Infection Control: That Thing You Do

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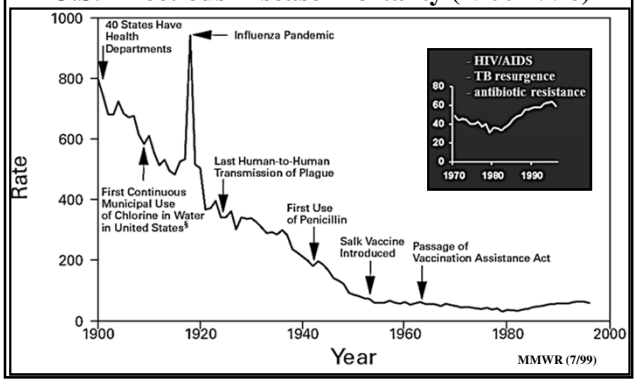
Disclosures:
-- Consultant, Hu-Friedy Manufacturing, Inc
-- Consultant, SciCan, Inc

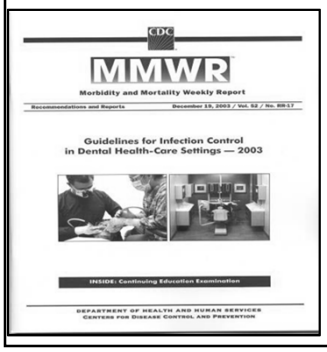
U.S. Infectious Disease Mortality (1900-1996)



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

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

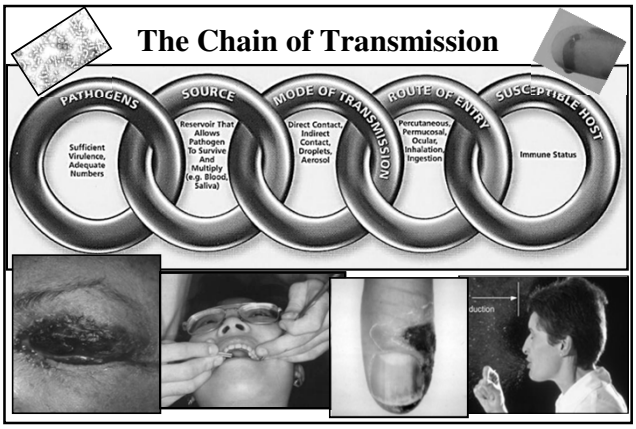
COMPLIANCE

WHY Continue To Be Scrutinized For IC?

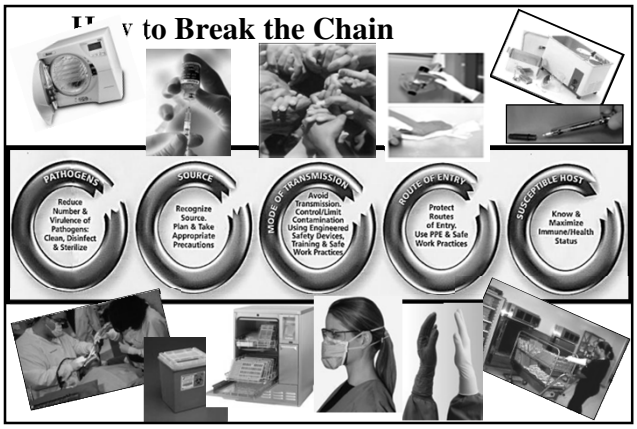
- ✓ **2007 ((NV): Hepatitis C transmission in med practice associated with re-use of multi-dose anesthetic vials**
- ✓ **2007 (NM): Pt-to-Pt HBV transmission in an O.S. practice**
- ✓ **2009 (FL): Possible infection transmission to >3,000 vets from improperly sterilized tubing with endoscopes**
- ✓ **2010 (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**
- ✓ **2012 (Italy): 1st reported Legionella case from DUWL**

AND MORE …….

The Chain of Transmission



H v to Break the Chain



Basic Infection Control Principles

- ✓ **Immunize against vaccine-preventable diseases**
- ❑✓ **Perform effective hand hygiene**
- ❑✓ **Use personal protective equipment (PPE)**
- ✓ **Heat sterilize all reusable patient care instruments/items used intraorally**
- ❑✓ **Use respiratory hygiene/cough etiquette**
- ✓ **Prevent cross-contamination with aseptic technique & environmental asepsis**
- ❑✓ **Prevent sharps injuries by using safe work practices & engineering controls**

JAM

POSSIBLE HCW PERCEPTIONS

<u>Ineffectiveness</u> of certain recommendations vs. <u>Overkill</u> of infection control vs. <u>Overlap</u> of effective procedures

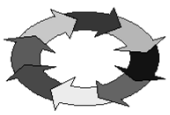
Lack of Adherence to Basic Infection Control Principles & Practices

↓

Lessens Margin of Effectiveness Overlap

↓

Increases Cross-Infection Risk



ASEPTIC TECHNIQUE

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

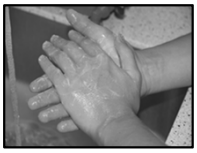
Applications & Examples:

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

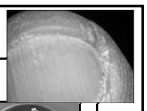
Hand Hygiene

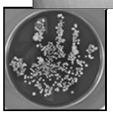
(previously termed "hand washing")

- **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**



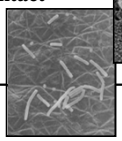
Types of Microflora

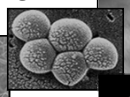


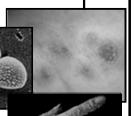


- **Resident flora – normal body flora**
  - **-- located on skin & in deeper skin layers**
  - **-- provide immune protection**
  - **-- if disrupted, re-establish at same site**

- **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)**

HAND HYGIENE

Multiple Acceptable Choices

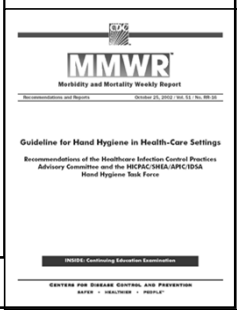
- **Non-antimicrobial**
- **Antiseptic**
- **Alcohol-based**

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)



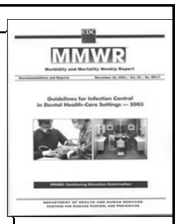
III. Hand Hygiene

A. General Considerations

1. **Perform hand hygiene with either a non-microbial or antimicrobial soap and water when hands are visibly dirty or contaminated with blood or other potentially infectious material. If hands are not visibly soiled, an alcohol-based hand rub can also be used. Follow the manufacturer's instructions.**

2. **For oral surgical procedures, perform surgical hand antisepsis before donning sterile surgeon's gloves**

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

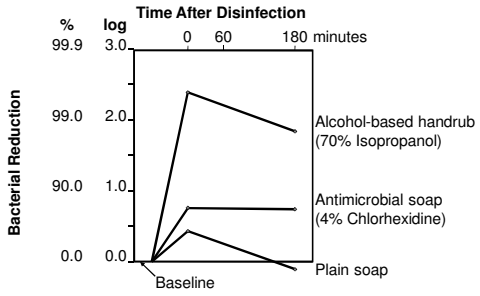


Antimicrobial Spectrum / Characteristics of Hand Hygiene Antiseptic Agents

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
Triclosan	+++	++	+	–	+++	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

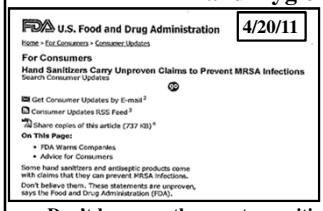
Pros (+)

- 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 4/20/11
Home > For Consumers > Consumer Updates
For Consumers
Hand Sanitizers Carry Unproven Claims to Prevent MRSA Infections
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On This Page:
• FDA Warns Companies
• 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).

- **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

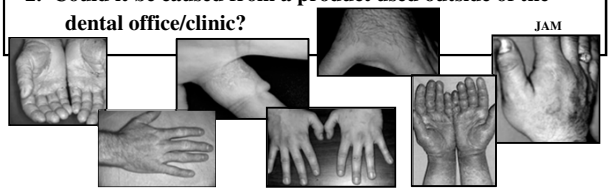
- Professional vs. personal hand products
- Concentration of emollients in waterless products:
  lubricates & reduces drying action of alcohol on skin
- Emollient accumulation on skin:
  seen with product repeated use - soap & water removal
- Supplemental hand lotions/creams:
  important factor contributing 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?



JAM

Standard Precautions

☞ Apply to all patients

☞ Integrate & expand universal precautions

☞ Standard precautions for preventing disease transmission include:

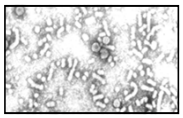
- ✓ Hand hygiene
- ✓ Use of personal protective equipment (PPE)
- ✓ Cleaning and decontamination of instruments
- ✓ Cleaning & disinfection of environment surfaces
- ✓ Injury prevention

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)



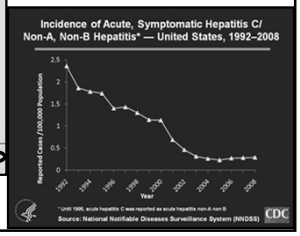
Hepatitis C Disease Burden

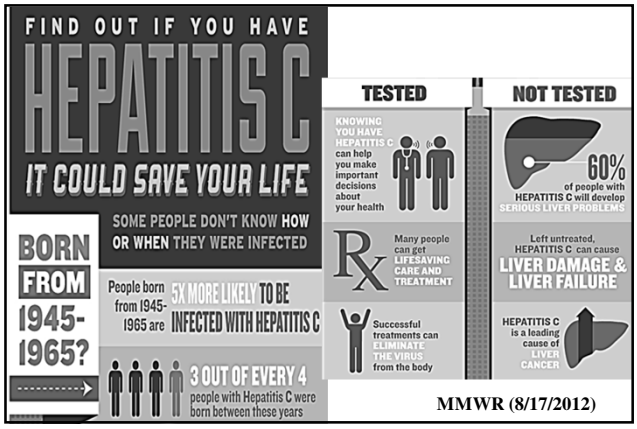
☞ Primarily bloodborne transmission
☞ Sexual & perinatal transmission – not as efficient
☞ Concern for needlestick & other occupational sharps injuries

	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					

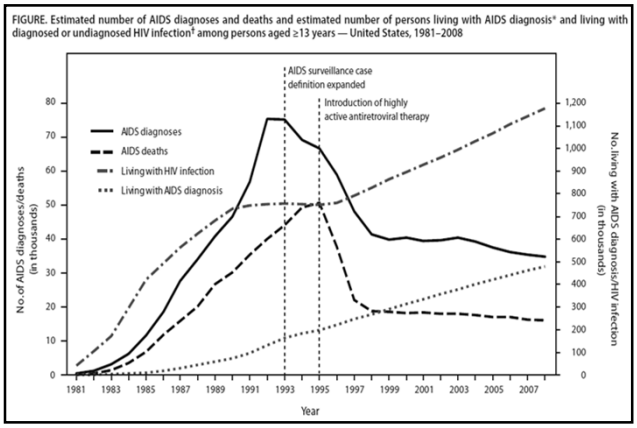
Hepatitis C Incidence

- 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





MMWR (8/17/2012)

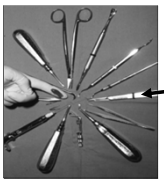


Potential Transmission Risks To HCWs

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

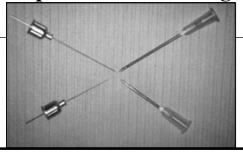
Healthcare Personnel with Documented and Possible Occupationally Acquired HIV Infection, by Occupation, 1981-2010

Occupation	Documented	Possible
Nurse	24	36
Laboratory worker, clinical	16	17
Physician, nonsurgical	6	13
Laboratory technician, nonclinical	3	-
Housekeeper/maintenance worker	2	14
Technician, surgical	2	2
Embalmer/morgue technician	1	2
Health aide/attendant	1	15
Respiratory therapist	1	2
Technician, dialysis	1	3
Dental worker, including dentist	-	6
Emergency medical technician/paramedic	-	12
Physician, surgical	-	6
Other technician/therapist	-	9
Other healthcare occupation	-	6
Total	**57**	**143**

CDC Surveillance as of Dec. 2010 Updated May 23, 2011

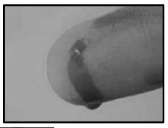
Characteristics of Percutaneous Injuries Among DHCP

- 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 prompt reporting, evaluation, counseling, treatment, and medical follow-up of occupational exposures
- Establish referral mechanisms to qualified health-care professional



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

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

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HEPATITIS B VACCINATION SCHEDULE

HBsAg + Alum Adjuvant

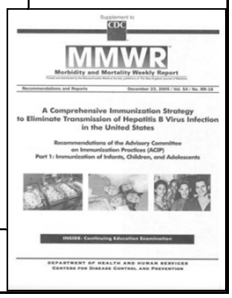
Adolescents & Adults

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.**

HBV Vaccine Recommendations for Diabetes

- **continuing hepatitis B outbreaks in LTC suggests risks for adults living with diabetes may be substantial.**
- **based on available information (i.e. HBV risk, morbidity, mortality, available vaccines, age at diagnosis of diabetes, cost-effectiveness), ACIP recommends the following:**

✓HBV vaccination **should** be administered to unvaccinated adults with diabetes mellitus who are aged 19 - 59 years (recommendation category A; evidence type 2).

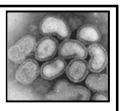
✓HBV vaccination **may** be administered at discretion of treating MD to unvaccinated adults with diabetes mellitus who are aged ≥60 years (recommendation category B; evidence type 2).

CDC. MMWR (12/23/2011)

Influenza Clinical Features & Viral Shedding

- ⇨ **Incubation period 2 days (range 1 - 4 days)**
- ⇨ **Adults infectious 1 day before symptoms thru 5 days after onset of illness (children up to 10 days).**
  - severely compromised pts can shed virus wks months.
- ⇨ **Illness severity depends on prior experience c related virus variants (possible cross–reacting Ab).**
- ⇨ **Abrupt onset of constitutional & respiratory symptoms: fever, myalgia, sore throat, malaise, nonproductive cough, headache.**
- ⇨ **Usually resolves in few days – confused with bad cold (?)**

Influenza & Vaccines

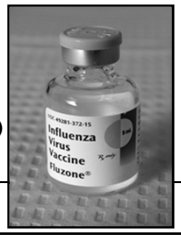


- ❑ **~24,000 excess deaths per year (1976-2007)**
- ❑ **>90% of deaths ⟹ persons ≥65 years of age**
- ❑ **vaccine targets 3 projected predominant strains for season**
- ❑ **70 – 90% effective in vaccinated persons**
- ❑ **do not contract the flu from vaccine**
  - ⇨ **Inactivated subunit (TIV)**
  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

Pertussis Epidemiology

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

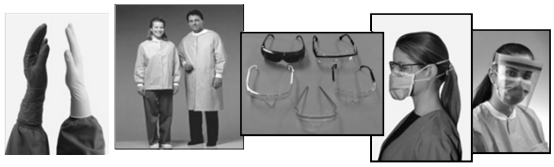
✓ Incubation period usually 7-10 days (range 4-21 days)
✓ Insidious onset, similar to minor upper respiratory infection with nonspecific cough
✓ Fever usually minimal throughout course of illness

Pertussis-containing Vaccines

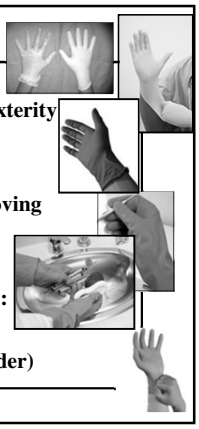
- **DTaP (pediatric)**
  - **approved for children 6 weeks thru 6 years (to age 7 years)**
  - **contains same amount of diphtheria & tetanus toxoid as pediatric DT**
- **Tdap (adolescent and adult)**
  - **approved for persons 10 through 18 years (Boostrix) and 11 through 64 years (Adacel)**
  - **contains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

Masks, Protective Eyewear, Face Shields

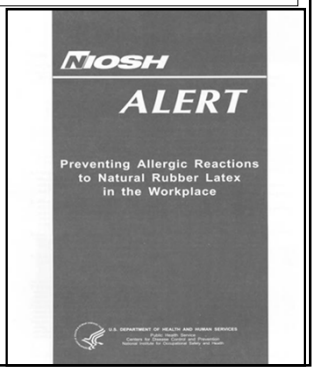
- Wear surgical mask & either eye protection with solid side shields or face shield to protect mucous membranes of eyes, nose, & mouth
- protection between patients; if visibly soiled, clean and disinfect Be certain of proper fit for masks & eyewear
- Change masks between patients
- Clean reusable face

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

GUESS WHO IS ALLERGIC TO LATEX



Latex Hypersensitivity Symptoms

- ❑ **Type I localized:**
  - -- immediate IgE allergic reaction
  - -- develops within minutes to latex protein challenge
  - -- urticaria, hives, pruritus, rhinitis
- ❑ **Type I systemic:**
  - -- more generalized, severe manifestations
  - -- conjunctivitis, laryngeal / respiratory distress
- ❑ **Type IV:**
  - -- delayed, contact dermatitis
  - -- slow-forming, localized rash, necrosis, sloughing
  - -- develops within 12-24 hrs to chemical challenge

JAM

Latex Allergy Risk Factors

- ❑ Persons with multiple surgery hx.
- ❑ Persons with spina bifida (18-68%).
- ❑ Health care workers (3-17%).
- ❑ Rubber industry workers (11%).
- ❑ Atopy - presence of multiple allergies
  note: increasing % of population atopic.
- ❑ Hx certain food allergies: banana, kiwi, avocado, papaya, melon, peach, chestnut, hazelnut, etc. cross - reacting protein allergens in latex sap.

JAM

AVAILABLE STERILIZATION METHODS

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

Heat – stable items

- ❑ Ethylene oxide
- ❑ Chemical (cold) sterilization

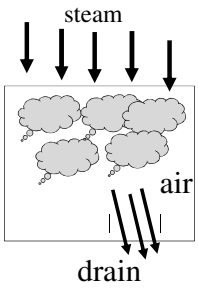
Heat – labile items

JAM

Liquid Chemical Sterilization

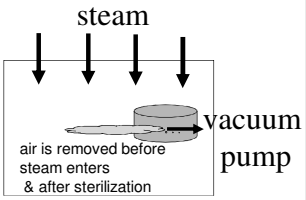
Advantages	Disadvantages
• Can sterilize items that would be damaged by heat	• Less reliable than heat methods • Very time-consuming & limited use-life • Expensive • Cannot be spore tested • Toxic fumes may require special ventilation • Potential for allergic reactions • PPE required during use • Cannot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

Gravity Steam Sterilizers



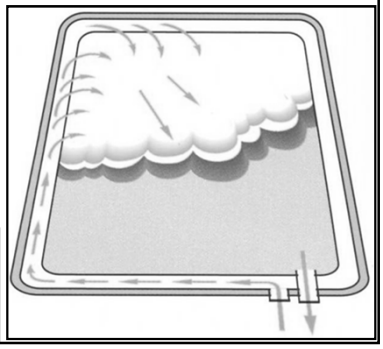
- ⇨10 to 25 minutes exposure time at 132° - 135°C (270°F to 275°F)
- ⇨15 to 30 minutes exposure time at 121° - 123°C (250°F to 254°F)
- ⇨Drying times vary according to load configuration, materials, contents

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



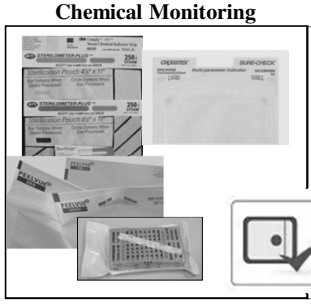
STERILIZATION CYCLE COMPONENTS

- ❑ Heat – up period:
  - must reach sterilizing temperature
- ❑ Exposure interval:
  - time required for sterilization of load
- ❑ Cool down period:
  - allow sufficient cooling for handling
  - removal of excess moisture
  - important for handpiece sterilization & function

JAM

Sterilization Monitoring

Chemical Monitoring



Biological Monitoring:

- ❑ In Office
- ❑ Mail Service
  - company
  - dental school

Value of Biological Monitoring Systems

They Test:

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

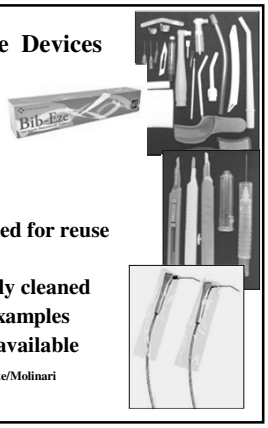
→ Person In Charge

JAM

Common Errors (All Sterilizer Types)

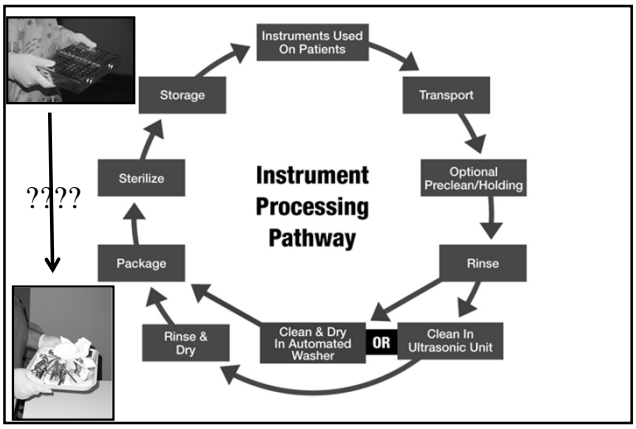
- Improper pre-cleaning, organic debris
- Incorrect or excessive packaging
- Overloading the sterilizer
- Improper time, temperature & pressure parameters
- Inadequate sterilizer maintenance
- Use of inappropriate equipment
  (e.g. household ovens, toaster ovens)

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



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;52RR-17:20.

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

GOAL OF STERILITY ASSURANCE

- Goal: deliver sterile instruments to patients
- Steps for infection control assurance:
  1. select appropriate cleaning, packaging, sterilization, & storage procedures.
  2. written step - by - step training protocols.
  3. perform procedures correctly.
  4. monitor performance
- Human error most common problem !

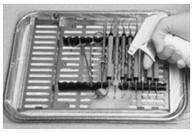
JAM

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 !

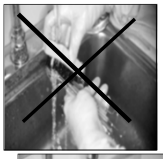
JAM




Cleaning Instruments: Options

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



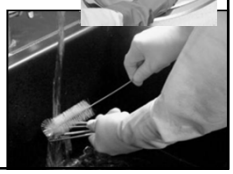
Mechanical (Hand Scrubbing)

Ultrasonics

Inst Washer / Disinfectors

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 PPE
- 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**

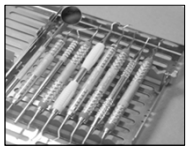
Automated Instrument Cleaning

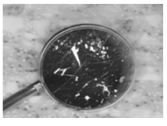
- **effective**
- **efficiency**
- **↓ exposure to blood & body fluids**
- **↓ exposure to sharps**

instrument washers **NOT** dish washers !

Advantages of Cassettes

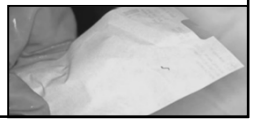
- **Safe transport**
- **Safe instrument cleaning**
- **Ease of instrument set-up**
- **Cannot overload sterilizer**
- **Ease of storage**
- **And….**





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**



Evolution of Dental Handpiece Infection Control

- ⇨ 1978: 1st ADA recommendations:
  "until handpieces can be replaced with models that can be routinely sterilized, scrubbing them in detergent solutions and wiping with alcohol is an alternative"
- ⇨ 1986: 1st CDC recommendations:
  "routine sterilization of handpieces is desirable , however not all handpieces can be sterilized"
- ⇨ 1980: HIV transmission to a dental patient (Acer-Bergalis case)
- ⇨ 1992: Published study re: microbial contamination of internal surfaces
- ⇨ 1992: FDA letter to dentists "recommends.. .. reusable dental handpieces & related instruments …. be sterilized between each patient use"
- ⇨ 1993 & 2003: CDC recommendations
- ⇨ 2008: CDC reaffirmed sterilization between uses & "handpieces that cannot be sterilized should NOT be used." **JAM (2012)**

Clean – Lubricate - Sterilize

- ✓ Follow manufacturer's instructions !!!
- ✓ Careful attn to fiber optics:
  - beware lubricant or dirt collecting between fiber bundles
  - heat sterilization can cause darkened/dimmed light
- ✓ Maximize use – life
- ✓ Minimize repair/replacement costs
- ✓ Do not use surface disinfectants or chemical sterilants
- ✓ Consider automatic handpiece maintenaince system

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

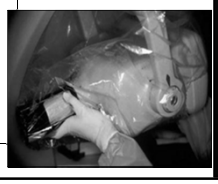
Surface Covers:

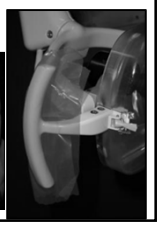
Advantages

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

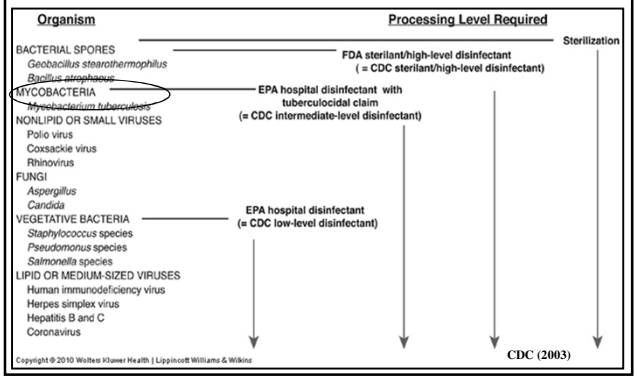
Disadvantages

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





Efficacy of Chemical Germicides



Surface Sprays: Pros and Cons

Pros:

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

Cons:

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

Disinfectant Wipes: Pros and Cons

Advantages:

Tuberculocidal (most)
less chemical sprays in environment
less HCW toxicity reactions due to arosilized disinfectants
more "equipment friendly"
Other classes available (phenolic wipes; H2O2 sodium hypochlorite; quaternary ammoniums (low-level disinfectants)

Disadvantages:

2 wipes needed for cleaning and disinfection
May need more due to large clinical contact area
May evaporate quickly (alcohols)
Potential for misuse by HCW
More expensive than liquid

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

JAM

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.

Representative DUWL Microbes

- Pseudomonas sp.
- Pasteurella sp.
- Micrococcus sp.
- Klebsiella pn.
- Legionella sp.
- Mycobacterium sp.
- Enterococcus sp.
- Actinomyces
- Salmonella
- Streptococcus
- Staphylococcus
- Bacteroides
- Escherichia coli
- Nematodes
- Protozoa, amoebas
- Fungi (Candida, Aspergillus sp.)

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 (?)**

JAM

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

JAM

Recent DUWL Developments

~~No current definable public health problem~~

Waterborne infection is a major public health concern

and

Unacceptable to use highly colonized water for any kind of dental treatment

1st Reported Case of *Legionella* From DUWL

- **Italian case report published in LANCET (February 18, 2012)**
- **82 yr. old woman died from Legionnaires disease after hospitalization**
- **During *Legionella* incubation period, only left house for 2 dental visits**
- **No underlying disease or other obvious *Legionella* risks**
- ***L. pneumophila* serogroup 1 isolated from bronchial aspirate & DUWL**
- **Dental office tests: $4x10^3$ CFU/mL from DUWL; $6.2x10^4$ CFU/mL from high speed handpiece turbine**
- **"Benidorm" *L. pneumophila* subgroup isolated from aspirate & DUWL:**
  - **same rare sequence type (ST 593) found in both**
  - **one of most virulent *L. pneumophila* subgroups**
- **No other Legionnaires' Disease or Pontiac Fever cases found among dental staff or practice pts identified by epidemiological investigation**

Ricci, Fontana, Pinci, et al. Lancet 379:684(2012)

DUWL, Biofilm, & Water Quality

- **A. General Recommendations**

1. Use water that meets EPA regulatory standards for drinking water (i.e. less than/equal to 500 CFU/mL of heterotrophic bacteria for routine dental treatment output water (*IB, IC*).
2. Consult with dental unit manufacturer for appropriate methods & equipment to maintain the recommended quality of water (*II*).
3. Follow recommendations for monitoring water quality ….
4. Discharge water & air for a minimum of 20-30 seconds after each patient ….. *(II).*
5. Consult with … manufacturer on need for periodic maintenance of anti-retraction mechanisms *(IB)* **CDC (2003)**

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**

JAM