Infection Control: That Thing You Do Why Do You Do It?

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Disclosures:
-- Consultant, Hu-Friedy Manufacturing, Inc
-- Consultant, SciCan, Inc

Are Your IC Precautions Effective ?

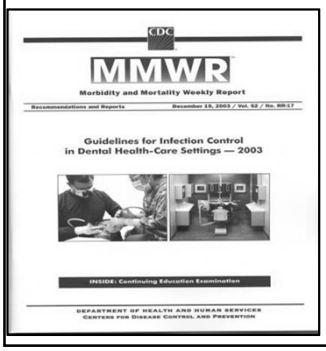
Hepatitis B, C, etc **Bird Flu**
SARS
Waterborne Diseases **MDR - Tuberculosis**
Immune Compromised Persons
Vaccine Preventable Diseases **HIV / AIDS**
Prions (CJD) **Bacterial Pneumonia**
SWINE FLU
Drug Resistance **Pertussis**
Viral Respiratory Tract Infection

CONFIDENCE
COMPLIANCE

Infection Control *Guidelines, Standards, Regulations*

1. **Occupational Safety and Health Administration (OSHA)**
   Bloodborne Pathogens Standard
   Hazard Communications Standard
2. **Centers for Disease Control and Prevention (CDC)**
   Universal Precautions (1986) ⟹ Standard Precautions (1996)
3. **Environmental Protection Agency (EPA)**
   Hospital-level disinfectants, hazardous waste disposal, infectious waste
4. **Food and Drug Administration (FDA)**
   Regulates manufacturers of medical devices, sterilants, high-level disinfectants

Principle Infection Control Documents



Evidence-based rankings

Recommendations: Each recommendation is categorized on the basis of existing scientific data, theoretical rationale, and applicability.

Category IA. Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiological studies.

Category IB. Strongly recommended for implementation and supported by certain experimental, clinical, or epidemiological studies and a strong theoretical rationale.

Category IC. Required for implementation, as mandated by federal or state regulation or standard.

Category II. Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

No recommendation. Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exist.

Evidence-Based Recommendations

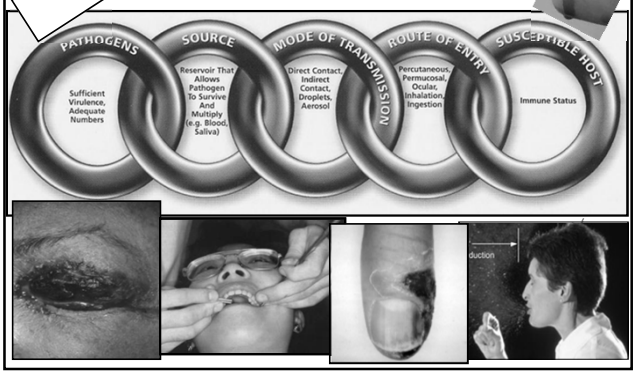
- Do not administer medication from a syringe to multiple patients, even if the needle on the syringe is changed. (IA)
- Wear medical gloves when a potential exists for contacting blood, saliva, OPIM, or mucous membranes. (IB)
- Use single-use devices for one patient only and dispose of them properly. (IC)
- Keep fingernails short with smooth, filed edges to allow thorough cleaning and prevent glove tears. (II)
- Pre-procedural mouth rinses. (No Rec)

CDC

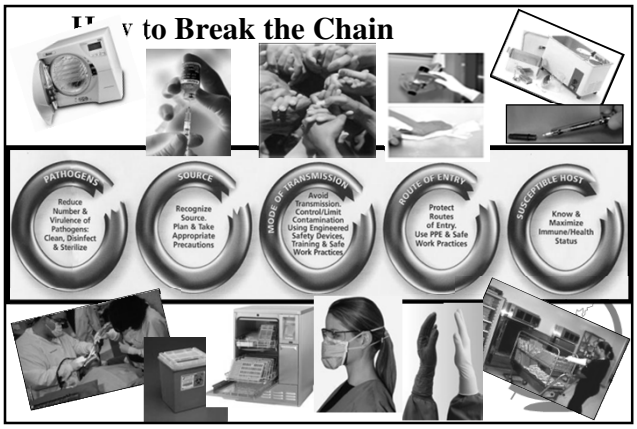
WHY Continue To Be Scrutinized For IC?

- ✓ 2007 ((NV): Hepatitis C transmission in med practice associated with re-use of multi-dose anesthetic vials
- ✓ 2007 (NM): Pt-to-Pt HBV transmission in an O.S. practice
- ✓ 2009 (FL): Possible infection transmission to >3,000 vets from improperly sterilized tubing with endoscopes
- ✓ 2010 (MO): Possible infection to 1,800 vets from improperly cleaned dental instruments
- ✓ 2010 (WV): 5 HBV cases following dental tx in free clinic
- ✓ 2011 (OH): VA dental clinic closed – *staff DDS IC practices!!* 375 vets tested: 7 HCV & 2 HBV infections

The Chain of Transmission



How to Break the Chain



POSSIBLE HCW PERCEPTIONS

Ineffectiveness of certain recommendations
vs.
Overkill of infection control
vs.
Overlap of effective procedures

Lack of Adherence to Basic Infection Control Principles & Practices

↓

Lessens Margin of Effectiveness Overlap

↓

Increases Cross - Infection Risk

ASEPTIC TECHNIQUE

Goal: procedures that break the circle of infection & reduce potential for cross-contamination.

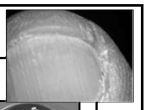
Applications & Examples:

1. Basic cleaning principles.
2. Keep sterilized instruments wrapped until use.
3. Consider single-use disposables.
4. Hand Hygiene: historical & fundamental.

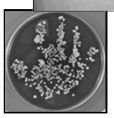
Hand Hygiene
(previously termed "hand washing")

- Single most important infection control precaution.
- Recent technology & procedure advances
- "It's not what you wash with, but how you wash"
- Cleaning remains basic tenet of hand hygiene
- Basic mechanics require compliance:
  - -- washing
  - -- rinsing
  - -- appropriate time for procedure
  - -- post - wash asepsis
  - -- dermatitis considerations

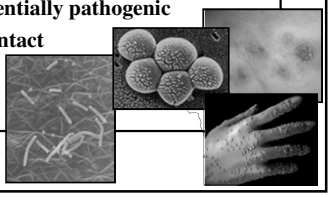
Types of Microflora



- **Resident flora – normal body flora**
  - -- located on skin & in deeper skin layers
  - -- provide immune protection
  - -- if disrupted, re-establish at same site



- **Transient flora – potentially pathogenic**
  - – Acquired by direct contact
  - – Outer skin layers
  - – More easily removed



Critical Importance of Hand Hygiene

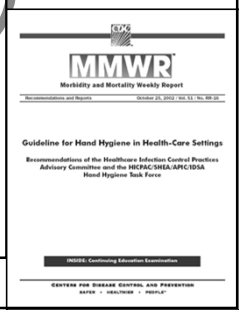
- 60-70% nosocomial infections related to improper hand washing & care
- Numerous clinical cases/outbreaks confirming patient-to-patient transmission of pathogens from HCW hands
  MRSA, *C. difficile*, gram-negatives
- Multiple handwashing & asepsis guidelines since 1975
- CDC 2002 – most recent & comprehensive
- New strategies & product types
- FDA alert & notice (2011)

Guidelines For Hand Hygiene In Health – Care Settings

Indications for Hand Hygiene:

- when hands are visibly dirty, contaminated, or soiled, wash with non-antimicrobial or antimicrobial soap & water.
- if hands <u>are not visibly soiled</u>, use an alcohol – based handrub for routinely decontaminating hands.

(CDC 2002)

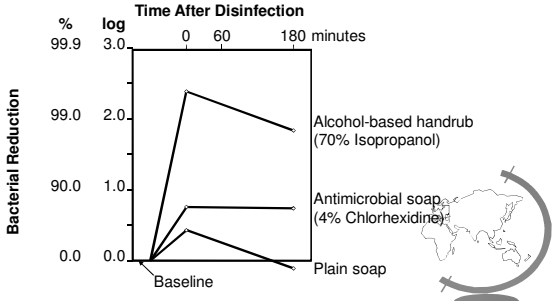


Antimicrobial Spectrum / Characteristics of Hand Hygiene Antiseptic Agents

Group	Gram-positive bacteria	Gram-negative bacteria	Mycobacteria	Fungi	Viruses	Speed of action	Comments
Alcohols	+++	+++	+++	+++	+++	Fast	Optimum concentration 60%–95%; no persistent activity
Chlorhexidine (2% and 4% aqueous)	+++	++	+	+	+++	Intermediate	Persistent activity; rare allergic reactions
Iodine compounds	+++	+++	+++	++	+++	Intermediate	Causes skin burns; usually too irritating for hand hygiene
Iodophors	+++	+++	+	++	++	Intermediate	Less irritating than iodine; acceptance varies
Phenol derivatives	+++	+	+	+	+	Intermediate	Activity neutralized by nonionic surfactants
Tricolsan	+++	++	+	—	+++	Intermediate	Acceptability on hands varies
Quaternary ammonium compounds	+	++	—	—	+	Slow	Used only in combination with alcohols; ecologic concerns

Note: +++ = excellent; ++ = good, but does not include the entire bacterial spectrum; + = fair; — = no activity or not sufficient.
* Hexachlorophene is not included because it is no longer an accepted ingredient of hand disinfectants.

Ability of Hand Hygiene Agents to Reduce Bacteria on Hands



Adapted from: *Hosp Epidemiol Infect Control*, 2nd Edition, 1999.

Hand Washing vs. Alcohol-Based Antiseptics 1

Hand Washing

Pros (+)

- Plain soap or antimicrobial soaps
- Antimicrobial soaps effective
- Sinks usually readily available
- Familiar technique
- Rare allergic rxs to active antimicrobial agents
- Irritation dermatitis resolved by relatively simple techniques or behavior changes

Cons (-)

- Frequent washing can cause dryness, chapping, irritation
- Takes more time than antiseptic hand rubs or sprays
- Requires sink, water, paper towels
- Personal habits & preferred products may compromise professional training
- Strong fragrances may adversely affect sensitive people
- Water may be irritating
- Time & technique critical

Hand Washing vs. Alcohol-Based Antiseptics 2

Alcohol-Based Antiseptics

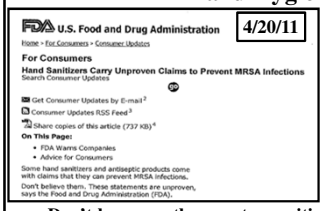
Pros (+)

- Provides more effective antiseptic action on visibly clean hands than washing c soaps or antimicrobial soaps
- Faster protocol than hand washing
- Reduced skin irritation & drying than hand washing
- May be used in absence of sinks & during boil water notices
- Rare allergic rxs to alcohol
- Reduces paper towel use & waste

Cons (-)

- Not indicated for use when hands are dirty or contaminated
- Critical to dispense proper amt
- Hands must be dry before applied
- Frequent use may cause irritation if product lack emollients
- Agent can sting compromised skin
- Strong fragrances may adversely affect sensitive people
- Alcohol flammability
- Glove powder can affect effectiveness

FDA Hand Hygiene Products Alert


FDA U.S. Food and Drug Administration

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For Consumers

Hand Sanitizers Carry Unproven Claims to Prevent MRSA Infections

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- Advice for Consumers

Some hand sanitizers and antiseptic products come with claims that they can prevent MRSA infections. Don't believe them. These statements are unproven, says the Food and Drug Administration (FDA).

4/20/11

- **Some hand sanitizers & antiseptic products come with "prevent MRSA infection" claims**
- **FDA: "Don't believe them. These statements are unproven"**
- **Products require FDA review & approval**

- **Don't buy over-the-counter sanitizers or other products that claim to prevent infection from MRSA, E. coli, Salmonella, flu, others**
- **examples of unproven claims:**
  - ✓ **kills over 99.9% of MRSA**
  - ✓ **helps prevent skin infections caused by MRSA and other germs**
  - ✓ **is effective against a broad spectrum of pathogens, including MRSA**

Hand Hygiene Considerations

- **Professional vs. personal hand products**
- **Concentration of emollients in waterless products:**
  lubricates & reduces drying action of alcohol on skin
- **Emollient accumulation on skin:**
  seen with product repeated use - soap & water removal
- **Supplemental hand lotions/creams:**
  important factor contributing to dermatitis associated with frequent handwashing
  water-based vs. petroleum- based lotions
- **Epithelial integrity:**
  prevent / minimize dermatitis & skin infections

What Do You Think ?

A co-worker develops symptoms of dry, itchy, irritated skin on portions of her hands

1. **What are the possible causes of the dermatitis?**
2. **Could it be caused from a product used outside of the dental office/clinic?**

Hand Hygiene Take Home Messages

- **-- consider skin sensitivities & allergies when selecting products**
- **-- initial procedure at beginning of day – thorough (1 minute) hand wash**
- **-- subsequent procedures ~ 15 seconds or time recommended for specific preparation**
- **-- appropriate washing & rinsing techniques - COMPLIANCE**
- **-- do not wear jewelry, long nails, or acrylic nails**
- **-- clean thoroughly under nails**
- **-- rinse with cool or tepid water & dry hands completely before gloving**
- **-- keep epithelial integrity intact**

Standard Precautions

- Apply to all patients
- Integrate & expand universal precautions
- Standard precautions for preventing disease transmission include:
  - ✓ Hand hygiene
  - ✓ Use of personal protective equipment (PPE)
  - ✓ Cleaning and decontamination of instruments
  - ✓ Cleaning & disinfection of environment surfaces
  - ✓ Injury prevention

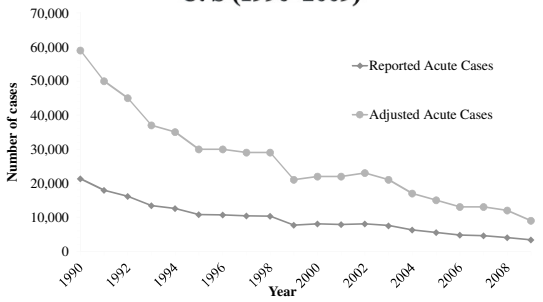
CDC/JAM

Hepatitis B Virus (HBV)

	Hepatitis B					
	2008	2007	2006	2005	2004	2003
No. of Acute Clinical Cases Reported [a]	4,033	4,519	4,758	5,494	6,212	7,526
Estimated No. of Acute Clinical Cases [b]	12,000	13,000	13,000	15,000	17,000	21,000
Estimated No. of New Infections [b] (current)	38,000	43,000	46,000	53,000	60,000	73,000
Percent Ever Infected [c]	4.3% - 5.6%					
Number of Persons Living with Chronic Infection [d]	800,000 - 1.4 million persons					
Annual Number of Chronic Liver Disease Deaths associated with Viral Hepatitis [e]	3,000					

-- Remains major, most infectious target of Standard IC Precautions
-- Infection risk from needlestick or cut is 6%–30%
-- Vaccination response lowers risk to near zero
-- HBV can remain viable on surfaces ~1 week
-- HBeAg-positive individuals much more infectious (higher concentration of virus in blood)

Reported & adjusted* Number of acute hepatitis B cases U. S (1990–2009)



*Adjusted for underreporting.
Source: National Notifiable Diseases Surveillance System (NNDSS)

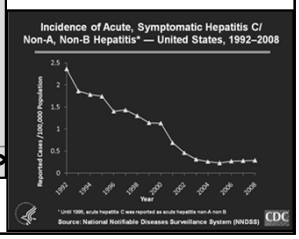
Hepatitis C Disease Burden

- Primarily bloodborne transmission
- Sexual & perinatal transmission – not as efficient
- Concern for needlestick & other occupational sharps injuries

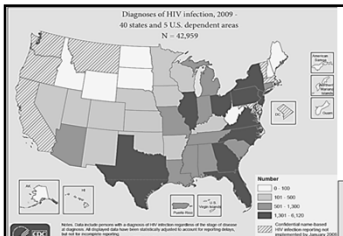
	Hepatitis C					
	2008	2007	2006	2005	2004	2003
No. of Acute Clinical Cases Reported [a]	878	849	802	694	758	891
Estimated No. of Acute Clinical Cases [b]	2,900	2,800	3,200	3,400	4,200	4,500
Estimated No. of New Infections [b] (current)	18,000	17,000	19,000	21,000	26,000	28,000
Percent Ever Infected [c]	1.3% - 1.9%					
Number of Persons Living with Chronic Infection [d]	2.7–3.9 million persons					
Annual Number of Chronic Liver Disease Deaths associated with Viral Hepatitis [e]	12,000					

Hepatitis C Incidence

- 75%–85% of newly infected persons develop chronic infection
- 15%–25% of newly infected persons clear the virus
- Acute illness is uncommon. Those who do develop acute illness recover with no lasting liver damage.
- 60%–70% of chronically infected persons develop chronic liver disease
- 5%–20% develop cirrhosis over a period of 20–30 years
- 1%–5% will die from cirrhosis or liver cancer
- Estimated 12,000 persons in the United States die from HCV-related illness per year
- No serologic marker for acute infection



HIV / AIDS 2009



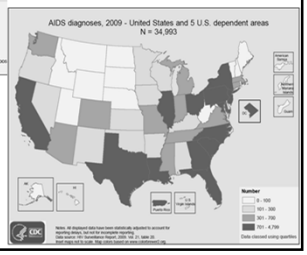
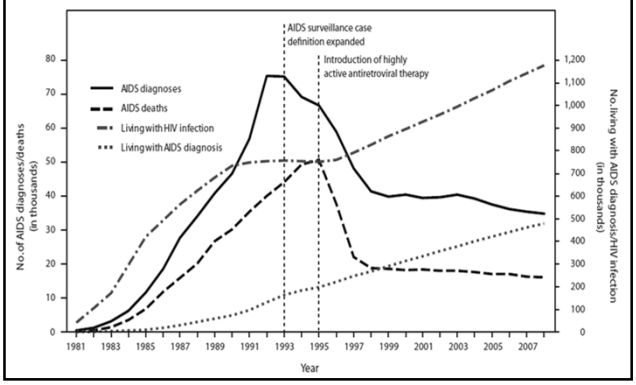


FIGURE. Estimated number of AIDS diagnoses and deaths and estimated number of persons living with AIDS diagnosis* and living with diagnosed or undiagnosed HIV infection† among persons aged ≥13 years — United States, 1981–2008



Healthcare Related Hepatitis Outbreaks (2008)

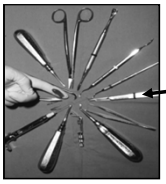
Agent	State	Setting	Persons Notified for Screening	Confirmed Cases	Suspected mode of transmission
Hepatitis B virus (HBV)					
HBV	IL	Assisted living facility	21	7	Hygiene lapse in fingerstick procedures on diabetics
HBV	CA	Skilled nursing facility	115	9	Primarily hygiene lapses during podiatric care, other possibly secondary modes
HBV	PA	Assisted living facility	25	9	Shared glucometers and fingerstick devices in diabetics
Hepatitis C virus (HCV)					
HCV	NV	Endoscopy clinics	>50,000	8	Reuse of syringes, contaminating vials of propofol (anesthetic)
HCV	NC	Outpatient cardiology clinic	1,200	7	Reuse of syringes which contaminated 30cc saline vials shared for IV catheter flushes
HCV	NY	Dialysis center	657	6	Investigation of dialysis center revealed multiple breaches in infection control practice. All patients who received dialysis In this facility since 2004 were notified for screening.

Potential Transmission Risks To HCWs

Pathogen	Conc / ml Serum/Plasma	Transmission Rate (Post-Needlestick)
HBV	1,000,000 - 100,000,000	6.0 - 30.0 %
HCV	10 - 1,000,000	2.7 - 6.0 % (1.8% current)
HIV	10 - 1,000	0.3 % (Blood splash to eye, nose, mouth is 0.1%)

Lamphear. Epid Rev (1994); CDC 2011

Occupational Exposures to Bloodborne Pathogens & Management

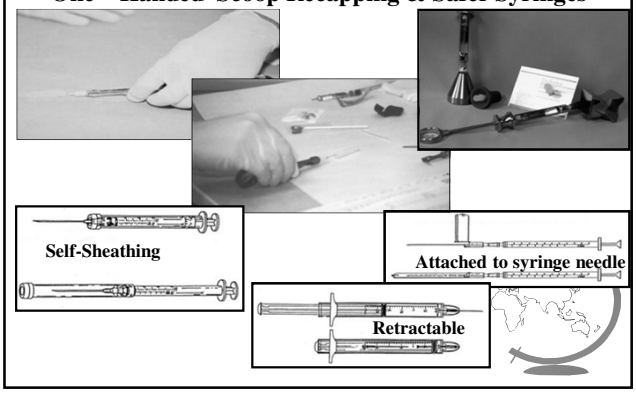


- Percutaneous injury
- Mucous membrane exposure
- Non-intact (broken) skin exposure
- Bites

Exposure Management Policies

- ✓ Include hepatitis B vaccination
- ✓ Consistent with
  - -- OSHA worker protection requirements
  - -- PHS exposure management recommendations
  - -- CDC exposure management recommendations

One – Handed Scoop Recapping & Safer Syringes



HCW with Documented & Possible Occupationally-Acquired AIDS/HIV Infection (1984 --)

	Documented	Possible
Dental Worker	0	6 *
Nurse	24	35
Lab Tech, clinical	16	17
Physician, nonsurgical	6	12
Lab Tech, nonclinical	3	–
Other	8**	70
Total	57	140

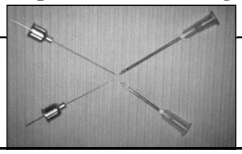
* 3 dentists, 1 oral surgeon, 2 dental assistants (possible)

** 2 housekeeper/maintenance, 2 surg. tech, 1 embalmer/morgue tech, 1 health aide tech, 1 respiratory therapist, 1 dialysis tech (documented)

CDC Database as of December 2006 **Released: September 2007**

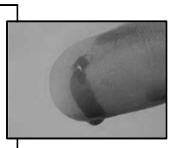
Characteristics of Percutaneous Injuries Among DHCP

- Reported frequency among general dentists has declined
- Most incidents caused by burs, other solid sharps, & *NOT* hollow-bore needles
- Occur outside the patient's mouth
- Involve small amounts of blood
- Among oral surgeons, most occur during fracture reductions and procedures involving wires
- Needles



Exposure Management

- Policies for medical follow-up of occupational exposures:
- Reporting ☞ Evaluation ☞ Counseling
- Treatment ☞ Medical follow-up (testing)
- Establish referral mechanisms to qualified health-care professional
- Updated CDC Guidelines (2005 --)

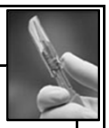


Factors To Consider When Assessing The Need for Follow-up

1. Type of exposure: percutaneous, mucus membrane, non-intact skin exposure, etc.
2. Type & amount of fluid / tissue: blood, OPIM.
3. Infectious status of source: presence of HBV, HCV, HIV.
4. Susceptibility of exposed person: HBV vaccine & response status; HBV, HCV, or HIV immune status.

MMWR

Engineering Device Ruling



- Identify, evaluate, and select devices with appropriate features.
- Employees must have input on the types of product that are used
- Employees must evaluate the product to agree on the level of safety
- If a safer product becomes available, the employees must be made aware of the product and given the opportunity to use it

Exposure Management Take Home Messages

1. Current data indicate occupational HBV, HCV, HIV risks low
2. Needle-stick accidents considered more serious
3. Most dental sharps accidents involve solid sharps
4. Best means to minimize exposure involves combination of:
   - pre-exposure HBV vaccination
   - routine practices
   - engineering controls
   - work practice controls
5. Written policies & procedures

Healthcare Personnel Vaccination Recommendations

Vaccine	Recommendations in brief
Hepatitis B	Give 3-dose series (dose #1 now, #2 in 1 month, #3 approximately 5 months after #2). Give IM. Obtain anti-HBs serologic testing 1–2 months after dose #3.
Influenza	Give 1 dose of influenza vaccine annually. Give inactivated injectable influenza vaccine intramuscularly or live attenuated influenza vaccine (LAIV) intranasally.
MMR	For healthcare personnel (HCP) born in 1957 or later without serologic evidence of immunity or prior vaccination, give 2 doses of MMR, 4 weeks apart. For HCP born prior to 1957, see below. Give SC.
Varicella (chickenpox)	For HCP who have no serologic proof of immunity, prior vaccination, or history of varicella disease, give 2 doses of varicella vaccine, 4 weeks apart. Give SC.
Tetanus, diphtheria, pertussis	Give all HCP a Td booster dose every 10 years, following the completion of the primary 3-dose series. Give a 1-time dose of Tdap to HCP of all ages with direct patient contact. Give IM.
Meningococcal	Give 1 dose to microbiologists who are routinely exposed to isolates of *N. meningitidis*. Give IM or SC.

Hepatitis A, typhoid, and polio vaccines are not routinely recommended for HCP who may have on-the-job exposure to fecal material.

ACIP CDC (1/2011)

Hepatitis B Vaccines: 2 Generations

- Heptavax B (Merck) -- 1982
  natural component vaccine from plasma of HBV carriers
- Recombivax HB (Merck) -- 1986/1987
  in vitro recombinant DNA technology in yeast cultures
- Engerix B (SmithKline) -- 1986/1987
  in vitro recombinant DNA technology in yeast cultures

JAM

HEPATITIS B VACCINATION SCHEDULE

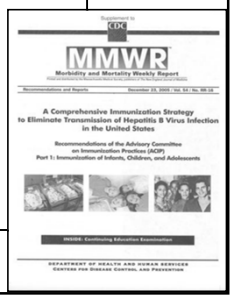
HBsAg + Alum Adjuvant

Adolescents & Adults → IM injection

0, 1, 6 mos.

Anti - HBs

1. confers protective immunity
2. up to 90 - 95% respond



For People Who Do Not Respond to HBV Vaccination

Results of Additional Injections:

Injection	% Responding
4th	25 %
5th	40 %
6th	50 %

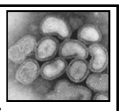
IF recipient negative after 6 injections:

- ⇨ genetic hepatitis B vaccine non-responder.
- ⇨ active hepatitis B virus infection: prodromal or icteric disease phase
- ⇨ hepatitis B carrier (HBsAg +): vaccine ineffective

Hepatitis B Vaccine Long-term Efficacy

- Immunologic memory established following vaccination (90 – 95% adults respond)
- Demonstrated efficacy for > 25 years
- HBV exposure results in anamnestic response
- Booster doses recommended only for hemodialysis pts, & can be considered for others with a weakened immune system.
- Chronic infection rarely documented among vaccine responders

Influenza & Vaccines



- ~24,000 excess deaths per year (1976-2007)
- >90% of deaths ⟹ persons ≥65 years of age
- vaccine targets 3 projected predominant strains for season
- 70 – 90% effective in vaccinated persons
- do not contract the flu from vaccine

⇨ Inactivated subunit (TIV)
- – intramuscular
- – Trivalent (3 current year strains)
- – split virus and subunit types
- – duration of immunity 1 year or less

⇨ Live attenuated vaccine (LAIV)
- – intranasal
- – Trivalent (3 current year strains)
- – duration of immunity at least 1 year

Influenza Vaccine

- Preparations are strain specific—use of current year strain for vaccine
- Goal: reduce influenza complications and mortality
- Contraindications:
  Pregnancy (1st trimester)
  Allergy to eggs or thimersol (no longer used)

Note: Do not get flu from vaccine!

Inactivated Influenza Vaccine Efficacy

- ✓ 70% - 90% effective among healthy persons <65 years of age
- ✓ 30%-40% effective among frail elderly persons
- ✓ 50%-60% effective in preventing hospitalization
- ✓ 80% effective in preventing death
- ✓ Common vaccination adverse reactions:
  - soreness - redness - swelling
  - muscle aches - fever - neuralgia

Rare adverse reaction: Guillan-Bare Syndrome
-- occurs following influenza & some vaccinations
-- 1/millions of vaccine doses

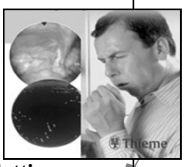
Pertussis Epidemiology

☞ Reservoir	Human Adolescents and adults
☞ Transmission	Respiratory droplets
☞ Communicability	Maximum in catarrhal stage Secondary attack rate up to 80%

- ✓ Incubation period usually 7-10 days (range 4-21 days)
- ✓ Insidious onset, similar to minor upper respiratory infection with nonspecific cough
- ✓ Fever usually minimal throughout course of illness

Bordetella pertussis

- ☞ Humans only reservoir – respiratory droplets
- ☞ Whooping cough (pertussis = violent cough)
- ☞ IP: 7 -21 days
- ☞ Pathogenesis: colonization of URT surfaces
  - tracheal toxin slows ciliary action
  - epithelial cell death
  - fever, excessive mucus output,
  - coughing; "whoop" sound narrowed glottis
- ☞ Epidemiology:
  - inhalation of infected droplets
  - older children & adults milder symptoms

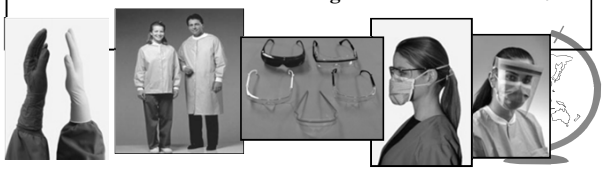


Pertussis-containing Vaccines

- ☞ DTaP (pediatric)
  - approved for children 6 weeks thru 6 years (to age 7 years)
  - contains same amount of diphtheria & tetanus toxoid as pediatric DT
- ☞ Tdap (adolescent and adult)
  - approved for persons 10 through 18 years (Boostrix) and 11 through 64 years (Adacel)
  - contains lesser amount of diphtheria toxoid & acellular pertussis antigen than DTaP

Personal Protective Equipment

- ✓ A major component of Standard Precautions
- ✓ Protects skin & mucous membranes from exposure to infectious materials in spray or spatter
- ✓ Proven effectiveness against microbial pathogens
- ✓ Should be removed when leaving treatment areas CDC/JAM

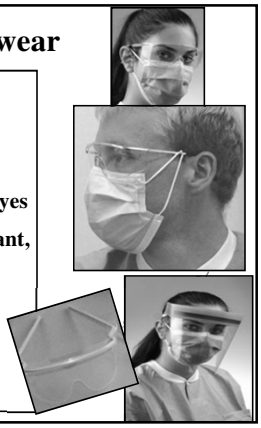


Gloves: Types

- ✓ Patient exam: non-sterile
- ✓ Sterile surgeon's: tactility, comfort, dexterity
- ✓ Non-medical (utility): thick, reusable
- ✓ Latex: "Gold" standard
- ✓ Vinyl : early high failure rates -- improving
- ✓ Nitrile, chloroprene, polyurethane, etc.
- ✓ Ambidextrous vs. right/left fitted
- ✓ Public Citizen petition to FDA (4/2011):
  - -- call to ban latex gloves
  - -- allergic rx risks cited (latex, powder)

Protective Eyewear

- Meets/exceeds ANSI standards
- High impact resistance
- Side shields
- Sufficient size to cover and protect eyes
- Desirable: no fogging, scratch resistant, anti-static
- Face shields effective – must still use mask
- Disposable eyewear available

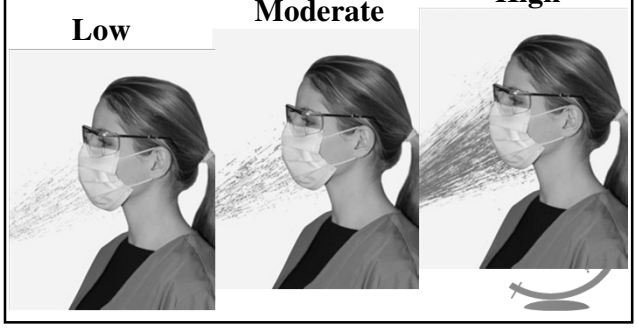


American Society for Testing and Materials (ASTM)

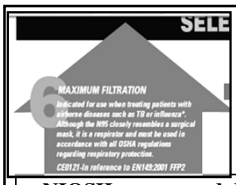
Low

Moderate

High



N – 95 Respirators



- NIOSH – approved disposable respirators – type of particulate respirator mask (PRM)
- For: HCW working in close contact c pts with A/H1N1 influenza or influenza-like illness
- More efficient than masks used for routine pt treatment
- Work best when fitted properly - employers to ensure
- Note: more efficient the PRM, the more difficult breathing through them ---- greater perceived discomfort

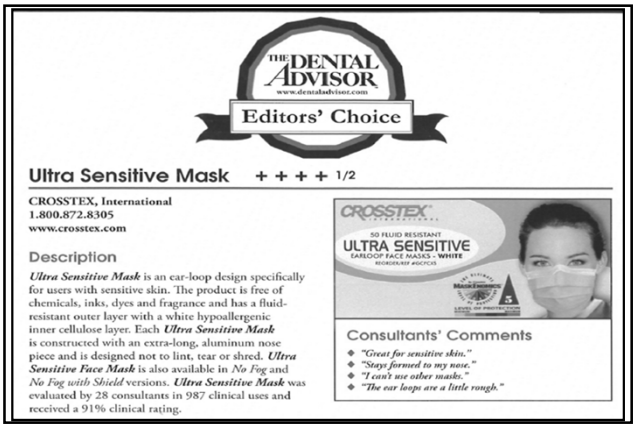
Masks, Protective Eyewear, Face Shields

- Wear surgical mask & either eye protection with solid side shields or face shield to protect mucous membranes of eyes, nose, & mouth
- protection between patients; if visibly soiled, clean and disinfect Be certain of proper fit for masks & eyewear
- Change masks between patients
- Clean reusable face

CDC/JAM

Fluid Resistance

- Remember: masks saturated from both sides
- "Wicking" of fluids through wet mask
- 20 min. routine use-life
- Face shield may lengthen use-life
- Position mask to "stand out" from face



AVAILABLE STERILIZATION METHODS

- Steam under pressure
- Prolonged dry heat
- Rapid heat transfer
- Unsaturated chemical vapor

Heat – stable items

- Ethylene oxide
- Chemical (cold) sterilization

Heat – labile items

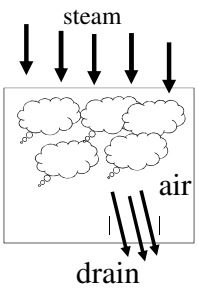
JAM

Liquid Chemical Sterilization

Advantages	Disadvantages
☞ Can sterilize items that would be damaged by heat	☞ Less reliable than heat methods ☞ Very time-consuming & limited use-life ☞ Expensive ☞ Cannot be spore tested ☞ Toxic fumes may require special ventilation ☞ Potential for allergic reactions ☞ PPE required during use ☞ Cannot package items ☞ Sterilized items must be rinsed off with STERILE water ☞ Inst corrosion or rusting

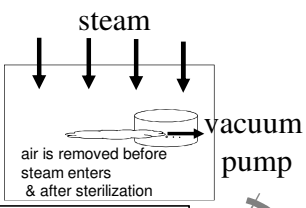
STOP
DANGER
HAZARD

Gravity Steam Sterilizers



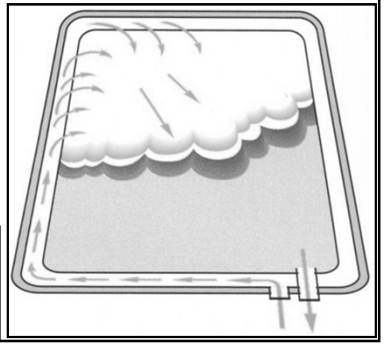
⇨10 to 25 minutes exposure time at 132º - 135ºC (270ºF to 275ºF)
⇨15 to 30 minutes exposure time at 121º - 123ºC (250ºF to 254ºF)
⇨Drying times vary according to load configuration, materials, contents

Pre- & Post-vacuum Steam Sterilizers

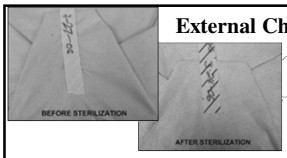


⇨ 3 to 4 min at 132 – 135C (270 – 275F)
⇨ Evacuate chamber to enhance steam penetration
More effective sterilization of handpieces & wrapped items
⇨ Post-vacuum cycle
Evacuate chamber to enhance drying
Decreased corrosion of high-carbon steel

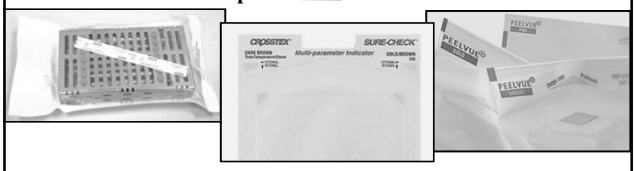
Steam Injection & Positive Pressure Pulse Displacement Autoclave



External Chemical Indicator: Autoclave Tape

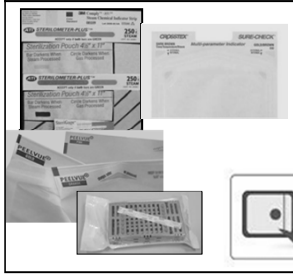


Representative Pouches with External & Internal Chemical Multi-parameter Indicators *



* temperature, pressure, time

Sterilization Monitoring

Chemical Monitoring	Biological Monitoring:
	❑ In Office ❑ Mail Service - company - dental school

The Dental Advisor
Sterilizer Monitor

Value of Biological Monitoring Systems

They Test:

- Packaging material
- Packaging procedures
- Sterilizer loading
- Sterilizer use
- Sterilizer functioning
- Sterilizer maintenance

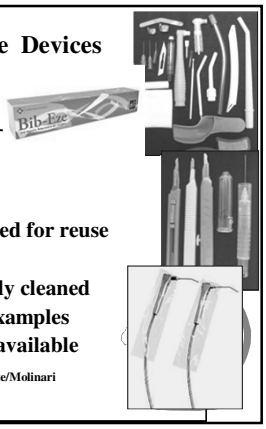
→ **Person In Charge**

JAM

Common Errors (All Sterilizer Types)

- Improper pre-cleaning, organic debris
- Incorrect or excessive packaging
- Overloading the sterilizer
- Improper time, temperature & pressure parameters
- Inadequate sterilizer maintenance
- Use of inappropriate equipment
  (e.g. household ovens, toaster ovens)

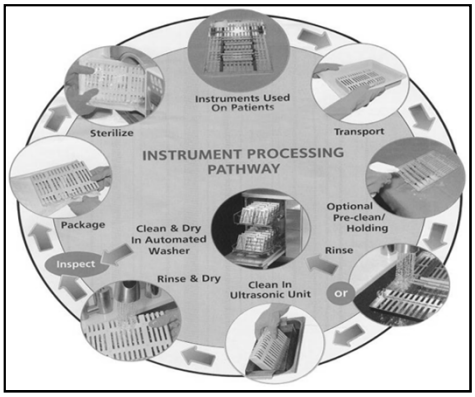
Single-Use Disposable Devices



- Introduced in 1960's -- promoted as convenient & easy to use
- Designed for use on 1 patient only
- Not intended to be cleaned & sterilized for reuse on another patient
- Not heat tolerant & cannot be reliably cleaned
- Numerous single-use & disposable examples
- More recyclables & biodegradables available

Harte/Molinari

Instrument Reprocessing



Spaulding Classification

TABLE 11-1 Categories of Patient-Care Items

Category	Definition	Examples in Dentistry	Comments
Critical	Penetrate soft tissue, contact bone, enter into or contact the bloodstream or other normally sterile tissue.	Surgical instruments, periodontal scalers, scalpels, surgical dental burs	Have the greatest risk of transmitting infection—clean and heat sterilize.
Semicritical	Contact mucous membranes or nonintact skin, but will not penetrate soft tissue, contact bone, or enter into or contact the bloodstream or other normally sterile tissue.	Dental mouth mirror, amalgam condenser, reusable dental impression trays, dental handpieces.*	Have a lower risk of transmission—clean and heat sterilize. If a semicritical item is heat-sensitive, it should, at a minimum, be processed with high-level disinfection.
Noncritical	Contact with intact skin.	Radiograph head/cone, blood pressure cuff, facebow, pulse oximeter.	Pose the least risk of transmission of infection—clean and disinfect or use disposable barrier protection.

*Although dental handpieces are "by definition" considered a semicritical item, they should always be heat-sterilized between uses and not high-level disinfected.
Adapted from CDC. Guidelines for infection control in dental health-care settings–2003. MMWR 2003;52(RR-17):20.

Critical Items ---- penetrate tissue or bone
Semicritical Items ---- touch mucous membranes
Noncritical Items ---- touch intact skin

Central Instrument Processing
Work Area Design

Cleaning
- Receiving, sorting, and cleaning reusable contaminated instruments and devices

Packaging
- Inspecting, assembling, and packaging clean instruments in preparation for final processing

Sterilization
- Sterilization equipment and related supplies and adequate space for loading, unloading, and cool down; may also include incubators for analyzing spore tests and enclosed storage for sterile items and disposable (single-use) items

Storage
- Enclosed storage for sterile and disposable (single-use) items

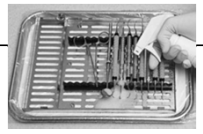
where is your office?

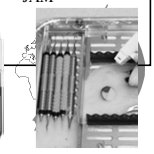
multiple opinions & approaches for individual practices

Holding Solutions or Foam Sprays (optional step)

- **Goal: avoid drying of debris prior to cleaning & sterilization**
  - **- loosen debris**
  - **- helps to decrease contaminant MO's**
  - **- minimize instrument handling**
- **- soap & water -- ultrasonic cleaning soln**
  - **- foam sprays c enzymes available**
- **NEVER, EVER use glutaraldehydes !**

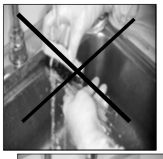


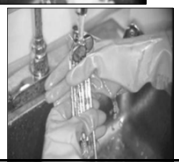




JAM


Cleaning Instruments: Options

"Cleaning is the first step in every decontamination process" (CDC)


Ultrasonics

Mechanical (Hand Scrubbing)

Inst Washer / Disinfectors


Sterilization and Disinfection of Patient-Care Items

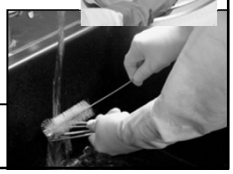
C. Receiving, Cleaning, and Decontamination Work Area

1. Minimize handling of loose contaminated instruments during transport to the instrument processing area (II).
2. Use automated cleaning equipment (e.g. ultrasonic cleaner or washer-disinfector) to remove debris to improve cleaning effectiveness and decrease worker exposure to blood (IB).
3. **Use work-practice controls that minimize contact with sharp instruments if manual cleaning is necessary (e.g. long-handled brush) (IB).**
4. Wear appropriate PPE (e.g. mask, protective eyewear, and gown) when splashing or spraying is anticipated during cleaning (IC).

MMWR 2003; 52(RR-17):1-66

Manual Instrument Cleaning

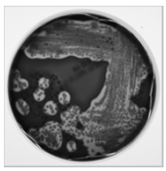
- Effective at removing debris
- Not as efficient as mechanical cleaners
- Dangerous – increased potential for sharps exposure when scrubbing instruments
- When need to scrub contaminated insts, use long-handle brush
- Wear utility gloves & other
- Use engineering controls

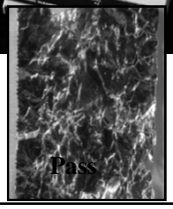



Ultrasonic Cleaners

- **Wear PPE – Utility gloves, mask, glasses, gown**
- **Sound waves cause bubbles to implode, loosening debris**
- **Use only correct solution, change daily**
- **Never overload**
- **Rinse instruments after cycle**
- **Dry before placing in pouches / wraps**
- **Keep lid on during use**
- **Periodic foil test for unit efficacy**


Ultrasonic Unit Testing


Pass


Fail

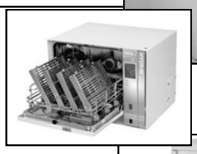
Automated Instrument Cleaning

⇨ **effective**

⇨ **efficiency**

⇨ **↓ exposure to blood & body fluids**

⇨ **↓ exposure to sharps**



instrument washers
NOT
dish washers !

Cleaning Efficacy of Miele Washer/Disinfector

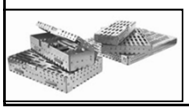
John A. Molinari, Ph.D., and Joelle Prose, M.B.S.
THE DENTAL ADVISOR Biomaterials Research Center
Dental Consultants, Inc., Ann Arbor, Michigan

Purpose – The purposes of this study were to investigate the efficacy of the *Miele G7881 Washer/Disinfector* with regard to:

1. Removing bioburden and contaminant microorganisms on instruments and cassettes used in a dental practice;
2. The antimicrobial effects of the washer/disinfector cycle on processed inanimate surfaces.

INSTRUMENT REPROCESSING CONSIDERATIONS: Cassettes

- ✓ initial cassette + compatible equipment cost
- ✓ most students now learn using cassettes
- ✓ less handling of contaminated instruments: reduced sharps – injury potential
- ✓ instruments tightly secured in cassettes:
  - -- rails hold instruments in place
  - -- less damage potential
- ✓ faster reprocessing & less inst handling

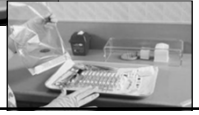


Paper Side Up?

What Do You Think?

Paper Side Down ?

Sterilized Wrapped Instruments

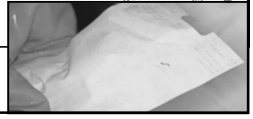


Keeping Instruments Wrapped Until Patient Treatment

The Pay – off : Patients Note Sterile Packages (Perception & Reality)

Storage & Use of Reprocessed Instruments

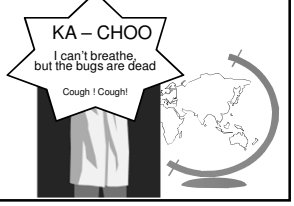
- **sterile insts dated & maintained as sterile until use**
- **Event – Related vs. Date-Related Shelf Life**
- **reprocessed insts stored in clean, dry location in manner to prevent contamination during storage**
- **inspect instrument package for integrity & dryness before opening ⟹**
- **if compromised -- insts cleaned, packaged, re-sterilized**



Principle 3
Limit the Spread of Contamination

- Cover surfaces that may become contaminated
- Disinfect surfaces
- Minimize sprays and splashes
- Properly dispose of medical waste CDC (2003)

Beware of the dangers of
- overspraying
- aerosols



Categories of Patient items

-- Critical
-- Semi-Critical
-- Noncritical

Categories of Environmental Surfaces

-- Clinic Contact Surfaces: (light handles, switches, tray) may be touched frequently with gloved hand during pt care, or may become contaminated with blood / OPIM
-- Housekeeping Surfaces: (floors, walls, sinks) do not come into contact with devices used in dental procedures

Surface Covers:

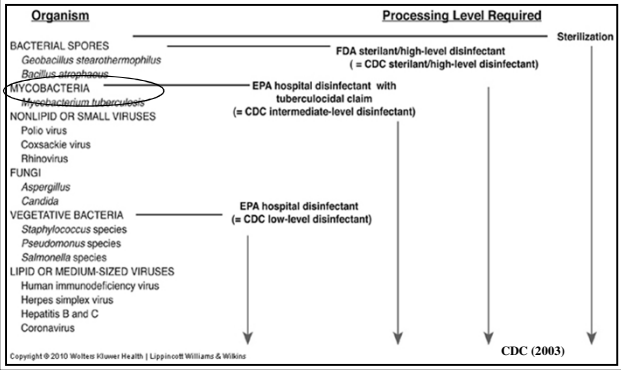
Advantages

1. Prevents contamination
2. Protects difficult-to-clean surfaces
3. Less time consuming
4. Reduces chemical use
5. More eco-friendly choices

Disadvantages

1. Need varied sizes / types
2. Non-biogradable plastics
3. Esthetically undesirable?
4. Additional costs over chemical sprays ?

Efficacy of Chemical Germicides



CDC (2003)

Surface Sprays: Pre-cleaning & Disinfection

Advantages

1. Purchase fewer items with multiple uses
2. May be less expensive than covers
3. Does not change esthetic appearance of office
4. Does not add plastic to environment
5. Eco-friendly choices becoming available

Disadvantages

1. More time-consuming than replacing covers (?)
2. Must use PPE for protection against chemicals
3. Cannot pre-clean some surfaces
4. Chemical & equipment compatibility issues
5. Chemical MSDS required
6. Need to label chemical containers
7. May need to periodically prepare use dilutions
8. Must dispose chemical according to environmental laws

Pre-Saturated Disinfectant Cloth Wipes

- ✓ "Wipe-discard-wipe" technique
  - – Cleaning & disinfection requires two cloths
- ✓ Produce less environmental chemical exposure
- ✓ More eco-friendly choices
- ✓ Disinfectant may evaporate too quickly
  - – Newer, thicker wipes address this issue

How Many Swipes Are Needed?

- ✓ Measured bacterial count reduction on environmental surfaces using 1,3, or 5 swipes
- ✓ Wipes: - Caviwipes: (14.3% isoprop +0.23% quat)
  - GreenWorks: (5% ETOH)
  - Accel TB Wipes: (0.5% H_2O_2)
  - Solu IV Antiseptic Wipes: (0.5% CHG+ 70% isoprop)
  - Saline-wetted wipes
- ✓ Decreased levels c increasing # swipes regardless of wipe type
  swiping surface 3-5 times eliminated more than 1 swipe
  3 swipes decreased bacterial load by 88%
  when 1 swipe used: disinfectant wipes better than saline wipes
- ✓ No statistical difference in type of wipe used

Berendt, et al. AJIC 39:442 (2011)

General Cleaning Recommendations

- ☞ **Use PPE precautions (e.g., heavy-duty utility gloves, masks, protective eyewear) when cleaning and disinfecting environmental surfaces**
- ☞ **Physical removal of microorganisms by cleaning is as important as the disinfection process**
- ☞ **Follow manufacturer's instructions for disinfectant use – Do Not Make Your Own Wipes From Disinfectants Approved As Sprays Only !!**
- ☞ **Do not use sterilant/high-level disinfectants on environmental surfaces**

CDC/JAM (2003,2010)

Use of Green Cleaning

- ☛ **Use of cleaning products claiming to be gentle on environment (i.e. glass cleaners, carpet spot cleaners, odor eliminators, toilet cleaners)**
- ☛ **Some "green" products are "green" because they have a reduced active agent concentration– may reduce product effectiveness**
  -- evaluate product effectiveness & "green" features

Environmental Surface Asepsis

- ☐ **Important Terms:**
  - **-- cleaning**
  - **-- disinfection**
  - **-- clinical contact surfaces**
  - **-- housekeeping surfaces**
  - **-- high - level disinfectant**
  - **-- intermediate - level disinfectant**
  - **-- low - level disinfectant**
  - **-- tuberculocidal**
  - **-- disinfectant use life & shelf life**

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Representative Label Content & Directions For Disinfectant Use: Look For ….

- -- **"It is a violation of Federal law to use this product in a manner inconsistent with its labeling."**
- -- **Precautionary statement: Hazardous to humans and domestic animals.**
- -- **Approved by EPA as pesticides.**
- -- **Cleaning required before disinfecting:**
  - **"Remove gross debris prior to disinfection"**
  - **" Spray onto pre-cleaned surfaces for disinfection"**
  - **"Pre-clean contaminated surfaces thoroughly before disinfection"**

Environmental Surface Take Home Messages

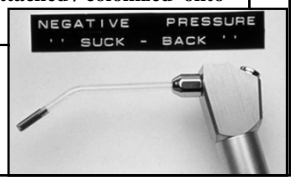
1. **Many products available**
2. **Consider surface barriers for difficult-to-clean areas**
3. **Evaluate properties of surface cleaners and disinfectants before purchase**
4. **Surface cleaning can remove >95% surface debris**
5. **Certain products useful as both cleaners & disinfectants**
6. **Surface wipes reduce aerosolized chemicals**
7. **Choices: no single available product is the only one to use**
8. **Major emerging "Green" IC area**

Dental Unit Waterline (DUWL) Asepsis

- ☐ **Sanitized, Potable, Drinking Water (PH Standards): 500 CFU/ml of heterotrophic bacteria**
- ☐ **Most untreated dental unit water samples: 1,000 to 10,000 CFU (some DUWL > 1,000,000 CFU documented)**
- ☐ **CDC Recommendation (2003): Use water that meets regulatory standards for drinking water (fewer than 500 CFU/ml of heterotrophic water bacteria) for routine dental treatment output water.**

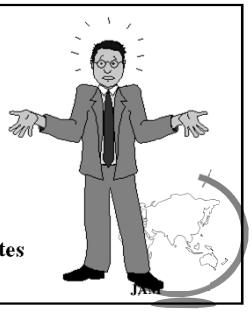
MICROORGANISMS IN DUWL

- **sources for bacteria, protozoa, & fungi:**
  - **1. incoming municipal water -- sanitized.**
  - **2. patient's mouth -- normal oral flora.**
- **retraction of microbes into lines:**
  - **- planktonic = in free – flowing lumen fluid.**
  - **- biofilm = tenaciously attached / colonized onto line walls.**



Reported Associated Illnesses from Contaminated Water

- **Gastroenteritis (*E. coli*, enterics)**
- **Nosocomial surgical infections**
- **Pneumonia, Bronchitis**
- **Legionellosis**
- **Abscesses, Septicemia**
- **Appendicitis**
- **Viral hepatitis (HAV; HEV)**
- **Salmonella poisoning**
- **Cryptosporidiosis & other parasites**
- **Head & neck infections (?)**



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Potential Effects on Health

- documented evidence for waterborne infections & disease in multiple hospital /public health settings.
- many involve medical devices (nebulizers, endoscopes, hemodialysis units).
- **most MO's from DUWL from public water supply, & do not pose high disease risk for HEALTHY persons.**
- **increasing # of immune compromised dental pts – common waterborne bacteria present increased infection / illness risks.**
- dental evidence:
  - -- higher Ab titers against *Legionella sp.* in dental personnel compared to other control populations (2 studies)
  - no *Legionella* disease documented in DHCW
  - -- DUWL implicated as source for localized Pseudomonas infections in 2 immune comp pts, carriage of same strain in 78 other persons

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DUWL CONCEPTS

No current definable public health problem
but
Waterborne infection is a major public health concern
and
Unacceptable to use highly colonized water for any kind of dental treatment

Representative DUWL Solutions

- **Autoclavable water delivery systems**
- **Self – contained water units**
  - **can use biocides for periodic disinfection**
- **Physical barriers**
  - **point – of – use filters (0.22 u)**
  - **water entry filters**
  - **improved pinch, check, & anti-retraction valves**
- **Water treatment strategies**
  - **UV, ozonization**
  - **super heating at entrance to office**

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DUWL Asepsis Take Home Messages

1. **Difficult to ascertain infection risks from DUWL**
2. **Most DUWL microorganisms do not usually pose high disease risk to healthy persons.**
3. **Increasing #'s of immune compromised outpatients**
4. **Ensure provision of clean water during dental procedures**
5. **Wide variety of DUWL cleaners & maintenance products available**
6. **Basic IC premise applies – initial cleaning of DUWL to remove biofilm, before waterline microbial maintenance**
7. **Consider staff compliance**