Disinfection and Sterilization
Current Issues, New Research and New Technology

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Former Director, Hospital Epidemiology, Occupational Health and
Safety, UNC Health Care, Chapel Hill, NC (1979-2017)

• Outpatient surgery/procedures
• Biofilms on instruments and environmental surfaces
• Sporicide in all discharge rooms
• Continuous room decontamination technologies
  ■ Visible light disinfection through LEDs
  ■ Low concentration hydrogen peroxide
  ■ Continuously active disinfectant
• DS of prion contaminated medical/surgical instruments
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US Outpatient Surgery/Procedures Passes Inpatient Surgery/Procedure
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- Knees repaired, tonsils removed, gall bladder, mastectomies do not require hospital stay
- Fueled by medical advances, minimally invasive procedures, better anesthesia, more effective drugs to manage pain
- Reduce costs (labor, overhead and maintenance costs)

Outpatient vs Inpatient Surgery/Procedure
2010, US DHHS

Top 10 Outpatient Surg/Proc-53M
- Lens and cataract procedures-7M
- Endoscopy of large intestine-5.7M
- Endoscopy of small intestine-3.4M
- Therapeutic injections-1.4M
- Coronary artery exam-1M
- Knee arthroscopy-~1M
- Hernia repair-~1M
- Tonsillectomy/adenoidectomy-750K
- Cystoscopy-750K

Top 10 Inpatient Surg/Proc-46M
- Coronary artery exam-1M
- C-section 1.3M
- Cardiac cath-1.1M
- Endoscopy of small intestine-1M
- Diagnostic ultrasound-~900K
- CAT scans-740K
- Realign broken bone-672K
- Balloon angioplasty of coronary-661K
- Coronary artery stent-661K
EH Spaulding believed that how an object will be disinfected depended on the object’s intended use (developed 1968).

CRITICAL-medical/surgical devices which enter normally sterile tissue or the vascular system or through which blood flows should be sterile.

SEMICRITICAL-medical devices that touch mucous membranes or skin that is not intact require a disinfection process (high-level disinfection [HLD]) that kills all microorganisms but high numbers of bacterial spores.

NONCRITICAL-medical devices that touch only intact skin require low-level disinfection.

Health Care Facilities Need to Immediately Medical Device Reprocessing Procedures
Train Staff, Audit Adherence to Steps, Provide Feedback on Adherence

Immediate Need for Healthcare Facilities to Review Procedures for Cleaning, Disinfecting, and Sterilizing Reusable Medical Devices

This is an official
CDC HEALTH ADVISORY

Distributed via the CDC Health Alert Network
September 13, 2015, 12:15 EDT (12:15 PM EDT)
CDC/HAN-00382

Summary
The Centers for Disease Control and Prevention (CDC) and U.S. Food and Drug Administration (FDA) are alerting healthcare providers and facilities about the public health need to properly maintain, clean, and disinfect or sterilize reusable medical devices. Recent infection control lapses due to non-compliance with recommended reprocessing procedures highlight a critical gap in patient safety. Healthcare facilities (e.g., hospitals, ambulatory surgical centers, clinics, and doctors’ offices) that utilize reusable medical devices are urged to immediately review current reprocessing practices at their facility to ensure they (1) are complying with all steps as directed by the device manufacturer, and (2) have in place appropriate policies and procedures that are consistent with current standards and guidelines.

Background
Recent media reports describe instances of patients being notified that they may be at increased risk for infection due to lapses in basic cleaning, disinfection, and sterilization of medical devices. These events involved failures to follow manufacturers’ reprocessing instructions for critical and semi-critical items and highlight the need for healthcare facilities to review policies and procedures that protect patients.

Recommendations
Healthcare facilities should arrange for a healthcare professional with expertise in device reprocessing to immediately assess their reprocessing procedures. This assessment should ensure that reprocessing is done correctly, including allowing enough time for reprocessing personnel to follow all steps recommended by the device manufacturer. The following actions should be performed:

Training
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Biofilms on Instruments and Environmental Surfaces
Alfa, AJIC 2019;47:A39-A45

- Three types of biofilm
  - Traditional hydrated biofilm (water content 90%)
  - Build-up biofilm—occurs in endoscope channels
  - Dry surface biofilm—heterogenous accumulation of organisms and other material in a dry matrix (water content 61%)
  
  - Raises questions about the inactivation of microbes with a dry surface biofilm by currently used cleaning/disinfecting methods
Dry Biofilms on Healthcare Surfaces
Examples of “Dry” Biofilms Recovered from Surfaces
Ledwoch et al. J Hosp Infect 2018;100:e47-e56
Dry Biofilms Containing Bacterial Pathogens on Multiple Healthcare Surfaces
Ledwoch et al. J Hosp Infect 2018;100:e47-e56

- Investigate the occurrence, prevalence and diversity of dry biofilms on hospital surfaces
- 61 terminally cleaned rooms were investigated for the dry biofilms using culture-based methods and SEM
- Multi-species dry biofilms were recovered from 95% of 61 samples
- Dry biofilms were predominately formed by gram-positive bacteria, although occasional *Acinetobacter spp* were identified
- Their role in transmission needs to be established

Dry Biofilms on Healthcare Surfaces
Difference in “Dry” Biofilm Composition Between Hospitals
Ledwoch et al. J Hosp Infect 2018;100:e47-e56

![Graph showing dry biofilm composition between hospitals](image-url)
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Asymptomatic carriers contribute to C. difficile transmission

1. Curry SR. Clin Infect Dis 2013 (29% of hospital-associated CDI cases linked to carriers by MLVA); 2. Blixt T. Gastroenterol 2017;152:1031 (exposure to carriers increased CDI risk); 3. Longtin Y. JAMA Int Med 2016 (screening for and isolating carriers reduced CDI by 63%); 4. Samore MH. Am J Med 1996;100:32 (only 1% of cases linked to asymptomatic carriers - roommates and adjacent rooms - by PFGE/REA); 5. Eyre DW. PLOS One 2013;8:e78445 (18 carriers: no links to subsequent CDI cases); 6. Lisenmyer K. Clin Infect Dis 2018 (screening and isolation of carriers associated with control of a ward outbreak); 7. Paquet-Bolduc B. Clin Infect Dis 2018 (unit-wide screening and isolation of carriers not associated with shorter outbreak durations vs historical controls); 8. Donskey CJ. Infect Control Hosp Epidemiol 2018 (14% of healthcare-associated CDI cases linked to LTCF asymptomatic carriers); 9. Kong IY. Clin Infect Dis 2018 (23% of healthcare-associated CDI linked to carriers vs 42% to CDI
Interventions focused on CDI rooms

- CDI rooms
- Sporicidal disinfection only in CDI rooms
- Non-CDI rooms


Interventions addressing CDI cases and asymptomatic carriers

- Sporicidal disinfection in CDI and non-CDI rooms
Use of Sporicidal Disinfectant on *C. difficile* spore Contamination in non-*C. difficile* Infection Rooms

Wong et al. AJIC. 2019:47:843-845

The percentage of rooms contaminated with *C. difficile* was significantly reduced during the period with a sporicidal product was used 5% vs 24%. Results suggest sporicidal disinfectant in all postdischarge rooms could potentially be beneficial in reducing the risk for *C. difficile* transmission from contaminated surfaces.

![Graphs showing contamination rates](image)

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To reduce microbial contamination

Continuous Room Decontamination Technology
Hygienically clean (not sterile)-free of pathogens in sufficient numbers to prevent human disease

Continuous Room Decontamination Technology

- Advantages
  - Allows continued disinfection (may eliminate the problem of recontamination)
  - Patients, staff and visitors can remain in the room
  - Does not require an ongoing behavior change or education of personnel
  - Self-sustaining once in place
  - Once purchased might have low maintenance cost
  - Technology does not give rise to health or safety concerns
  - No (limited) consumable products
Continuous Room Decontamination Technology

• Disadvantages
  ■ Room decontamination/biocidal activity is slow
  ■ Capital equipment costs are substantial
  ■ Does not remove dust, dirt, stains that are important to patients and visitors
  ■ Studies have not shown whether the use will decrease HAIs

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Antimicrobial Activity of a Continuous Visible Light Disinfection System

• Visible Light Disinfection uses the blue-violet range of visible light in the 400-450nm region generated through light-emitting diodes (LEDs)

• Initiates a photoreaction with endogenous porphyrin found in microorganisms which yield production of reactive oxygen species inside microorganisms, leading to microbial death

• Overhead illumination systems can be replaced with Visible Light Disinfection counterparts
Visible Light Disinfection in a Patient Room
(automatic switching between modes performed by wall-mounted controls)

White light

Blue light—increase irradiance, increase

Inactivation of Health Pathogens by Continuous Visible Light Disinfection
Rutala et al. ICHE 2018;39:1250-1253

- The treatment (i.e. both “blue” and “white” light) had significantly different rates over time for all four organisms
- Both light treatments were associated with more rapid decreases in observed bacterial counts over time with all four organism
- Overall, the model demonstrated improved inactivation of pathogens with the “blue” and “white” light
Time to Specified Percent Reduction of Epidemiologically-Important Pathogens with “Blue” and “White” Light
Rutala et al. ICHE 2018;39:1250-1253

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Treatment (light)</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>White</td>
<td>5</td>
<td>10</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>VRE</td>
<td>White</td>
<td>13</td>
<td>29</td>
<td>51</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>2</td>
<td>5</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>MDR-Acinetobacter</td>
<td>White</td>
<td>2</td>
<td>5</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>C. difficile</td>
<td>White</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>56</td>
<td>68</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Continuous Room Decontamination Technologies for Disinfection of the Healthcare Environment

- Visible light disinfection through LEDs
- Low concentration hydrogen peroxide
- Self-disinfecting surfaces
- Continuously active disinfectant (CAD) or persistent disinfectant that provides continuous disinfection action
  - Allows continued disinfection (may eliminate the problem of recontamination)
  - Patients, staff and visitors can remain in the room
Dilute Hydrogen Peroxide Technology

UV activates the catalyst which creates H ion and hydroxyl radical and free electron, hydroxyl radicals removed from catalyst and combine to form HP; also H₂ and O₂ and electron make HP

Application of Dilute Hydrogen Peroxide Gas Technology for Continuous Room Decontamination

Rutala et al. ICHE 2019

- DHP units were installed in the ceilings of a model room and the hallway in front of the room per manufacturer’s installation specifications, and the door closed
- We tested three test bacteria: MRSA, VRE and MDR *Acinetobacter*
- An estimated 100-500 CFU for each test organism was inoculated and spread separately on each Formica sheet then exposed to DHP gas released into
Application of Dilute Hydrogen Peroxide Gas Technology for Continuous Room Decontamination
Rutala et al. ICHE. 2019

- There was no statistical differences in survival between DHP and control groups except very few time points
- The DHP units did not generate a germicidal concentration of hydrogen peroxide gas
- Modifications will be required to maintain effective DHP levels for continuous room decontamination

Continuous Room Decontamination Technologies for Disinfection of the Healthcare Environment

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Test surface inoculated (10^5), treated with test disinfectant, allowed to dry.

Surface will undergo “wears” (abraded under alternating wet and dry conditions [24 passes, 12 cycles]) and 6 re-inoculations (10^3, 30min dry) over 24hr

At the end of the study and at least 24 hours later, the ability of the test surface to kill microbes (99.9%) within 5 min is measured using the last inoculation (10^6)
Efficacy of a Continuously Active Surface Disinfectant
Rutala WA, Gergen M, Sickbert-Bennett E, Anderson D, Weber D. ICHE, 2019

<table>
<thead>
<tr>
<th>Test Pathogen</th>
<th>Mean Log₁₀ Reduction, 95% CI n=4</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.aureus*</td>
<td>4.4 (3.9, 5.0)</td>
</tr>
<tr>
<td>S.aureus (Formica)</td>
<td>4.1 (3.8, 4.4)</td>
</tr>
<tr>
<td>S.aureus (stainless steel)</td>
<td>5.5 (5.2, 5.9)</td>
</tr>
<tr>
<td>VRE</td>
<td>≥4.5</td>
</tr>
<tr>
<td>E.coli</td>
<td>4.8 (4.6, 5.0)</td>
</tr>
<tr>
<td>Enterobacter sp.</td>
<td>4.1 (3.5, 4.6)</td>
</tr>
<tr>
<td>Candida auris</td>
<td>≥5.0</td>
</tr>
<tr>
<td>K pneumoniae</td>
<td>1.5 (1.4, 1.6)</td>
</tr>
<tr>
<td>CR E.coli</td>
<td>3.0 (2.6, 3.4)</td>
</tr>
<tr>
<td>CR Enterobacter</td>
<td>2.0 (1.6, 2.4)</td>
</tr>
<tr>
<td>CR K pneumoniae</td>
<td>2.1 (1.8, 2.4)</td>
</tr>
</tbody>
</table>

*Test surface glass unless otherwise specified

4-5 log₁₀ reduction in 5min over 24hr for most pathogens; ~99% reduction with Klebsiella and CR Enterobacter.

Comparison of CAD with Three Disinfectants Using EPA Method and S. aureus
Rutala WA, Gergen M, Sickbert-Bennett E, Anderson D, Weber D. ICHE 2019

<table>
<thead>
<tr>
<th>Test Disinfectant</th>
<th>Mean Log₁₀ Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuously Active Disinfectant</td>
<td>4.4</td>
</tr>
<tr>
<td>Quat-Alcohol</td>
<td>0.9</td>
</tr>
<tr>
<td>Improved hydrogen peroxide</td>
<td>0.2</td>
</tr>
<tr>
<td>Chlorine</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Efficacy of a Continuously Active Disinfectant

Summary

- Preliminary studies with a new continuously active disinfectant are promising (e.g., 4-5 log_{10} reduction in 5min over 24hr)
- Unclear why 99% reduction with *Klebsiella* and CR *Enterobacter* (another researcher [Donskey] found a 4 log_{10} reduction; most surfaces have <100 CFU/Rodac
- Continuously active disinfectants may reduce or eliminate the problem of recontamination.

Evaluation of Three Disinfectants for Ability to Limit Establishment of Bioburden After Disinfection


The CAD (disinfectant 1, red-24h sample) was able to significantly control bioburden on bed rails, a critical touch surface
Why do we need to consider continuous room decontamination technology?

To reduce microbial contamination
(associated with suboptimal CD practices and recontamination)

Evaluation of Three Disinfectants for Ability to Limit Establishment of Bioburden After Disinfection

• The use of a continuously active disinfectant (CAD) offers the infection prevention community a new opportunity to limit the re-establishment of bacteria on touch surfaces in the hospital environment

• Several studies (Salgado et al., Anderson et al, Rutala et al) were able to demonstrate that when the microbial bioburden of a patient room was kept low, the risk of acquisition of HAIs was reduced
### Environmental Disinfection in Health Care Facilities

**Recommendations**

- **Decontaminate surfaces in patient room** that are touched by health care workers and patients **(daily, terminal)**
- **Decontaminate portable equipment** that is shared among patients such as medication carts, wheelchairs, portable x-ray machines, etc. **after each patient use**
Environmental Disinfection in Health Care Facilities

- Environmental disinfection is suboptimal
  - Patient rooms are contaminated due to suboptimal cleaning/disinfection and recontamination
  - Portable equipment not decontaminated per policy
  - Outbreaks and environmental-mediated infections occur

Thoroughness of Environmental Cleaning

Carling et al. ECCMID, Milan, Italy, May 2011

Mean = 32%

>110,000 Objects
Portable Equipment
(decontaminate after each patient use)

Interactions Between Patients and Shared Portable Equipment
Suwantrat N, et al. AJIC 2017;45:1276

Of 360 interactions between portable equipment and patients, 42% involved equipment or fomites that made direct contact with the patient or surfaces in the room
Frequency of Recovery of Healthcare Pathogens from Portable Equipment
Suwantarat N, et al. AJIC 2017;45:1276

Of 80 items cultured, 12 (15%) were contaminated with ≥ 1 healthcare pathogen

<table>
<thead>
<tr>
<th>Portable equipment and fomites</th>
<th>MRSA</th>
<th>VRE</th>
<th>Clostridium difficile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication carts</td>
<td>2/31 (7)</td>
<td>1/31 (3)</td>
<td>1/31 (3)</td>
</tr>
<tr>
<td>Wheelchairs</td>
<td>1/12 (8)</td>
<td>0/12 (0)</td>
<td>0/12 (0)</td>
</tr>
<tr>
<td>ECG machines</td>
<td>1/8 (13)</td>
<td>1/8 (13)</td>
<td>0/8 (0)</td>
</tr>
<tr>
<td>Food trays</td>
<td>0/7 (0)</td>
<td>0/7 (0)</td>
<td>0/7 (0)</td>
</tr>
<tr>
<td>Laundry carts</td>
<td>3/5 (60)</td>
<td>2/5 (40)</td>
<td>1/5 (20)</td>
</tr>
<tr>
<td>Bladder scanners</td>
<td>0/3 (0)</td>
<td>2/3 (67)</td>
<td>0/3 (0)</td>
</tr>
<tr>
<td>Portable x-ray machines</td>
<td>1/3 (33)</td>
<td>0/3 (0)</td>
<td>0/3 (0)</td>
</tr>
<tr>
<td>Weight scales</td>
<td>0/3 (0)</td>
<td>0/3 (0)</td>
<td>0/3 (0)</td>
</tr>
<tr>
<td>Doppler ultrasound machines</td>
<td>0/2 (0)</td>
<td>0/2 (0)</td>
<td>0/2 (0)</td>
</tr>
<tr>
<td>Glucometers</td>
<td>0/2 (0)</td>
<td>0/2 (0)</td>
<td>0/2 (0)</td>
</tr>
<tr>
<td>Transfer gurneys</td>
<td>0/2 (0)</td>
<td>0/2 (0)</td>
<td>0/2 (0)</td>
</tr>
<tr>
<td>Vital sign machines</td>
<td>0/2 (0)</td>
<td>0/2 (0)</td>
<td>0/2 (0)</td>
</tr>
<tr>
<td>Total</td>
<td>8/80 (10)</td>
<td>6/80 (8)</td>
<td>2/80 (3)</td>
</tr>
</tbody>
</table>

NOTE. Values are the no. of positive samples/no. sampled (%).
ECG, electrocardiogram; MRSA, methicillin-resistant Staphylococcus aureus; VRE, vancomycin-resistant enterococci.

Environmental Disinfection in Healthcare Facilities

- Continuously active disinfectants reduces bioburden
- Whether a CAD translates in a reduction of HAIs remains to be determined
- Continuously active disinfectants should not alter the frequency of cleaning and disinfection as one of the purposes of routine cleaning and disinfection is to remove dirt and debris in addition to the reduction of microbial contamination
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Creutzfeldt Jakob Disease (CJD):
Disinfection and Sterilization
SHEA Prion Guideline

Guideline for Disinfection and Sterilization of Prion-Contaminated Medical Instruments

William A. Rutala, PhD, MPH; David J. Weber, MD, MPH

Epidemiology of the Creutzfeldt-Jakob Disease Prion

Creutzfeldt-Jakob disease (CJD) is a degenerative neurologic disorder of humans with an incidence in the United States of approximately 1 case per million population per year. Transmissions. To date, no evidence for transmission of chronic wasting disease of deer and elk to humans has been identified.

Transmission of CJD via Medical Devices

CJD
Transmissible Spongiform Encephalopathies (TSEs) of Humans

- Kuru—now eradicated
- Gertsmann-Straussler-Scheinker (GSS)-1/40M
- Fatal Familial Insomnia (FFI)-<1/40M
- Creutzfeldt-Jakob Disease (CJD)-1/1M
- Variant CJD (vCJD), (229 cases, August 2013) Acquired from consumption of cattle products with BSE agent, first cases in 1996: 177 UK, 27 France, 5 Spain, 4 Ireland and US, 3 Netherlands, 2 each from Portugal, Italy and Canada, and 1 each from Japan, Taiwan and Saudi Arabia

Epidemiology of CJD in the US

Rutala, Weber. ICHE 2010;31:107-117

- Degenerative neurologic disorder
- CJD (a prion) incidence
  - One death/million population
  - No seasonal distribution, no geographic aggregation
  - Both genders equally affected
  - Age range 50-80+ years, average 67
- Long incubation, rapid disease progression after onset
- Prions resistant to conventional disinfection/sterilization
Prion Diseases
Rutala, Weber. ICHE 2010;31:107-117

• Etiology
  ■ Prions (proteinaceous infectious agent)
    ◆ No agent-specific nucleic acid
    ◆ Host protein (PrP<sup>c</sup>) converts to pathologic isoform (PrP<sup>sc</sup>); PrP
      gene resides on chromosome 20
    ◆ Mutation in this gene may trigger transformation
    ◆ Accumulates in neural cells, disrupts function, cell death
    ◆ Resistant to conventional D/S procedures

Decreasing Order of Resistance of Microorganisms to
Disinfectants/Sterilants

Most Resistant
  Prions
  Spores (C. difficile)
  Mycobacteria
  Non-Enveloped Viruses (norovirus, adeno)
  Fungi
  Bacteria (MRSA, VRE, Acinetobacter)
Most Susceptible
  Enveloped Viruses
CJD: potential for secondary spread through contaminated surgical instruments

CJD and Medical Devices
Rutala, Weber. ICHE 2010;31:107-117

• Six cases of CJD associated with medical devices
  ■ 2 confirmed cases-depth electrodes; reprocessed by benzene, alcohol and formaldehyde vapor
  ■ 4 cases-CJD following brain surgery, index CJD identified-1, suspect neurosurgical instruments
• Cases occurred before 1980 in Europe
• No cases since 1980 and no known failure of steam sterilization
A New Practical Diagnostic Test for Creutzfeldt-Jakob Disease
Brown, Farrell. ICHE. 2015;36:849

• 14-3-3 protein in spinal fluid has proved to be an invaluable diagnostic aid for 2 decades but recognized as “marker protein” not causally related to CJD
• Two published independent studies of a newly modified prion protein amplification test named RT-QuIC (real-time quaking-induced conversion)
• Two studies yielded high sensitivity (85-96%) and specificity (99-100%)
• Tests results are available within 24 hours of specimen collection

Risk Assessment: Patient, Tissue, Device
Rutala, Weber. ICHE 2010;31:107-117

• Patient
  ■ Known or suspected CJD or other TSEs
  ■ Rapidly progressive dementia
  ■ Familial history of CJD, GSS, FFI
  ■ History of dura mater transplant, cadaver-derived pituitary hormone injection
• Tissue
  ■ High risk-brain, spinal cord, eyes
• Device
  ■ Critical or semicritical
CJD: Recommendations for Disinfection and Sterilization
Rutala, Weber. ICHE 2010;31:107-117

- High risk patient, high risk tissue, critical/semicritical device-special prion reprocessing
- High risk patient, **low/no risk tissue**, critical/semicritical device-conventional D/S or special prion reprocessing
- **Low risk patient**, high risk tissue, critical/semicritical device-conventional D/S
- High risk patient, high risk tissue, **noncritical device**-conventional disinfection

CJD: Disinfection and Sterilization
Conclusions
Rutala, Weber. ICHE 2010;31:107-117

- Critical/SC-cleaning with special prion reprocessing
  - 134°C for 18m (prevacuum)
  - 132°C for 60m (gravity)
  - NaOH and steam sterilization (e.g., 1N NaOH 1h, 121°C 30 m)
- No low temperature sterilization technology effective*
- Noncritical-four disinfectants (e.g., chlorine, Environ LpH) effective (4 log decrease in LD_{50} within 1h)

*VHP reduced infectivity by 4.5 logs (Lancet 2004;364:521)


CJD: Disinfection and Sterilization
Conclusions
Rutala, Weber. ICHE 2010;31:107-117

• Epidemiologic evidence suggest nosocomial CJD transmission via medical devices is very rare
• Guidelines based on epidemiologic evidence, tissue infectivity, risk of disease via medical devices, and inactivation data
• Risk assessment based on patient, tissue and device
• Only critical/semicritical devices contaminated with high-risk tissue from high risk patients requires special treatment

Prevent Patient Exposure to CJD

**Question:** How do hospitals minimize patient exposure to neurosurgical instruments from a patient who is later given a diagnosis of CJD?

**Answer:** Consider using the reviewed sterilization guidelines for neurosurgical instruments used on patients undergoing brain biopsy when a specific lesion (e.g., tumor) has not been demonstrated. Alternatively, neurosurgical instruments used in such cases could be disposable.
Management of Neurosurgical Instruments and Patients Exposed to CJD

- Conventional sterilization/disinfection inadequate for prions. Need special prion reprocessing (critical/semi device contaminated with high risk tissue from high-risk patient)
- Belay et al. ICHE 2014;34:1272. Decontamination options combine chemical and SS-1) immerse in 1N NaOH and heat in gravity at ≥121°C for 30m in appropriate container; 2) immerse in 1N NaOH or NaOCl 20,000ppm 1h then transfer into water and autoclave at ≥121°C for 1h; 3) immerse in 1N NaOH or NaOCl 20,000ppm 1h, rinse with water, transfer to pan and autoclave at 121°C (gravity) or 134°C (porous) for 1 hour. Clean and sterilize by conventional means.
- McDonnell et al. J Hosp Infect. 2013;85:268. Investigates the combination of cleaning, disinfection and/or sterilization on prions
- Rutala, Weber. ICHE 2010;31:107. SHEA Guideline-134°C for 18m in prevacuum or NaOH/autoclave (such as CDC option 2)

Disinfection and Sterilization
Current Issues, New Research and New Technologies

- Outpatient surgery/procedures
- Biofilms on instruments and environmental surfaces
- Sporicide in all discharge rooms
- Continuous room decontamination technologies
  - Visible light disinfection through LEDs
  - Low concentration hydrogen peroxide
  - Continuously active disinfectant
- DS of prion contaminated medical/surgical instruments
THANK YOU!
www.disinfectionandsterilization.org