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Infection Control:
Best Practices to Combat the Spread

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Today's Moderator

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Infection Control:
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Today's Presenter

Darrel Hicks

Author and Consultant

J. Darrel Hicks, BA, REH, CHESP, is the director of environmental services at a 500-bed, award-winning hospital in the United States. Darrel started his career in the management of housekeeping services in 1981. Hicks was President of the IEHA-Uniting Facility Managers Worldwide during the term 2006-2008 and holds the title of Registered Executive Housekeeper (REH).

He is also an active member in AHE (the Association for the Healthcare Environment) and holds the designation of CHESP (Certified Health-care Environmental Services Professional) through that great organization as well. Hicks is nationally recognized as one of the industry experts in infection prevention and control as it relates to cleaning. He has written and published numerous articles in professional and healthcare related journals as part of his commitment to providing a cleaner, safer and healthier indoor environment.

In 2010, Hicks authored “Infection Prevention for Dummies”, a 43-page, pocket-size book with topics such as: Use cleaning techniques to keep infection at bay; Match the disinfectant to the situation; Understand disinfectant label claims; Keep your environment healthy.

Learning Objectives:

- Learn about considerations specific to various types of facilities: schools, health care, hospitality, offices, etc.
- Identify best practices in regards to certain cleaning methods
- Analyze cleaning and disinfecting common touch-points, such as door knobs, keyboards, light switches, hand rails, etc.
- Recognize ways to provide a clean and safe work environment for patients, students, and building occupants

Infection Control:
Best Practices to Combat the Spread

To ask questions:

Please use the question and answer panel on the right-hand side of the screen, and send to all panelists.

Presentation Handouts

All participants will receive an e-mail by the end of the day with a link to download a PDF copy of today's presentation slides.

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The Power of Cleaning and Disinfection in the 21st Century

By J. Darrel Hicks, BA, REH,
CHESP and author of "Infection Prevention for Dummies"

OBJECTIVES

- Define "Clean"
- Develop the concept of soil removal
- Answer the question, "Do we need to disinfect everything"
- Discuss the role Biofilm plays in preventing proper cleaning and disinfection
- Discuss the Difference Between "Sanitizer and Disinfectant"
- Discuss Disinfectants, Myths and Facts
- Categories of Labeled Disinfectants
- Properties of "Ideal Disinfectant"
- Discuss QUAT binding
- Discuss the best method for applying cleaners and disinfectants
- Minimizing Contamination While Cleaning and Disinfecting
- Chemicals and Resistant Bacteria

Define "Clean"

No dust

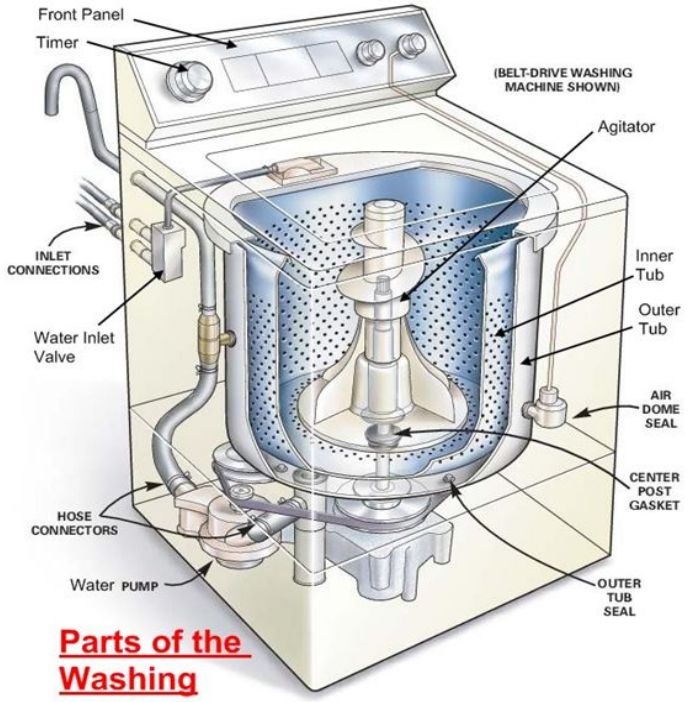
No spots

No smells

No smudges

= CLEAN

The Process of Cleaning



1. Clean-hot & cold water
2. Detergent
3. Time
4. Agitaation
5. Clean Water Rinse
6. Agitation
7. Spin dry

The Process of Cleaning (cont.)

- Cleaning removes the food and moisture necessary for microorganisms to survive.
- Most chemical disinfectants can't do their job when high levels of organic soil are present
- By removing the organic soil with microfiber and an appropriate cleaner, you give the right disinfectant a much better opportunity to kill the germs, bacteria and viruses.
- When 96-99% of soil is removed from a surface (sometimes with just microfiber and water), chances are the bad guys are gone, too
- Tackling biofilm

Do we need to disinfect EVERYTHING?

1. What do dinner plates and toilets have in common?
2. Traditionally, how are dinner plates cleaned? And, how often are they cleaned
3. Traditionally, how are toilets cleaned? And, how often are they cleaned

Eggs from the frying pan to the sink

2 Eggs in the Frying Pan

After breakfast, a dirty plate and fork

Eggs & Bacon on the Plate

Breakfast dishes in the sink to be washed

Toilets and Toilet Cleaning

Is this person in your facility?

Cleaning toilets
Like a Boss!

Of course, this is the way we clean toilets all the time; right?

These are all made with vitreous China!!

By removing the organic soil with an appropriate cleaner with microfiber, you give the right disinfectant a much better opportunity to kill the target "bugs".

Remember…The guiding principle is always to *remove* germs if possible rather than *kill* them, and then, when necessary, use the least amount of the mildest chemical that will do the job, because stronger often means more toxic to people and the environment.

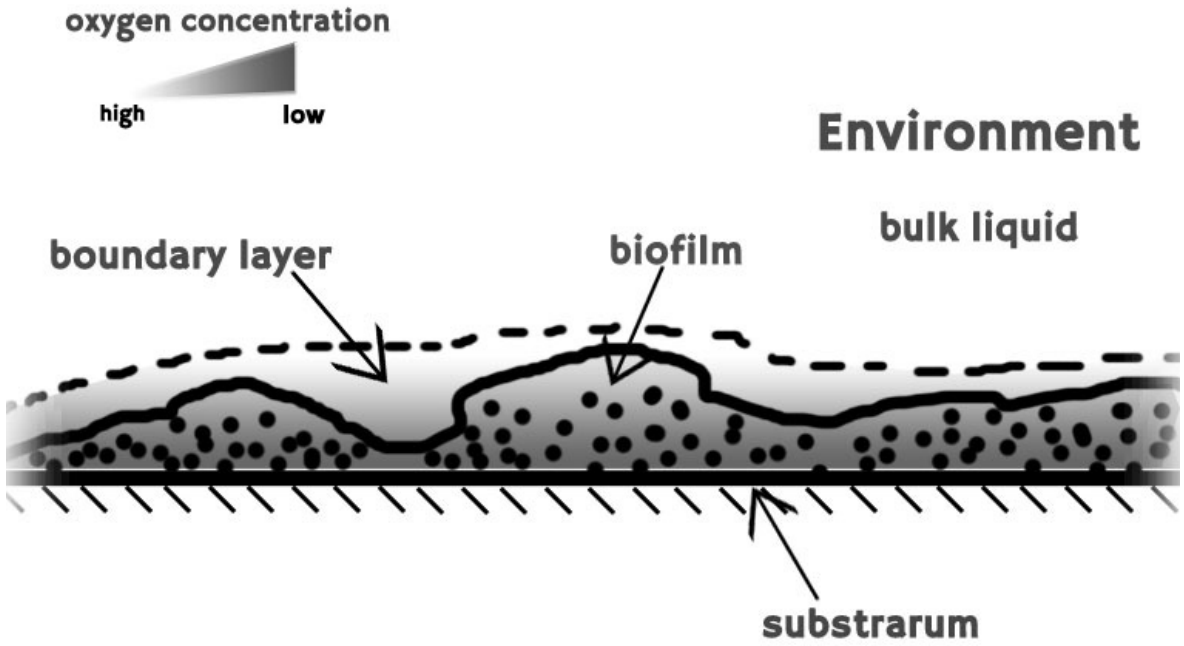
Defining A Biofilm

According to the Healthy Facilities Institute:
"Biofilms are around us everywhere in our rooms, offices and even in our own bodies. By scientific definition, a biofilm is microbes (bacteria, algae, yeast or fungi, protozoa and viruses, hereafter called 'bugs') that grow collectively in adhesive polymers (mainly extracellular polymeric substances) on live or non-live surfaces. You may have already seen different forms of biofilms, for example, green coatings on rocks, black spots on the wall in buildings and white films on the top of juices in open glasses left standing for several days. Sometimes you can also feel biofilms as slimy coatings on the inner surfaces of faucets and slippery materials on the floor in a shower room. Most times, however, you cannot see biofilm directly with your naked eyes. On a clean-looking surface, like a stainless steel counter top in a kitchen, the stainless steel is shining but very likely not biofilm free."

Underscoring the need for cleaning in addition to disinfecting, scientists are finding that germs are more tenacious survivors than anyone ever imagined.

Bacteria on damp surfaces don't remain as isolated and free-floating life forms; they communicate and colonize with other germs to build a tough, protective bio-film that can withstand even the strongest disinfectants.

Tackling Biofilm



Biofilm protects itself with a tough, thick matrix that makes up two-thirds of the film. You have to break up the matrix to make the germs vulnerable.

BIOFILM MYTHS AND FACTS

- ***Myth #1:*** Biofilm is a buildup of organic or biological matter.
- Not so, since even as skin flakes, skin oils and other organics provide "germ-food," they do not constitute biofilm.
- ***Fact #1:*** Biofilm is actually the "house" microbes build for themselves.
- It's a somewhat slimy, polymeric house but it provides them shelter and protection from the elements themselves, including disinfectants.

BIOFILM MYTHS AND FACTS

- ***Myth #2:*** Biofilm can be removed using the right disinfectant and dwell time.
- Not true.
- Biofilms have been known to survive submerged under pure disinfectant for 20 minutes or more.
- ***Fact #2:*** Scrubbing — aka, good, old-fashioned "elbow grease"— is the best way to prevent and remove biofilms.
- According to a study, Influence of Biofilms by Chemical Disinfectants and Mechanical Cleaning: "Water conducting systems in hospitals (endoscopes, nebulizers, tap water systems, dental units, etc.) are often important reservoirs of conditional pathogens. The sanitation of those systems by in vitro efficient chemical disinfectants is very difficult. An explanation may be that microorganisms are growing in such systems in wall adhering biofilms wherein they are protected from biocides ... A criterion for the efficacy of sanitation procedure is not only the good disinfection result but also the removal of biofilms … Investigation showed that aldehydes and peracetic acid can reduce multiplying microorganisms without disrupting the biofilm ... The best result was achieved by mechanical cleaning."
- As noted by the Cleaning Industry Research Institute (CIRI): "...old-fashioned scrubbing is sometimes the best 'intervention' when it comes to biofilm."

Biofilm-the Unseen Threat

- 90% of harmful bacteria live in Biofilm
  - This figure comes from both the CDC and NIH
- Viruses hide in Biofilm
  - Biofilm provide viruses a means to live without a host
  - These viruses can seriously impact human health
- Biofilm is a major challenge for cleaning
  - Biofilm "houses and protects pathogenic bacteria" such as MRSA, Salmonella, C-diff et al.
- Biofilm is a protective shield that bacteria produce that make them highly resistant against disinfectants

What's the Difference Between "Sanitizers and Disinfectants"?

- Sanitizers are generally used on food preparation surfaces or spaces occupied by infants and toddlers where disinfectants would require a second step of rinsing a surface that has air-dried.
- Rinsing would be necessary so that the preparation of food on that surface wouldn't pick up toxic chemicals that might be ingested by humans.
- Rinsing would be required on surfaces where infants and toddlers might touch the surface and place their hands in their mouth and ingest the toxic chemical.

What's the Difference Between "Sanitizers and Disinfectants"? (cont.)

- Disinfectants are not USUALLY sporicidal; but some are (i.e., they kill C-diff spores)
- Disinfectants are usually a chemical agent (but sometimes a physical agent) that destroys disease-causing pathogens or other harmful microorganisms but might not kill bacterial spores.
- Applied to inanimate surfaces
- The EPA groups disinfectants by product label claims of "limited", "general", or "hospital" disinfection".

What's the Difference Between "Sanitizers and Disinfectants"? (cont.)

- Sanitizers kill 99.99% of pathogens (that's pretty good, right?)
- Disinfectants must kill 99.9999% of pathogens
- If we start with 1,000,000 pathogens on a surface, if we were satisfied with 99.99% kill, there would still be **10,000** pathogens still on the surface.
- But, if we kill 99.9999% of the pathogens, only **100** would remain.
- Big difference between ***Sanitizing*** and ***Disinfecting***!

Myths and Facts of Disinfectants

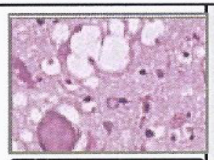
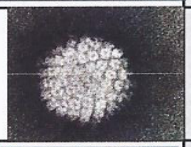
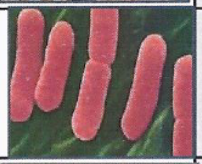
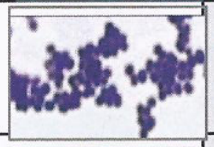
- Myth: “OMG, this disinfectant kills HIV and AIDS, it must be good”
- Fact: HBV, HIV and AIDS are viruses with lipid envelopes that are easily “killed” and are the lowest on the continuum from “Easy to Kill” to “Extremely Difficult to Kill” pathogens (see following chart)

Levels of Disinfection Difficulty

Extremely Difficult to kill

Harder to Kill

Easy to kill

Prions		Transmissible Spongiform Encephalopathy (TSE); Creutzfeldt-Jakob disease(CJD) Mad cow disease; Scrapies
Bacterial Spores		Spores of: C. difficile; C. tetanus; C. botulinum; C. perfringens; Anthrax
Mycobacteria		M. tuberculosis; M. avium
Viruses without envelopes		Norovirus; Rotavirus; Rhinovirus; Poliovirus; Papillomavirus (HPV); Coxsackie; Adenovirus
Fungi includes fungal spores		Aspergillus fumigatus, A. flavus; A. niger; Candida albicans
Gram negative bacteria		Pseudomonas, Acinetobacter, Klebsiella, E. coli; Enterobacteriaceae, Legionella
Gram positive bacteria		Staphylococcus; Enterococcus; Streptococcus; Clostridia vegetative rods
Viruses with lipid envelopes		Influenza; HBV; HCV; HIV; RSV; Coronavirus; CMV; HSV; Measles, Mumps; Rubella; VZV (Varicella-Zoster) Shingles/ Chickenpox

Myths and Facts of Disinfectants

- Myth: The contact time on a disinfectant's label is the time a surface must remain wet in order for the disinfectant to kill the listed organisms.
- Fact: 10 minute contact time is meant for EPA registration, NOT the time it takes to kill microorganisms on pre-cleaned surfaces

Factors Influencing Cleaning and Disinfecting

Contact Time

Time to kill microorganisms on surfaces:

EPA testing methodology

Vs

Pre-cleaned surfaces

Testing Disinfectants against Bacteria

EPA Hard Surface Carrier Test

- 60 Non-porous carriers
- Test organisms - *Salmonella, pseudomonas, staph aureus*
- Organic Soil (5% blood)
- Hard Water
- Requirements – 59/60 no growth

Time to Kill Organisms on Surfaces

	Log$_{10}$ Reduction			
	S. aureus		*P. aeruginosa*	
Product	**30 sec.**	**5 min**	**30 sec.**	**5 min**
Phenol	**> 8.2**	**> 8.2**	**> 6.7**	**> 6.7**
Quat	**> 6.4**	**> 6.4**	**> 6.9**	**> 6.2**
Chlorox	**> 5.8**	**> 5.8**	**> 5.3**	**> 5.3**

Rutala, W. ICHE 2000;21:33-38

Contact Time on Non-Critical Surfaces[1]

- Contact time is rarely per label claim; exposure time 1- 1.5 minutes
- 10 min. contact time require 6 applications
- 6 log reduction in 30 seconds

Rutala, W. APIC 2003

Contact Time on Non-Critical Surfaces[2]

- Low-level disinfection (LLD) for at least 30-60 seconds is supported by at least 14 scientific studies

- 10 minute contact time is meant for EPA registration, **NOT** the time it takes to kill microorganisms on pre-cleaned surfaces

Rutala, W. APIC Annual Ed. Conference; 2005

Myths and Facts of Disinfectants

- Myth: If a product label states "DISINFECTANT", it is OK to use on just about all germs or pathogens.
- Fact: Check labels for specific germ-killing claims to find out which of the following basic categories of disinfectant you are buying--

Categories of Labeled Disinfectants

- **Limited Disinfectant**- is effective for use against a specific major group of micro-organisms. Laboratory test have demonstrated its efficacy against either *Salmonella enterica* or *Staphylococcus aureus*

Categories of Labeled Disinfectants

- **General Disinfectant**- is effective for use against both *Salmonella enterica* and *Staphylococcus aureus.* A general disinfectant is also referred to as a *broad spectrum disinfectant.*

Categories of Labeled Disinfectants

- **Hospital-grade Disinfectant**-is effective for use in hospitals, clinics, dental offices or any other medical-related facility. Efficacy is demonstrated against *Salmonella enterica, Staphylococcus aureus* and *Pseudomonas aerugionsa* bacteria (which can cause bacterial pneumonia)

Categories of Labeled Disinfectants

- These categories have become roughly equivalent to “Strong”, “Stronger” and “Strongest”.
- But, do keep in mind that with increasing strength often (*but not always*) goes increasing toxicity to humans and, possibly, the environment.

Properties of Ideal Disinfectant

- Broad spectrum: should have a wide antimicrobial spectrum
- Fast acting: <5 minutes
- Not affected by environmental factors: should be active in the presence of organic matter (e.g., blood, sputum, feces) and compatible with soaps, detergents and other chemicals encountered during use.

Properties of Ideal Disinfectant (continued)

- Nontoxic: Not dermally or orally toxic, should not harm the environment on disposal.
- Surface compatibility: Should not corrode or pit metallic surfaces and should not cause the deterioration of cloth, rubber, plastics and other materials.
- Residual effect: On disinfected surfaces, an antimicrobial film should be left behind once the surface is dry.

Properties of Ideal Disinfectant (continued)

- Easy to use with clear label directions
- Odorless: should have a pleasant odor or no odor to facilitate its routine use.
- Economical: should not be prohibitively high in cost. First choice would be a concentrate that is dilutable at <2 oz. per gallon of water.
- Solubility: should be soluble in water
- Stability: should be stable in concentrate and use-dilution
- Cleaner: should have good cleaning properties

Myths and Facts of Disinfectants

- Myth: The cloth used to apply quat (quaternary ammonium compound) disinfectants isn't important.
- Fact: Some fabrics and materials have a strong attraction for the active ingredient in QUATS.

1) QUAT preferentially attaches or exhausts to fabric
2) QUAT level in solution is reduced
3) Efficacy of the disinfectant decreases

QUAT Binding

Quaternary Ammonium Chloride

Some fabrics and materials have a strong attraction for the active ingredient in QUATS.

- QUAT preferentially attaches or exhausts to fabric -
- QUAT level in solution is reduced -
- Efficacy of the disinfectant decreases -

Disinfectants are registered with the EPA and efficacy claims are approved at a specific level of active ingredients.

When the QUAT level is less than the level approved by the EPA, the efficacy claims are no longer valid.

QUAT Binding

Disinfectants:

- How are you using them?
- How do you test them (test kits)?

- How do we know that the surface is clean and disinfected (Environmental Monitors)?

Cleaning Methods:

Spray bottle, squirt bottle, or hand pail?

Is one method better than the other?

Effectiveness of Disinfection Methods For VRE

Number of positive surfaces

	Spray Bottle		Bucket
First	60/376	(16%)	0/135
Second	8/82	(10%)	
Third	3/28	(11%)	
Fourth	0/10	(0)	

Byers. ICHE 1998;19:261

Minimizing Contamination While Cleaning and Disinfecting

According to the CDC (Centers for Disease Control):

- Minimize contamination of cleaning solutions
- Bucket solutions become contaminated almost immediately if you use the method of returning soiled wipers or mops to the clean solution
- The preferred method of using mops and wipers in a bucket solution is to set up the bucket with properly mixed disinfectant or cleaning solution and placing clean wipers or mops in the solution. Withdraw wiper or mops and apply the solution to the surface.
- When finished with wiper or mop, place the soiled material in a bag for laundering.
- **Never** return a soiled wiper or mop to the clean solution.

Minimizing Contamination While Cleaning and Disinfecting

- Another source of contamination in the cleaning process is the cleaning cloth or mop head, especially if left soaking in dirty cleaning solutions.
- Laundering of cloths and mop heads after use and allowing them to dry before re-use can help to minimize the degree of contamination.
- After laundering and drying, make sure DRY cloths and mop heads are placed in clean plastic liners to prevent contamination.

Chemicals and Resistant Bacteria

- With Multidrug Resistant Organisms (MDROs) proliferating in developed countries throughout the world, the question is, "Will those same bacteria become resistant to disinfectants?"
- The answer to this question is a resounding **NO,** but rather than taking my Coles Notes version for gospel, let's look at the facts.
- **Fact # 1**: Antibiotics have very specific targets where they attack the bacteria just as a lock needs a specific key in order to open. Any changes to the bacteria can make to the target renders the key ineffective.

Chemicals and Resistant Bacteria (cont.)

- **Fact #2:** Antibiotics, while useful, have limits to the concentration that can be used before it will cause harm to the patient. If the bacteria adapts to the therapeutic dose it can become resistant.
- **Fact #3:** The development of antibiotic resistance has been seen to occur within a few years after the introduction of a new antibiotic.
- **Fact #4:** Disinfectants are not specific in their attack, hence a "sledgehammer" being a perfect metaphor. This makes development of resistance much more difficult.

Chemicals and Resistant Bacteria (cont.)

- **Fact #5:** Disinfectants are used at concentrations far more potent (**100-10,000 times**) than the minimum inhibitory concentration (MIC) for antibiotics; thus, making it ***far more unlikely for bacteria to develop resistance*.**
- **Fact #6:** Disinfectants have been used for well over 100 years without loss of effectiveness. While there is a hierarchy with respect to some bacteria such as spore formers or Myco-bacteria spp. being less susceptible to chemicals that their gram negative or gram positive cousins, there is no current scientific evidence that supports that antibiotic resistant organisms are more resistant to disinfectants.

Chemicals and Resistant Bacteria (cont.)

For now we can feel confident that whether we are talking about MRSA, VRE, ESBLs, MDR-Pseudo, MDX-TB or CRE the disinfectant you are currently using against the susceptible strains will still be effective against the antibiotic resistant strains.

"Infection Prevention for Dummies"

J. Darrel Hicks

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