that contact intact skin but not mucous membranes (BP cuffs, counter tops, exam chairs)
  - Minimal risk of transmitting infection if handled improperly
  - Must be low-level disinfected on a routine basis

Role of the Environment



Survival of Pathogens

Non-critical

Liquid Disinfectants

Disinfectant Agent	Use Concentration
Ethyl or isopropyl alcohol	70% - 90%
Chlorine (bleach)	100 ppm
Phenolic	UD
Iodophor	UD
Quaternary ammonium compound (QUAT)	UD
Improved/Accelerated hydrogen peroxide	0.5%, 1.4%

Non-critical

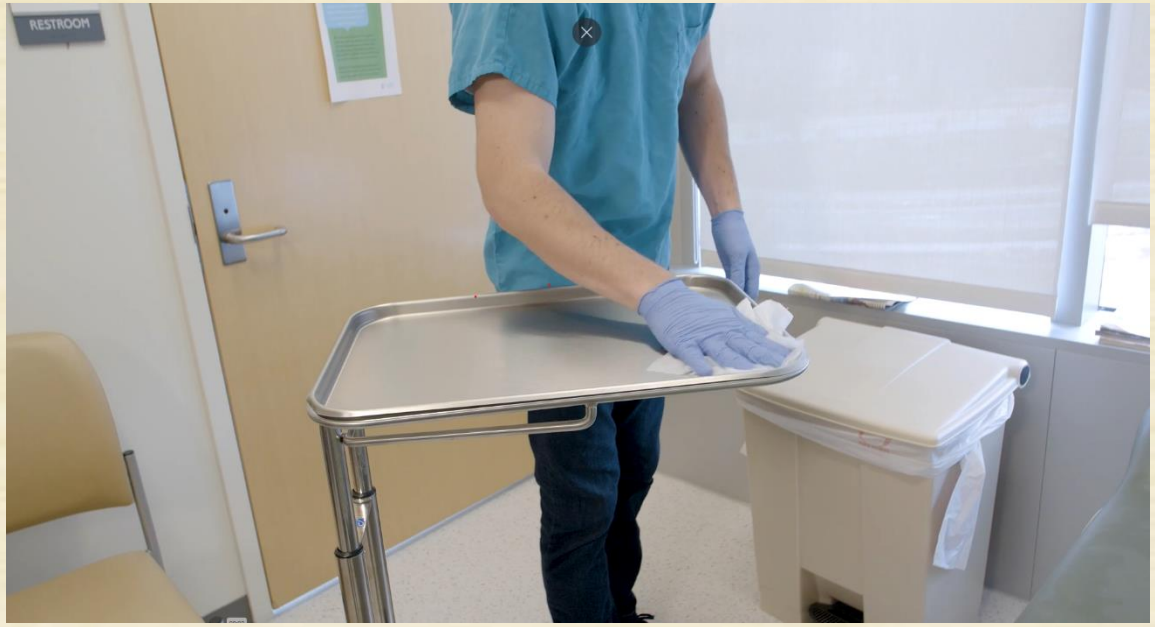
UD = Manufacturer's recommended use dilution

Properties of an Ideal Disinfectant

- Broad Spectrum
- Fast Acting
- Non-Toxic
- Surface Compatibility
- Easy to Use
- Acceptable odor
- Economical

Non-critical

Other Environmental Issues



Use appropriate PPE

Other Environmental Issues

Blood and Body Fluid Spills

- Contaminated work surfaces shall be decontaminated with an appropriate disinfectant
  - After completion of procedures
  - Immediately or as soon as feasible when surfaces are overtly contaminated
  - After any spill of blood or other potentially infectious materials
  - At the end of the work shift if the surface may have become contaminated since the last cleaning
- When there are large spills of blood and/or body fluids it is important to clean or remove the spill prior to disinfecting the area
  - The first step is to clean and decontaminate the area promptly.
  - If the spill contains large amounts of blood or body fluids, clean the visible matter with disposable absorbent material, and discard the contaminated materials in appropriate, labeled container (treat as OSHA regulated medical waste)
  - Use EPA-registered disinfectants labeled tuberculocidal or EPA registered germicides with specific label claims for HIV or hepatitis B virus (HBV) in accordance with label instructions to decontaminate spills of blood and other body fluids

Use appropriate PPE

Knowledge Check

Contaminated reusable items should be:

1. Handled as little as possible
2. Placed in a bio-hazard labeled container and left in room until end of the workday
3. Pre-cleaned in sink in the exam room
4. Transported immediately after use and not left in the patient care area

Choose

A. 1 and 3
B. 3 and 4
C. 1 and 4 ✓
D. 1, 2, 3, 4

Training and Quality Control

Provide comprehensive and intensive training for all staff assigned to reprocess medical/surgical instruments

To achieve and maintain competency:

- Staff receive hands-on training
- Work with supervision until competency is documented
- Competency testing should be conducted at commencement of employment and no less than annually
- Training and competencies should be documented

Training and Quality Control

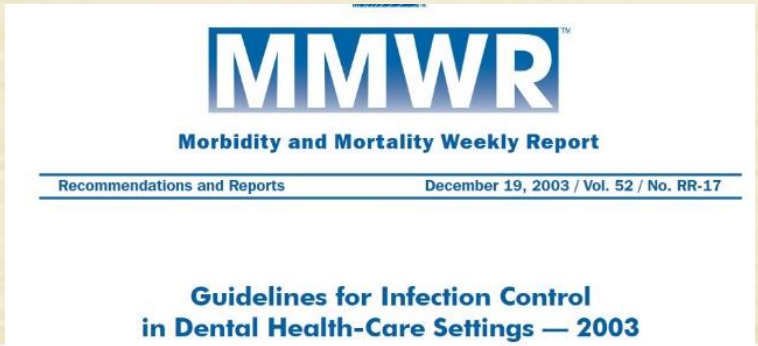
- Conduct monitoring/observations of process measures such as hand hygiene, use of PPE, environmental cleaning and disinfection sterilization
- Ensure all products used for disinfection and/or sterilization have been approved by infection prevention
- Follow manufacturer instructions for use (IFUs)for preparation and packing of items

Additional Resources

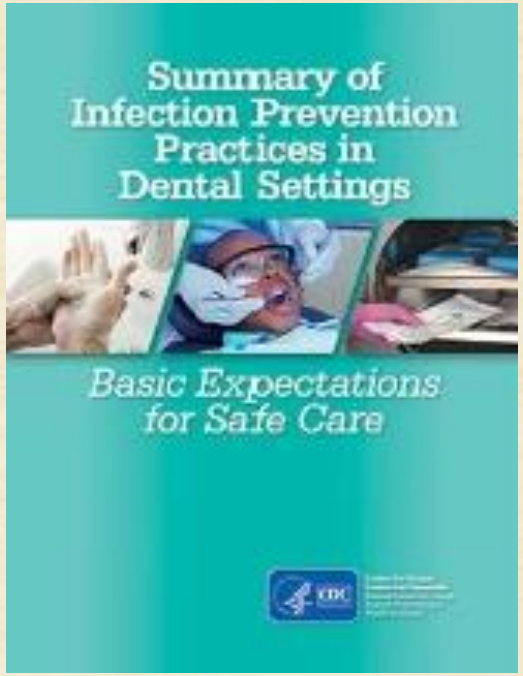
Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008

William A. Rutala, Ph.D., M.P.H.[1,2], David J. Weber, M.D., M.P.H.[1,2], and the Healthcare Infection Control Practices Advisory Committee (HICPAC)[3]

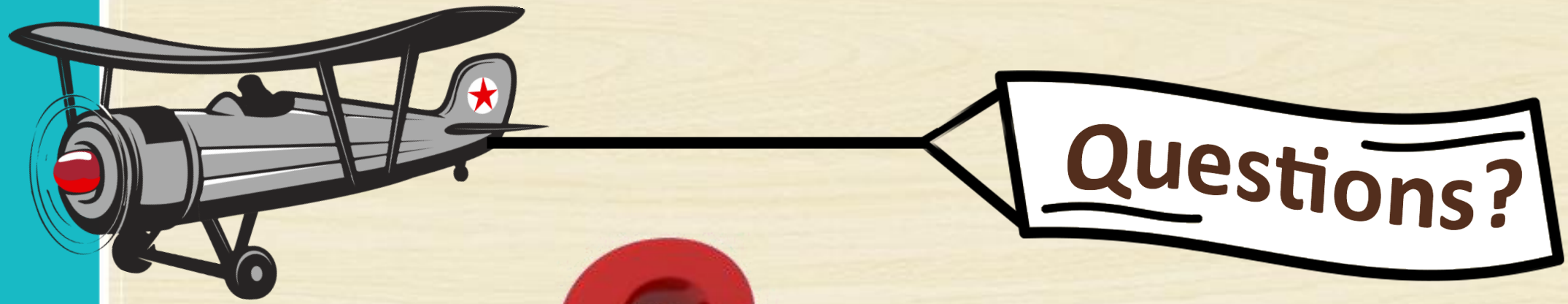
https://www.cdc.gov/infectioncontrol/pdf/guidelines/disinfection-guidelines.pdf



https://www.cdc.gov/mmwr/PDF/rr/rr5217.pdf



https://www.cdc.gov/oralhealth/infectioncontrol/pdf/safe-are2.pdf


Questions?