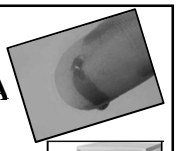
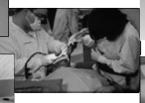
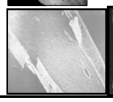










Let's Talk about Infection Control & OSHA

John A. Molinari, Ph.D.
Director of Infection Control
THE DENTAL ADVISOR

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

WHY Continue To Be Concerned?

- ✓ **2007 ((NV): Hepatitis C transmission in med practice associated with re-use of multi-dose anesthetic vials**
- ✓ **2012 (Italy): 1st reported Legionella case from DUWL**
- ✓ **2012: MERS-CoV outbreak in Middle East & spread to other countries**
- ✓ **2013 (OK): OS office c multiple safety violations**
  1st case dental pt-to-pt hepatitis C transmission
- ✓ **2013 CA: Antibiotic-resistant *Enterobacteriacae***
- ✓ **2014: Ebola outbreak**
- ✓ **2014 (CA): Measles outbreak in unvaccinated persons**

Transmission of Bloodborne Pathogens in Dental Settings: CDC (2002-2014)

- No confirmed reports of HIV transmission in dental settings or transmission of a BBP b/w a patient and DHCP

Setting	Year	Pathogen	No. Infected	Comments
OMS Practice	2002	HBV	1	• Pt-to-Pt
Portable Dental clinic in school gymnasium	2009	HBV	5	• Multiple procedural & infection control breaches • Of the 5 cases, 3 were patients & 2 were non-professional volunteers
OMS Practice	2013	HCV	1	• Pt-to Pt • Multiple breaches in injection safety documented

Cleveland. CDC. (2015)

Infectious Disease Emergence Factors

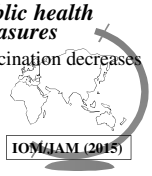
Human demographics and behavior
International travel and commerce
Technology and industry
Human susceptibility to infection
War and famine
Lack of political will
Poverty and social inequality

Microbial adaptation and change
Antibiotic misuse
Microbiotome changes

Emergence

Breakdown in public health measures
Vaccination decreases

Ecological factors
Zoonotic diseases
Economic development & land use
Changing ecosystems
Climate & weather

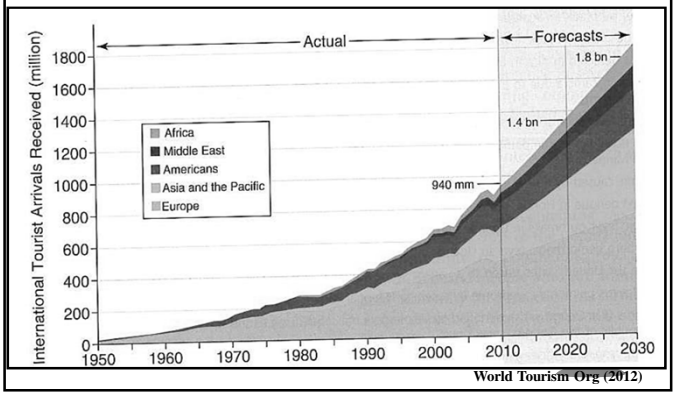


IOM/JAM (2015)

Contributing Factors for Reemergence of Vaccine-Preventable Diseases

Factor	Examples
Failure to vaccinate by HC system	Missed opportunities (clinician practice, financial, or system constraints)
Patient or parent refusal or deferral	Religious exemptions, person beliefs, vaccine hesitancy
Vaccine failure (i.e. moderate or low vaccine efficacy & waning immunity over time	Mumps vaccine efficacy in setting of high disease incidence; waning immunity after pertussis vaccination
Pathogen "escape" from vaccine-induced immunity	Serotype replacement (i.e. capsular switching in *Streptococcus pneumoniae*)

International Tourism/Travel Trends (1950-2030)



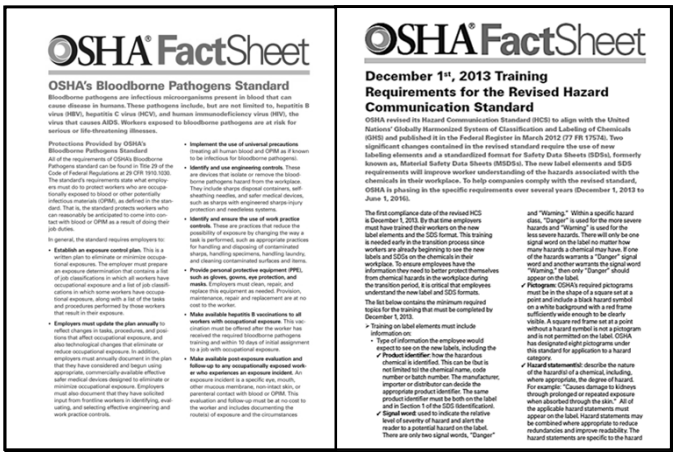
World Tourism Org (2012)

Status of CDC Dental Guidelines for Infection Control

- No evidence to support changes to 2003 guidelines
  - Principles of infection prevention have not changed
  - COMPLIANCE issues, not the ineffectiveness of current recommendations

- Summary of basic infection prevention expectations for safe care in all dental settings
  - Based on Standard Precautions
  - Supplements existing CDC recommendations (not a replacement)
  - Provides links to references & additional resources + a checklist

CDC. OSAP Mtg (2015)



OSHA FactSheet

OSHA's Bloodborne Pathogens Standard

Bloodborne pathogens are infectious microorganisms present in blood that can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV), the virus that causes AIDS. Workers exposed to bloodborne pathogens are at risk for serious or life-threatening illnesses.

Protections Provided by OSHA's Bloodborne Pathogens Standard

All of the requirements of OSHA's Bloodborne Pathogens standard can be found in Title 29 of the Code of Federal Regulations at 29 CFR 1910.1030. The standard's requirements state what employers must do to protect workers who are occupationally exposed to blood or other potentially infectious materials (OPM), as defined in the standard. That is, the standard protects workers who can reasonably be anticipated to come into contact with blood or OPM as a result of doing their job duties.

In general, the standard requires employers to:

- **Establish an exposure control plan.** This is a written plan to eliminate or minimize occupational exposures. The employer must prepare an exposure determination that contains a list of job classifications in which all workers have occupational exposure and a list of job classifications in which some workers have occupational exposure, along with a list of the tasks and procedures performed by those workers that result in their exposure.
- **Employers must update the plan annually** to reflect changes in tasks, procedures, and positions that affect occupational exposure, and also technological changes that eliminate or reduce occupational exposure. In addition, employers must annually document in the plan that they have considered and begun using appropriate, commercially-available effective safer medical devices designed to eliminate or minimize occupational exposure. Employers must also document that they have solicited input from frontline workers in identifying, evaluating, and selecting effective engineering and work practice controls.
- **Implement the use of universal precautions** (treating all human blood and OPM as if known to be infectious for bloodborne pathogens).
- **Identify and use engineering controls.** These are devices that isolate or remove the bloodborne pathogens hazard from the workplace. They include sharps disposal containers, self-sheathing needles, and safer medical devices, such as sharps with engineered sharps injury protection and needleless systems.
- **Identify and ensure the use of work practice controls.** These are practices that reduce the possibility of exposure by changing the way a task is performed, such as appropriate practices for handling and disposing of contaminated sharps, handling specimens, handling laundry, and cleaning contaminated surfaces and items.
- **Provide personal protective equipment (PPE), such as gloves, gowns, eye protection, and masks.** Employers must clean, repair, and replace this equipment as needed. Provision, maintenance, repair and replacement are at no cost to the worker.
- **Make available hepatitis B vaccinations to all workers with occupational exposure.** This vaccination must be offered after the worker has received the required bloodborne pathogens training and within 10 days of initial assignment to a job with occupational exposure.
- **Make available post-exposure evaluation and follow-up to any occupationally exposed worker who experiences an exposure incident.** An exposure incident is a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or OPIM. This evaluation and follow-up must be at no cost to the worker and includes documenting the route(s) of exposure and the circumstances

OSHA FactSheet

December 1st, 2013 Training Requirements for the Revised Hazard Communication Standard

OSHA revised its Hazard Communication Standard (HCS) to align with the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and published it in the Federal Register in March 2012 (77 FR 17574). Two significant changes contained in the revised standard require the use of new labeling elements and a standardized format for Safety Data Sheets (SDSs), formerly known as, Material Safety Data Sheets (MSDSs). The new label elements and SDS requirements will improve worker understanding of the hazards associated with the chemicals in their workplace. To help companies comply with the revised standard, OSHA is phasing in the specific requirements over several years (December 1, 2013 to June 1, 2016).

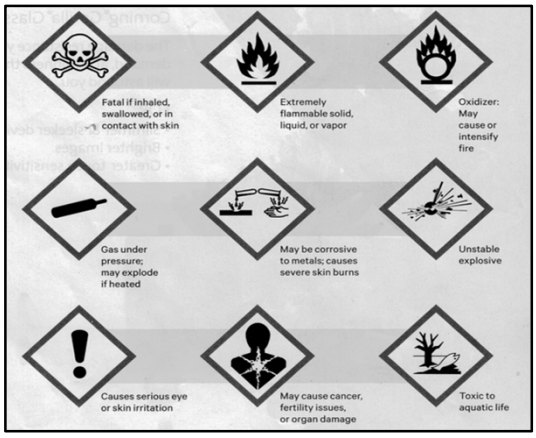
The first compliance date of the revised HCS is December 1, 2013. By that time employers must have trained their workers on the new label elements and the SDS format. This training is needed early in the transition process since workers are already beginning to see the new labels and SDSs on the chemicals in their workplace. To ensure employees have the information they need to better protect themselves from chemical hazards in the workplace during the transition period, it is critical that employees understand the new label and SDS formats.

The list below contains the minimum required topics for the training that must be completed by December 1, 2013.

- Training on label elements must include information on:
  - Type of information the employee would expect to see on the new labels, including the
    - ✓ **Product identifier:** how the hazardous chemical is identified. This can be (but is not limited to) the chemical name, code number or batch number. The manufacturer, importer or distributor can decide the appropriate product identifier. The same product identifier must be both on the label and in Section 1 of the SDS (Identification).
    - ✓ **Signal word** used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. There are only two signal words, "Danger" and "Warning." Within a specific hazard class, "Danger" is used for the more severe hazards and "Warning" is used for the less severe hazards. There will only be one signal word on the label no matter how many hazards a chemical may have. If one of the hazards warrants a "Danger" signal word and another warrants the signal word "Warning," then only "Danger" should appear on the label.
    - ✓ **Pictogram:** OSHA's required pictograms must be in the shape of a square set at a point and include a black hazard symbol on a white background with a red frame sufficiently wide enough to be clearly visible. A square red frame set at a point without a hazard symbol is not a pictogram and is not permitted on the label. OSHA has designated eight pictograms under this standard for application to a hazard category.
    - ✓ **Hazard statement(s):** describe the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard. For example: "Causes damage to kidneys through prolonged or repeated exposure when absorbed through the skin." All of the applicable hazard statements must appear on the label. Hazard statements may be combined where appropriate to reduce redundancies and improve readability. The hazard statements are specific to the hazard

Globally Harmonized System Phase-in Period

- Dec 1, 2013: Employers train employees - SDS sheets, labels
- June 1, 2015: Manufacturers & employers comply, but older packaging may be shipped
- June 1, 2016: Employers update labeling and HazCom program, training update
- Must comply with either 29 CFR 1910, GHS, or both during transition



Does your office routinely evaluate the office infection-control program?

- Periodic assessments
- Review and document procedures (SOP)
- Review occupational exposures and prevention strategies
- Purpose:
  1. improve IC program effectiveness & dental practice protocols
  2. dental team understanding
  3. communicate IC practices to patients

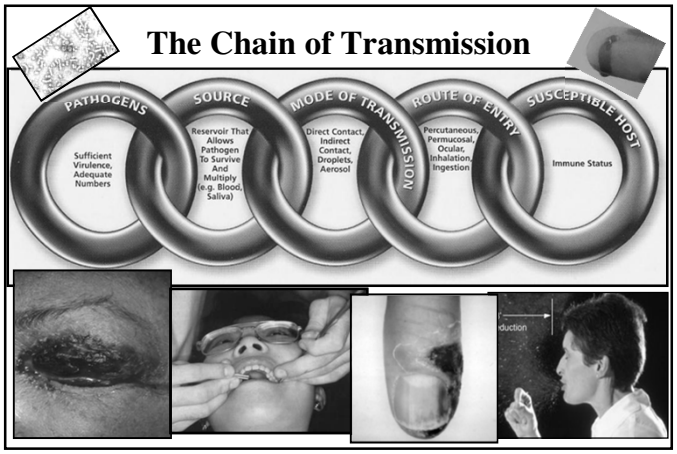
Are single-dose medications and devices used for one patient only and disposed of appropriately?

Single-dose vials:
- Preferable
- Discard leftover contents
- Never combine with medications for use on another patient

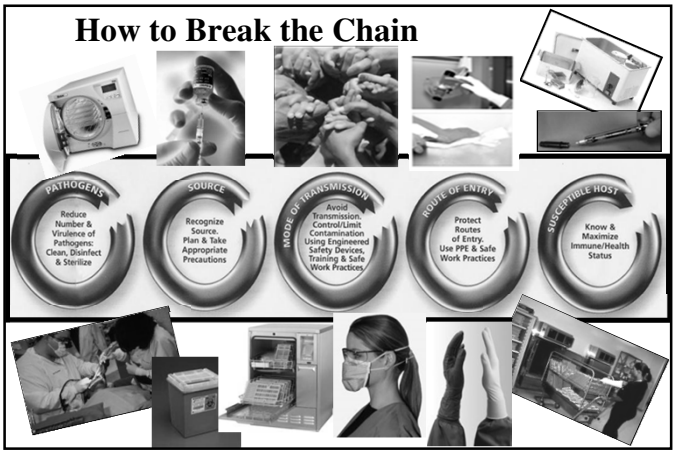
Multi-dose vial:
- Clean diaphragm with 70% alcohol
- Only insert sterile needle into vial
- Discard if sterility is compromised

CDC

The Chain of Transmission



How to Break the Chain



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**
- **New strategies & product types**
- **CDC 2002 guidelines – most recent & comprehensive**
- **CDC 2003 IC recommendations for dentistry**
- **FDA alert & notice (2011)**
- **Updated CDC dental IC guidelines 2015 – proposed date**

III. Hand Hygiene

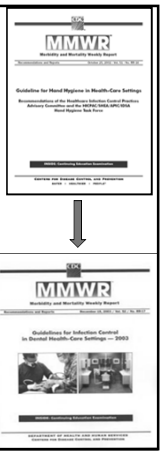
A. General Considerations

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.

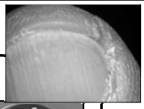


HAND HYGIENE

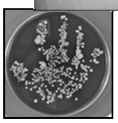
Multiple Acceptable Choices

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

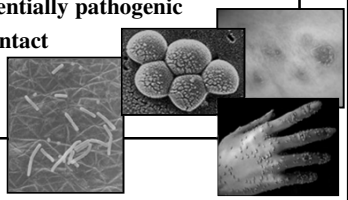
Types of Microflora

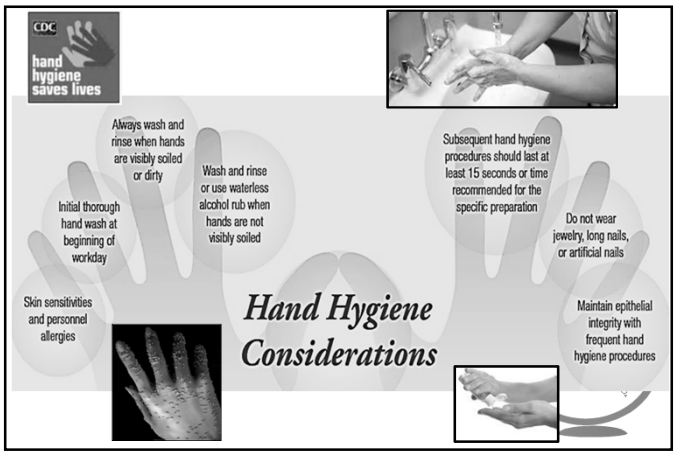


- **Resident flora – normal body flora**
  - **-- located on skin & in deeper skin layers**
  - **-- provide immune protection**
  - **-- if disrupted, re-establish at same site**

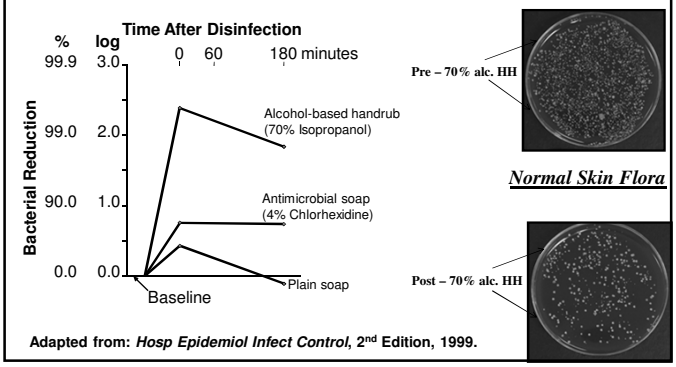


- **Transient flora – potentially pathogenic**
  - **– Acquired by direct contact**
  - **– Outer skin layers**
  - **– More easily removed**





Ability of Hand Hygiene Agents to Reduce Bacteria on Hands



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

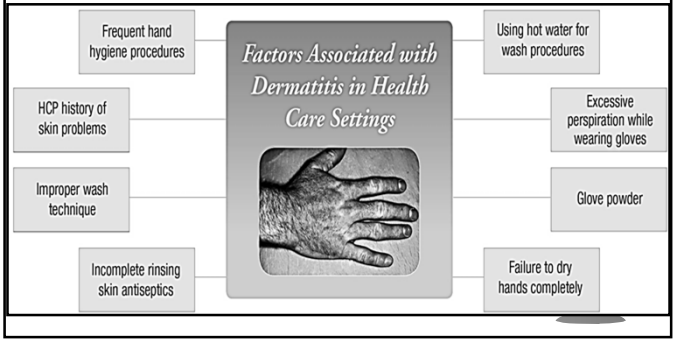
Are products available for hand hygiene manufactured for health care providers?

Improved:
- **Skin integrity after repeated use**
- **Compatibility with soaps, alcohol based hand rubs, etc.**

Fewer:
- **Fewer scents**
- **Fewer allergenic components**

Also consider:
- **Consistency (i.e., "feel")**
- **Acceptance by HCP**
- **Accessibility**
- **Dispenser systems**
- **Cost per use**

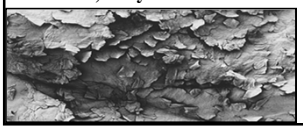
Are HCP hands exhibiting skin irritation problems?

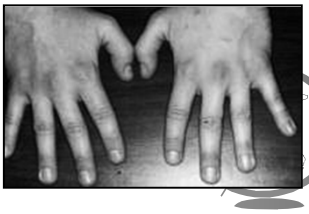


Are appropriate hand lotions or gels available to prevent skin disorders?

Normal, healthy skin

Cracked, scaly skin

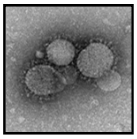




Are Standard Precautions followed for all patients?

- **Integrate & expand universal precautions for BBP**
- **Apply to all HCP for all patients**
- **Precautions include, among others:**
  - ✓ **Hand hygiene**
  - ✓ **Vaccinations**
  - ✓ **Use of personal protective equipment (PPE)**
  - ✓ **Injury prevention**
  - ✓ **Cleaning and decontamination of instruments**
  - ✓ **Cleaning & disinfection of environmental surfaces**
  - ✓ **Waterline maintenance**

MERS-CoV
(Middle East Respiratory Syndrome Coronavirus)



- **MERS-CoV: Novel Coronavirus**
  - acts like a cold virus
  - also attacks respiratory system
  - causes diseases ranging from common cold to Severe Acute Respiratory Syndrome (SARS)
  - MERS-CoV is NOT SARS virus
  - different from other coronaviruses previously found in people
  - spread by respiratory secretions (i.e. coughing)
    precise mode of spread still not well understood.

MERS-CoV:
Symptoms / Treatment / Travel / Prevention

- **Transmission: respiratory secretions; coughing**
- **Severe, acute respiratory illness: fever, cough, shortness of breath, pneumonia in many, diarrhea**
  - **~ 50% fatality incidence (pneumonia, kidney failure)**
  - **some only c mild illness**
- **Antiviral tx: none; supportive care for symptoms**
- **Vaccine: none available as yet**
- **Travel warnings: none for countries with MERS-CoV cases**
- **Prevention: hand washing/hygiene, contact, & surface disinfection precautions**

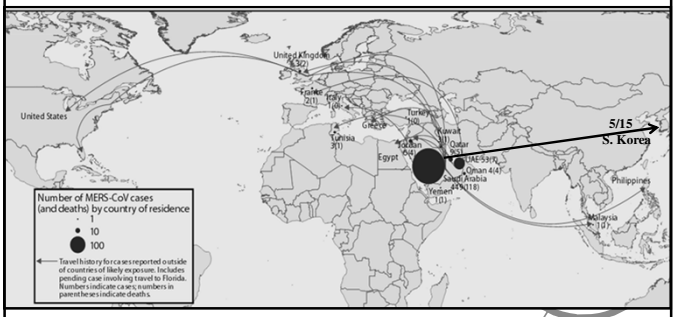
MERS-CoV Epidemiology

- **1st cases in Spring 2012**
- **Several clusters identified.**
- **For large clusters:**
  - **connection between cases not fully understood**
- **Evidence for limited p-to-p passage c close contact**
  - **no sustained transmission**
  - **patient-to-HCW transmission shown**

MERS Cases & Deaths
(4/2012 – 8/12/2013)

Countries	Cases (Deaths)
France	2 (1)
Italy	3 (0)
Jordan	2 (2)
Qatar	2 (1)
Saudi Arabia	74 (39)
Tunisia	2 (0)
United Kingdom (UK)	3 (2)
United Arab Emirates (UAE)	6 (1)
Total	**94 (46)**

Confirmed cases (and deaths) of MERS-CoV infection (N = 536), & history of travel from in or near the Arabian Peninsula within 14 days of illness onset (2012–2014)



WHO (5/12/2014)

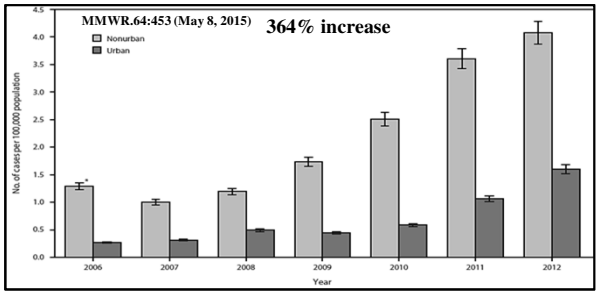
MERS-CoV Epidemiology & Hosts

- Original: bats as natural hosts for MERS-CoV ?
- Current: camels suspected as primary infection source for humans
- No evidence of ongoing community transmission in any country
- Settings where infection has occurred:
  - Communities: sporadic cases c unknown exposure
  - Families: contact c infected family members
  - HC facilities: patients & HC workers

- **1st cases MERS-CoV infection in U.S. (5/2014, Indiana & Florida)**
  - **infected travelers returned from Saudi Arabia**
  - **no ongoing U.S. transmission**

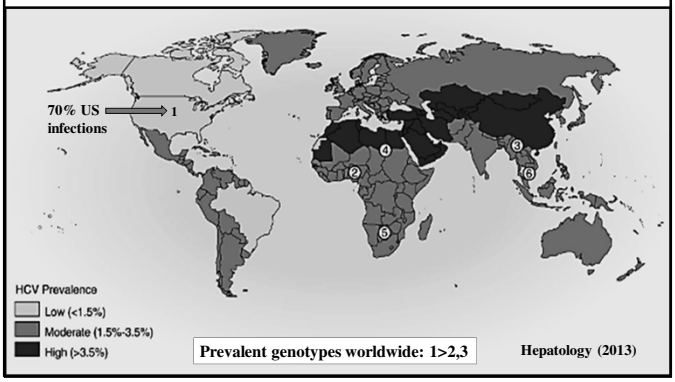
Current BBP Issues

1. Acute hepatitis C among persons aged ≤30 years-- Kentucky, Tennessee, Virginia, West Virginia, (2006–2012)



2. HIV outbreak in IV drug users in Southern Indiana (> 160 cases)

HCV Prevalence (2013)



Prevalent genotypes worldwide: 1>2,3

Hepatology (2013)

Hepatitis C Virus (HCV) Epidemiology

- RNA virus (family *Flaviviridae*); discovered 1989
  - high genetic diversity ("quasi-species") in infected host
- HCV chronic infection occurs in 75% pts after acute infect.
  - major global cause of chronic liver disease
- Est. > 185 million infected persons
- Transmission: blood exposure most common
  - developed countries: IV drug abuse
  - developing countries: unsafe medical practices
  - sexual transmission infrequent
- Effective antiviral treatment breakthrough last few years
- No current vaccine candidates

JAM (2015)

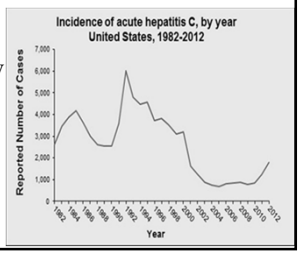
Reported Acute (New) Cases of Hepatitis C Virus (HCV)								Estimated Actual New Cases of HCV (range)	
2005	2006	2007	2008	2009	2010	2011	2012	2011 (estimated)*	2012 (estimated)*
694	802	849	878	781	853	1,230	1,778	16,500 (7,200-43,400)	24,700 (19,600-84,400)

* Actual acute cases estimated to be 13.9 times the number of reported cases in any year

Est. No. of Chronic Cases In the United States	No. of Death Certificates listing HCV as a Cause of Death			
	2010	2011	2012	2013*
2.7- 3.9 million	16,627†	17,721†	18,650†	19,368†

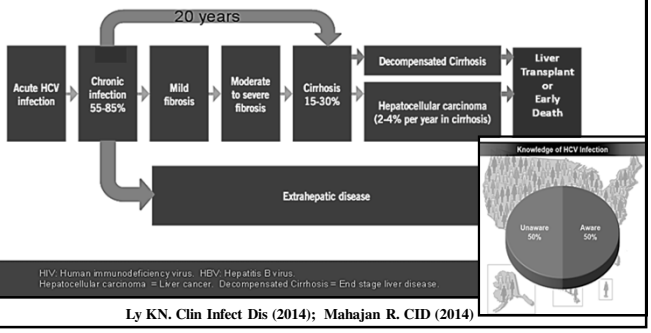
Mean death age 69 yrs

- ✓ Dramatic decline since mid-1990's
- ✓ Est. 4.2 – 5.1 million inf. (anti-HCV+)
- ✓ Est. 2.7–3.9 million living c chronic HCV
- ✓ Mean death age = 59yrs
- ✓HCV prevalence highest in persons born 1945-1965



Natural History of HCV Infection

In 20 years, 15-30% progress to cirrhosis
Progression accelerated by HIV, HBV, alcohol use, and fatty liver



Ly KN. Clin Infect Dis (2014); Mahajan R. CID (2014)

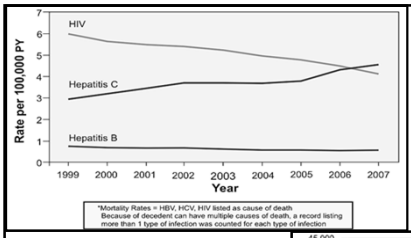
Therapeutic Milestones for HCV

FDA Approval of HCV Treatments:

- ◆ 1991: Interferon (IFN)
- ◆ IFN & ribavirin
- ◆ Pegylated IFN
- ◆ Boceprevir & Telaprevir
- ◆ Sofosbuvir & Ledipasvir

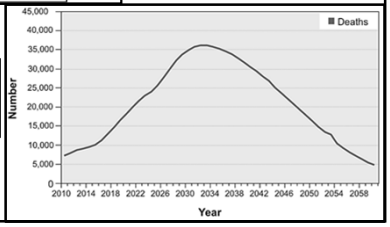
- highly effective against untreated HCV genotype 1 inf.

Thomas. Nat Med (2013) / Afdahl, et al. NEJM (5/15/2014)



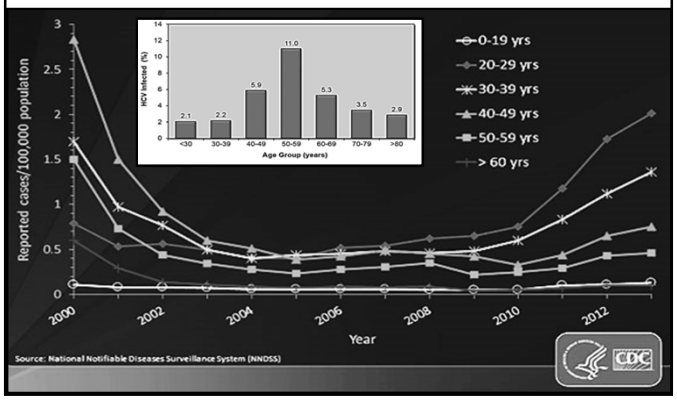
Annual HBV, HCV, HIV Deaths: U.S.

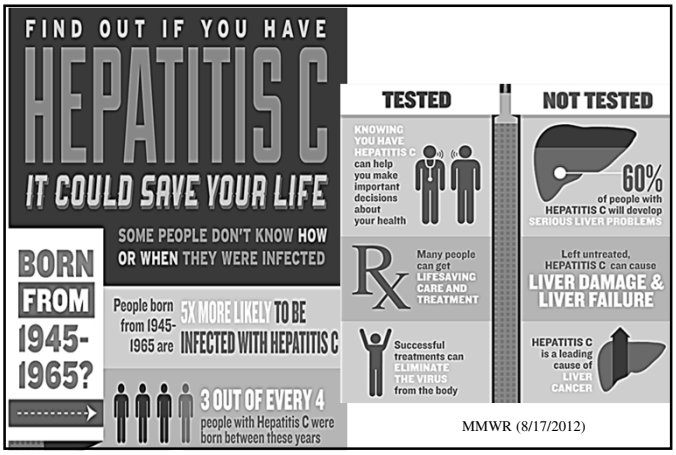
Forecasted Annual Deaths Associated with Chronic Hepatitis C Infection



CDC / UW Online Course (2013)

Incidence of Acute Hepatitis C by Age Group (2000-13)





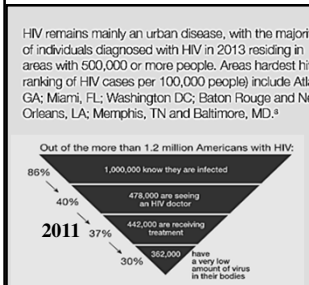
MMWR (8/17/2012)

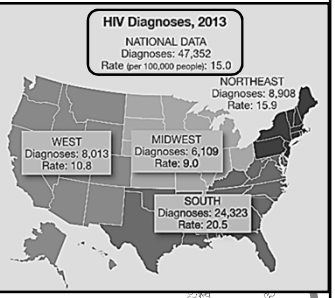
World Map of Prevalence of HIV Infection.

Piot & Quinn. NEJM. (6/6/2013)

U.S. HIV Infection: Current Status

HIV remains mainly an urban disease, with the majority of individuals diagnosed with HIV in 2013 residing in areas with 500,000 or more people. Areas hardest hit (by ranking of HIV cases per 100,000 people) include Atlanta, GA; Miami, FL; Washington DC; Baton Rouge and New Orleans, LA; Memphis, TN and Baltimore, MD.[a]

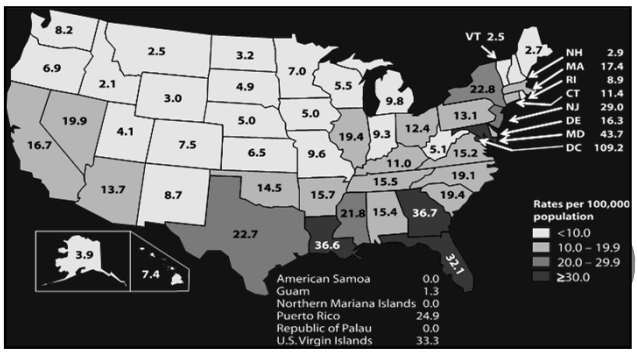




- **Rural Indiana County's HIV Outbreak Tops 140 Cases (5/2015)**
  - **currently >140 confirmed & 11 preliminary positive cases**
  - **outbreak linked to needle-sharing among IV drug users**

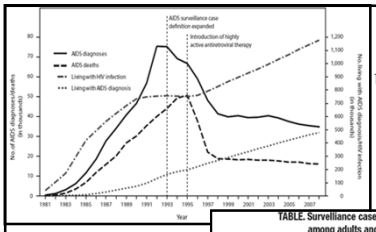
Rates of Diagnoses of HIV Infection among Adults and Adolescents, 2013—United States and 6 Dependent Areas

N = 47,958 Total Rate = 18.0



Diagnoses of HIV Infection among Adults and Adolescents, by Transmission Category, 2013—United States and 6 Dependent Areas

Transmission Category	No.	%
Male-to-male sexual contact	31,023	64.7
Injection drug use (IDU)	3,240	6.8
Male-to-male sexual contact and IDU	1,284	2.7
Heterosexual contact	12,216	25.5
Other	194	0.4
Total	47,958	100



U.S. HIV/AIDS Statistics
(1991-2008)

"Revised classification"
CDC. MMWR. 12/5/2008
57(RR10);1-8

TABLE. Surveillance case definition for human immunodeficiency virus (HIV) infection among adults and adolescents (aged ≥13 years) — United States, 2008

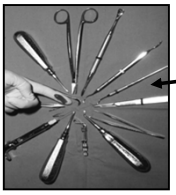
STAGE	LABORATORY EVIDENCE	CLINICAL EVIDENCE
STAGE 1	Laboratory confirmation of HIV infection and CD4+ T-lymphocyte count of ≥500 cells/µL or CD4+ T-lymphocyte percentage of ≥29	None required (but no AIDS-defining condition)
STAGE 2	Laboratory confirmation of HIV infection and CD4+ T-lymphocyte count of ≥200-499 cells/µL or CD4+ T-lymphocyte percentage of 14-28	None required (but no AIDS-defining condition)
STAGE 3 (AIDS)	Laboratory confirmation of HIV infection and CD4+ T-lymphocyte count of <200 cells/µL or CD4+ T-lymphocyte percentage of <14	or documentation of an AIDS-defining condition (with laboratory confirmation of HIV infection)
STAGE UNKNOWN	Laboratory confirmation of HIV infection and no information on CD4+ T-lymphocyte count of percentage	and no information on presence of AIDS-defining conditions

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



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

- CDC estimates ~385,000 sharps injuries annually among hospital-based healthcare personnel (>1,000 injuries/day)
  - many more in other healthcare settings (e.g., emergency services, home care, nursing homes)
- Increased risk for bloodborne virus transmission
- Costly to personnel and healthcare system

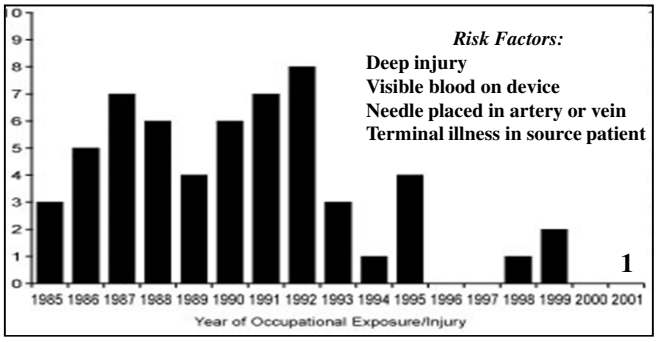
Healthcare Personnel with Documented and Possible Occupationally Acquired HIV Infection, by Occupation, 1984-2010

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**

*** Also 0 occupational HIV cases in world**

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

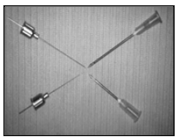
Health Care Workers with Documented Occupationally - Acquired HIV/AIDS as of 12/2006 (Yr of Occupational Exposure / Injury)



Characteristics of Percutaneous Injuries Among DHCP

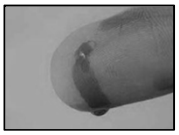
- **Declining frequency**
  - **-- improved awareness & precautions**
- **Most incidents: burs, other solid sharps, & *NOT* hollow-bore needles**
- **Most occur outside patient's mouth**
- **Small amounts of blood**
- **Needles – 25, 26, 27, 30 gauge vs. larger medical needles**





Does the practice have a post-exposure management plan?

- Clear written policies and procedures
- Education of dental health care personnel (DHCP)
- Rapid access to:
  - Clinical care
  - Referral mechanisms to qualified HCP
  - Post-exposure prophylaxis (PEP)
  - Testing of source patients/HCP
- **Confidentiality!!!**



Vaccination: Science & Success

⇨ ***Protection Against Infection Accomplished by:***

Antimicrobials -- therapeutic or prophylactic
Recovery from Disease
Immunization -- prophylactic

⇨ ***Categories of Immunity:***

- ❒ **Natural Active: recovery from symptomatic or asymptomatic disease.**
- ❒ **Natural Passive: cross - placental transfer of Ab; colostrum.**
- ❒ **Artificial Active: vaccination with Ag.**
- ❒ **Artificial Passive: temporary protection from injection of exogenous Ab.**

Is Hepatitis B Vaccination offered & records kept?

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 (2/2015)

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

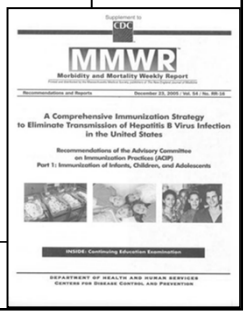
HBsAg + Alum Adjuvant

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**

Interpretation of Hepatitis B Serologic Test Results

HBsAg anti-HBc anti-HBs	negative negative negative	Susceptible
HBsAg anti-HBc anti-HBs	negative positive positive	Immune due to natural infection
HBsAg anti-HBc anti-HBs	negative negative positive	Immune due to hepatitis B vaccination
HBsAg anti-HBc IgM anti-HBc anti-HBs	positive positive positive negative	Acutely infected
HBsAg anti-HBc IgM anti-HBc anti-HBs	positive positive negative negative	Chronically infected
HBsAg anti-HBc anti-HBs	negative positive negative	Interpretation unclear; four possibilities: 1. Resolved infection (most common) 2. False-positive anti-HBc, thus susceptible 3. "Low level" chronic infection 4. Resolving acute infection

Are Booster Doses Needed ?

- ***NO -- not routinely recommended at this time***
- **recent data: protective immunological memory at least 30 years; ongoing long-term studies**
- **while vaccine-induced anti-HBs titers might decline over time, *immunological memory remains intact***
- **thus, people with declining anti-HBs titers still protected against infection & chronic disease**

  Am J IC (2011): waning immunity from infant vaccines (Taiwan)
- **booster recommendations -- certain circumstances:**
  1. **hemodialysis patients: annual assessment for need; booster dose given when anti-HBs titer <10mIU/ml**
  2. **other immune compromised persons: need for boosters not determined; <10 mIU/ml consider**

CDC/APIC/JAM (2013)

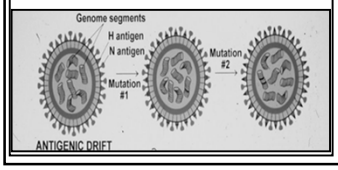
Influenza Virus Transmission

- **Viral replication: antigenic "drift" & "shift"**
- **Person-to-person: respiratory droplets**
- **Direct contact with person-contaminated object before washing hands.**
- **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).**
- **Abrupt symptoms: fever, myalgia, sore throat, malaise, nonproductive cough, headache**
- **HCW at high risk**
- **Confused with "bad cold?"**
- **cross-rx Ab's between strains**

Ongoing Influenza Virus Mutations

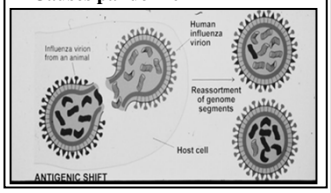
Antigenic Drift

- **Small "point" mutation changes**
- **Creates new variants**
- **May be immune to previous strains**
- **New strain: no prior immunity**
- **Causes epidemic**



Antigenic Shift

- **Re-assortment of strains**
- **Completely new antigens**
- **Everyone susceptible**
- **Will spread uncontrollably**
- **Causes pandemic**



WHO Influenza Vaccine Recommendations:

2012 – 2013 Influenza Vaccine Recommendations

-- an A/California/7/2009 (H1N1)-like virus;
-- an A/Victoria/361/2011 (H3N2)-like virus;
-- a B/Wisconsin/1/2010-like virus (from B/Yamagata lineage of viruses)

WHO/CDC (2/2012)

2013-2014 Vaccine Recommendations

- an A/California/7/2009 (H1N1)-like virus;
- an A(H3N2) virus antigenically like the cell-propagated prototype virus A/Victoria/361/2011;
- a B/Massachusetts/2/2012-like virus.

Recommended that quadrivalent vaccines containing 2 influenza B viruses contain the above 3 viruses and a B/Brisbane/60/2008-like virus.

WHO/CDC (2/2013)

Influenza Vaccine (2014-2015)

All of the 2014-2015 influenza vaccine is made to protect against the following 3 viruses:

- ⇨ **an A/California/7/2009 (H1N1)pdm09-like virus**
- ⇨ **an A/Texas/50/2012 (H3N2)-like virus**
- ⇨ **a B/Massachusetts/2/2012-like virus.**

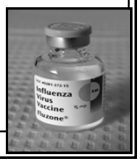
-- Some of the 2014-2015 flu vaccine also protects against an additional B virus (B/Brisbane/60/2008-like virus).

CDC (9/2014)

Influenza Vaccine

- **Preparations are strain specific—use of current year strain for vaccine (due to viral "antigenic drift")**
- **High-dose vaccine for elderly**
- **Recent vaccine advance for people c egg allergy (Flublok)**
- **Goal: reduce influenza complications and mortality**
- **~70-90% recipients develop protective Ab's**
- **Prevents death in 80% vaccinated, compromised pts**
- **Contraindications:**
  - **Pregnancy (1st trimester)**
  - **Allergy to eggs (?) or thimerosol (only in multi-dose vials)**

Note: Do not get flu from vaccine!!



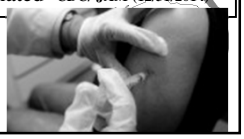
Available Influenza Vaccines (2014-15)

Name	Manufacturer	Age Range	# of Strains
Afluria	Merck/CSL	9 years and older*	Trivalent
Fluarix	GSK	3 years and older	Trivalent
			Quadrivalent
Flublok	Protein Sciences	18 – 49 years	Trivalent
Flucelvax ✻	Novartis	18 years and older	Trivalent
FluLaval	GSK	3 years and older	Trivalent
			Quadrivalent
FluMist	Medimmune	2 – 49 years	Quadrivalent
Fluvirin	Novartis	4 years and older	Trivalent
Fluzone	Sanofi Pasteur	6 months and older	Trivalent
			Quadrivalent
Fluzone High-Dose	Sanofi Pasteur	65 years and older	Trivalent
Fluzone Intradermal	Sanofi Pasteur	18 – 64 years	Trivalent

IIV: Inactivated Influenza Vaccine (Afluria, Fluarix, FluLaval, Fluvirin, Fluzone)
IIV3 = Trivalent IIV; IIV4 = Quadrivalent IIV
LAIV (Quadrivalent): Live, Attenuated Influenza Vaccine (FluMist)
RIV3: Recombinant Influenza Vaccine, Trivalent (Flublok)
ccIIV3: Cell Culture Inactivated Influenza Vaccine, Trivalent (Flucelvax)

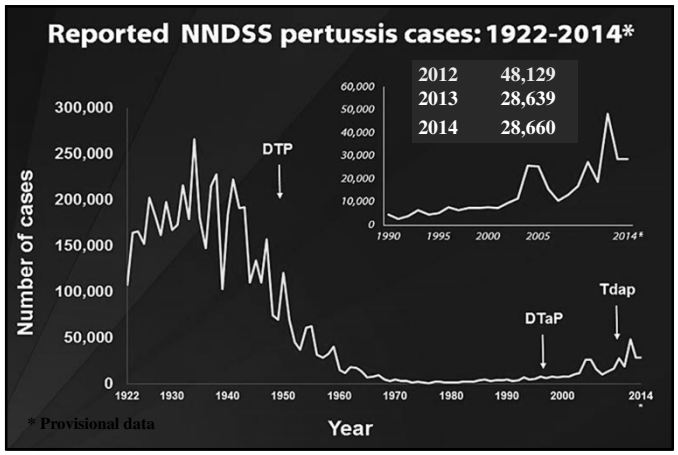
CDC: Flu shot less effective in 2014-15 ?

- similar situation to 2008-2009 flu season
- continuing "antigenic shift" by H3N2 vaccine strain
- "…could have a season that is more severe than most with more hospitalizations and more deaths" **(CDC)**
- "widespread" in 36 states; deaths of 15 children
- not too late to get vaccinated **CDC/ JAM (12/31/2014)**

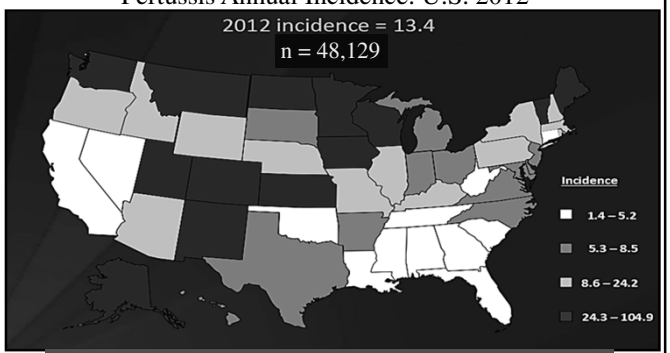


Global Impact of Pertussis & Resurgence of a Vaccine-Preventable Disease

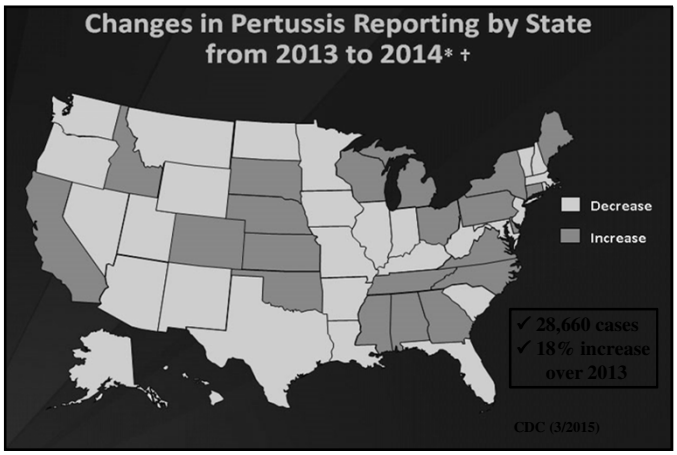
- ~50 million cases & 300,000 deaths / year
- high burden of disease in developing countries
- among leading causes of vaccine-preventable deaths.
- case-fatality rates in developing countries as high as 4% in infants
- high immunization coverage: mainstay of prevention
- 82% global DTP3 vaccine coverage **WHO 2012**



Pertussis Annual Incidence: U.S. 2012



2011	**18,719 cases**
2010	**27,550 cases**



Recent Pertussis Outbreaks

- Washington (2012): 4,783 cases; 965 cases (2011); 608 cases (2010)
- Minnesota (2012): 4,443 cases; 661 cases (2011)
- Wisconsin* (2012): 5,923 cases ; 1,192 (2011)
  *highest US incidence: 104.9/100,000 persons
- Vermont (2012): 632 cases; 94 (2011)
- Colorado (2012): 1,510 cases; 158 (2011)
- California (2010): 9,143 cases (10 infant deaths) reported
  - most cases reported in 63 years
  - in 2011: disease activity at relatively increased levels
- California (2014): 9,935 cases thru 11/26 reported; 26/100,000 pop.
  - 5x greater than baseline levels
  - highest disease burden in infants <12 mos., especially Hispanic infants & non-Hispanic white teenagers 14-16 yrs.

(CDC 2/2013 & 12/2014)

Pertussis Epidemiology

Reservoir	Humans; 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 illness

Infants – signs & symptoms
violent coughing spells; hard to eat, drink, breathe; can last for several weeks.
can lead to pneumonia, seizures, brain damage, or death

(JAM/CDC)

Adults and *Pertussis* – HCW Tips?

- Neither acquisition of the disease nor vaccination provides complete or lifelong immunity
- 1 attack usually provides immunity for many years, *but* immunity wanes with time
- Attack rate over 50% reported when post-immunization interval is > 12 years
- Adult disease often milder than in infants / children
- Infection may be asymptomatic, or as classic pertussis
- Older persons often source of infection for children

Pertussis Vaccines

Pertussis-Containing Vaccines for Children	Brand	Licensed Date and Used For
DTaP	INFANRIX® DAPTACEL® Tripedia®	First licensed in 1991; used for all childhood doses
DTaP+Hib	TriHiBit®	Used for the fourth dose only
DTap+IPV+HepB	PEDIARIX®	Used for the first three doses
DTap+IPV+Hib	PENTACEL™	Approved in 2008; used for primary four-dose series
DTap+IPV	KINRIX™	Approved in 2008; used for booster dose at 4-6 years
Pertussis-Containing Vaccines for Adolescents and Adults	**Brand**	**Licensed Date**
Tdap	ADACEL® BOOSTRIX®	First available in 2005
Other Vaccines	**Brand**	**Licensed Date**
Pertussis Only		Not available in the U.S.
DT/Td	DECAVAC™ TENIVAC™	Do not contain pertussis; DT used for primary series when pertussis vaccination was not desired; Td used in persons aged ≥7 years

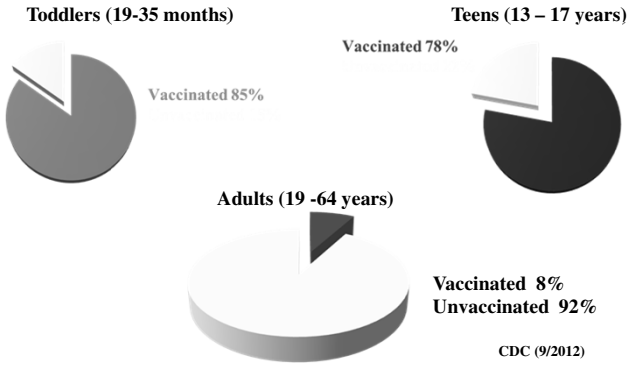
Some People Should NOT Get Tdap Vaccine

- ⇨ life-threatening allergic rx after a previous dose of any diphtheria, tetanus or pertussis containing vaccine
- ⇨ severe allergy to any part of vaccine
- ⇨ coma or long repeated seizures within 7 days after a childhood dose of DTP or DTaP, or a previous dose of Tdap, *should not get Tdap, unless a cause other than the vaccine was found.*
  can still get Td.

⇨ Talk to your doctor if you:
- have seizures or another nervous system problem,
- had *severe* pain or swelling after any vaccine containing diphtheria, tetanus or pertussis,
- ever had Guillain Barré Syndrome (GBS), or aren't feeling well on the day vaccination is scheduled.

CDC (2/24/2015)

Pertussis Vaccination Rates



CDC (9/2012)

3 Types of Varicella – Containing Vaccines:

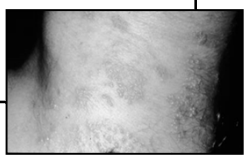
- **Varicella vaccine (Varivax)**
  - **approved for persons 12 months and older**
- **Measles-mumps-rubella-varicella vaccine (ProQuad)**
  - **approved for children 12 months through 12 years**
- **Herpes zoster vaccine (Zostavax)**
  - **approved for persons 60 years and older**

Vaccine Recommendations for Adolescents & Adults:

- All persons 13 years of age and older without evidence of varicella immunity
- 2 doses separated by at least 4 weeks
- Do not repeat 1st dose because of extended interval between doses

Herpes Zoster (Shingles)

- **Reactivation of varicella zoster virus**
- **Can occur years or even decades after illness with chickenpox**
- **Generally associated with normal aging and with anything that causes reduced immune competence**
- **Lifetime risk (est.) ~32%**
- **Estimated 500,000- 1 million cases of zoster diagnosed annually in the U.S**
- **50% persons <85 yrs will develop zoster**



VZV Vaccination for Older Adults: HCW Implications

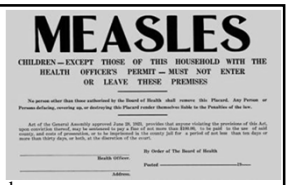
- **tested hypothesis: would VZV vaccination decrease incidence &/or severity of herpes zoster &/or post-herpetic neuralgia among older adults.**
- **38,546 adults 60 yrs & older, placebo –controlled trial of investigational live, attenuated VZV vaccine.**
- **VZV vaccination:**
  - **reduced illness burden by 61.1%**
  - **reduced post-herpetic neuralgia by 66.5%**
  - **reduced herpes zoster incidence by 51.3%**
- **conclusion: vaccine markedly reduced zoster & post-herpetic neuralgia among older adults** (Oxman, et al. NEJM 6/2/2005)

Herpes Zoster Vaccine (Zostervax)

- **2006: Approved single dose among persons 60 years & older**
- **significantly reduces post-herpetic neuralgia risk**
- **may vaccinate regardless of prior history of herpes zoster (shingles)**
- **persons with a chronic medical condition may be vaccinated unless a contraindication or precaution exists for the condition**
- **2011: FDA expanded age indication to include adults 50 - 59 years old**
  - **study showing vaccine reduced zoster risk by ~ 70% in certain adult groups, BUT efficacy decreased with recipient age:**
    - **50 – 59 yrs: 68.9%**
    - **>70 yrs: 37.6%**
- **2nd generation subunit vaccine being tested**
  - **96.6 – 97.9% efficacy for all age groups tested**

CDC (2009; 2011) & Lal, et al. NEJM. 372 (5/28/2015)

Measles Timeline U. S.:



MEASLES

CHILDREN — EXCEPT THOSE OF THIS HOUSEHOLD WITH THE HEALTH OFFICER'S PERMIT — MUST NOT ENTER OR LEAVE THESE PREMISES

No person other than those authorized by the Board of Health shall remove this Placard. Any Person or Persons defacing, covering up, or destroying this Placard render themselves liable to the Penalties of the law.

Act of the General Assembly approved June 26, 1935, provides that anyone violating the provisions of this Act, upon conviction thereof, may be sentenced to pay a fine of not more than $100.00, to be paid to the use of said county, and may be confined in the county jail for a period of not less than ten days or more than thirty days, or both, at the discretion of the court.

By Order of The Board of Health

Health Officer. Posted ——————————, 19—

Address.

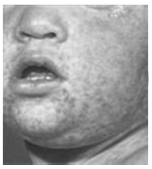
- 1920 - 469,924 U.S. cases (7,575 deaths)
- 1941 - 894,134 cases
- 1954 - measles virus isolated
- 1962 - 503,282 cases (432 deaths)
- 1963 - first live measles vaccine licensed
- 1968 - improved live measles vaccine licensed
- 1958 - first measles vaccine is tested
- 1970 - 47,351 cases (89 deaths)
- 1971 - MMR vaccine introduced
- 1978 - 26,871 cases (measles targeted for eliminated in U.S. by 1982)
- 1983 - 1,497 cases
- 2010 - 61 cases
- 2011 - 220 cases
- 2012 - 55 cases
- 2013 - 189 cases, including large NYC outbreak - 58 cases.
- 2014 - 644 cases

CDC/ JAM (2015)

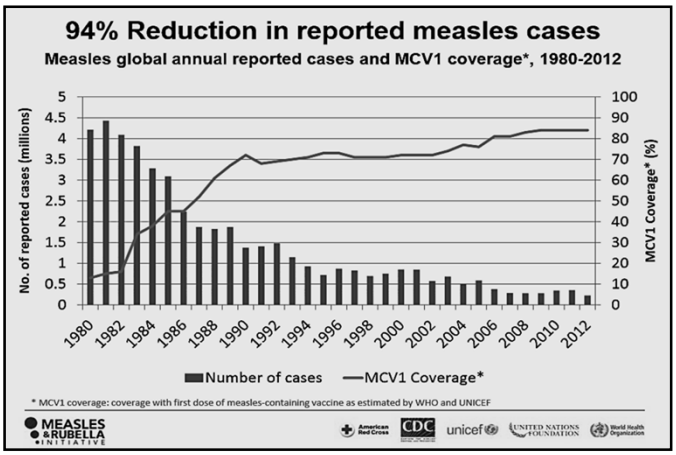
Measles Epidemiology

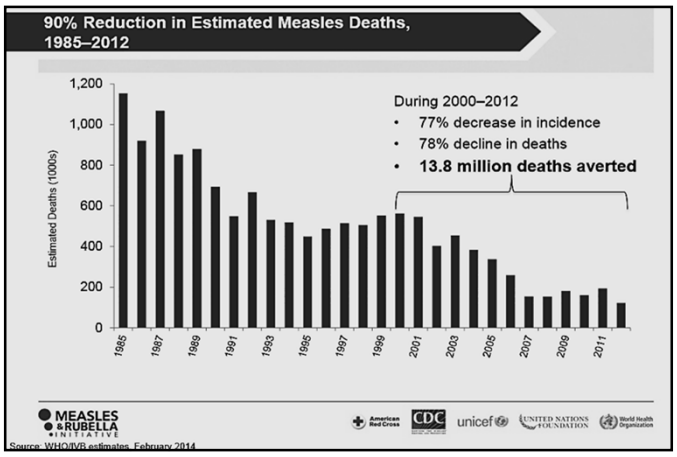
- ☞ **Reservoir** — **Human**
  Adolescents and adults
- ☞ **Transmission** — **Airborne; respiratory droplets**
- **Communicability** — **4 days before to 4 days after rash onset**
- **Incubation period 10-12 days**

✓ Prodrome: 2-4 days stepwise increase in fever to 103°F–105°F
- cough, coryza, conjunctivitis, Koplik spots (rash on mucous membranes)



✓ Rash: 2-4 days after prodrome, 14 days after exposure
- persists 5-6 days (begins on face & upper neck)
- maculopapular, becomes confluent
- fades in order of appearance

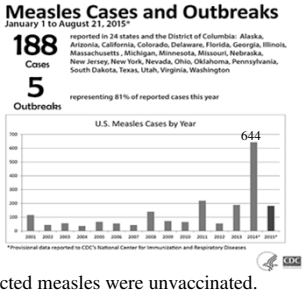




2014-15 Measles Outbreak:

Latest Example of a Worsening PH Problem

✓ **Different State Rules On Vaccinations:**
California (<51% preschool children measles vaccine)**
vs.
Mississippi (99.7%)



▶The majority of people who have contracted measles were unvaccinated.
▶Measles is still common in many parts of the world including some countries in Europe, Asia, the Pacific, and Africa.
▶Travelers with measles continue to bring disease into U.S.
****June 29, 2015: California governor signs strict vaccination law exemptions only for children with serious hlth issues**

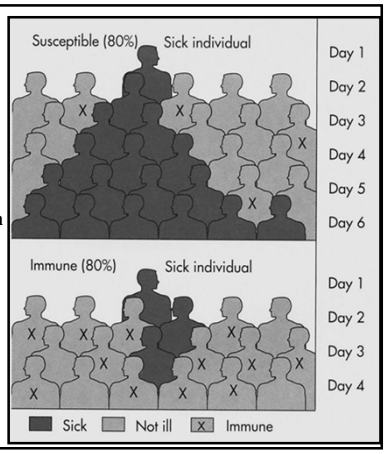
"Herd Immunity" & Public Health

❑ **immune persons to a communicable disease will not be carriers, & thus –**

❑ **cannot spread infection to susceptible persons & pathogen occurrence reduced in population**

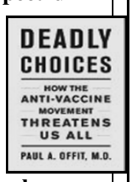
❑ **the larger the "herd" of protected people, the lower the risk for an epidemic to occur**

❑ **HOWEVER**.....



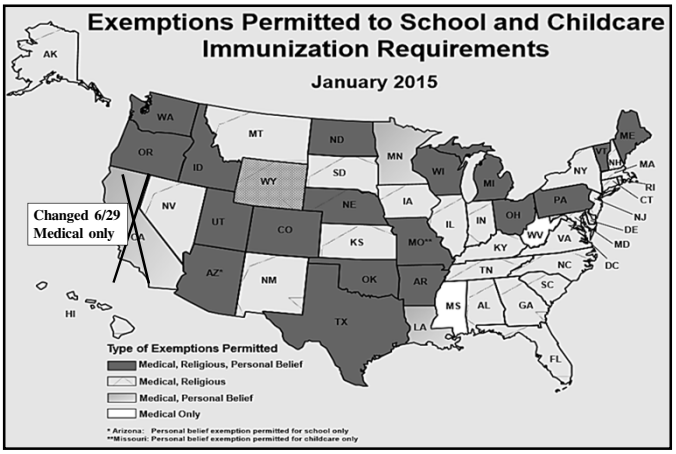
Increasing Threat to Public Health – Vaccination Misconceptions

- **Why do we still need to vaccinate when the targeted diseases are virtually extinct?**
- **Is there a relationship between vaccines & autism spectrum disorders?**
- **Are we weakening children's immune systems by giving too many vaccines?**
- **Are children getting more vaccines than necessary in today's world?**
- **Is the mercury in the vaccine preservative thimerosal causing autism & other disorders ?**



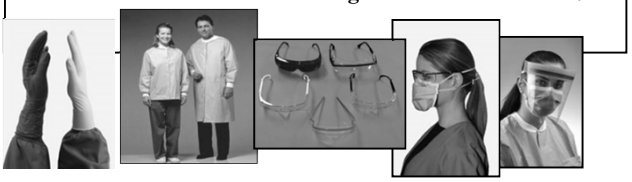
Exemptions Permitted to School and Childcare Immunization Requirements

January 2015

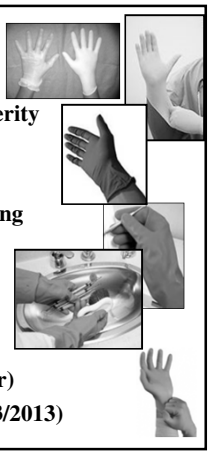


Personal Protective Equipment

- ✓ 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)
- ✓ FDA cracks down on "latex-free" items (3/2013)

Are Appropriate Gloves Available?

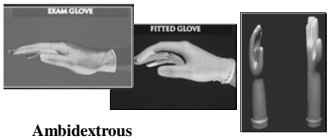
Considerations	Examples
Material	- latex, vinyl, nitrile, chloroprene
Skin sensitivity	-allergies to latex or nitrile -hand perspiration
Size	-proper size, lightweight & pliable - snug fit without hand constriction -appropriate finger length -fits palm without compression **-ambidextrous vs. right- & left-fitted**
Tactile sensation	-grip -glove thickness -slipperiness of material when wet
Function	-non-sterile gloves for most procedures -sterile gloves for surgical procedures -utility gloves reprocessing & clean-up

Molinari & Nelson. TDA (2/2015)

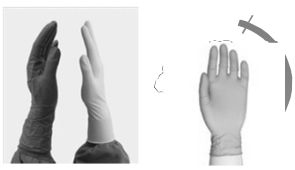
Are Hands Hurting When Wearing Gloves?

Hand & Wrist Risk Factors Associated with Dentistry

- ✓ Repetitive hand movements
- ✓ Awkward wrist positions
- ✓ Mechanical stresses to digital nerves (i.e. sustained grasping on instrument handles)
- ✓ Forceful treatment procedures in confined, small space
- ✓ Extended vibratory instrument use (i.e. handpieces, ultrasonic scalers)



Ambidextrous
vs. Right-Left Fitted



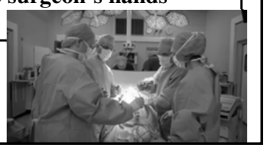
Are gloves removed and changed between patients?

- Wear new, single-use gloves for each patient
  - Contact with blood, saliva, mucous membranes
  - Contact with contaminated instruments or devices
- Remove gloves after patient care
- Remove torn, cut, or punctured gloves
- Do not wash or disinfect gloves for reuse

Are Gloves Infallible?

- Cardiovascular surgeon with inflammation on hands transmitted *Staphylococcus epidermidis* infection to 5 pts
- Hospl surgeries involved heart valve replacements
- Long procedures same pair gloves – "microscopic tears" allowed bacteria to pass into pts
  - valve surgery requires use of thick sutures and >100 knots tied -- can cause extra stress on the gloves
- Same *S. epidermidis* strains traced to surgeon's hands

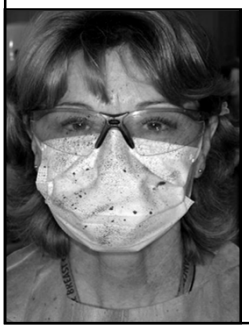
(12/ 2012)

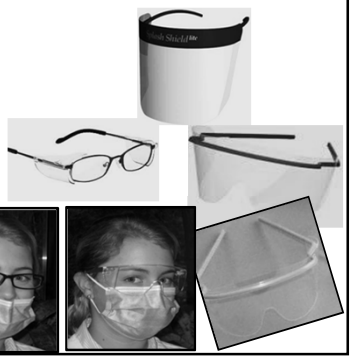


Protective Eyewear

- 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

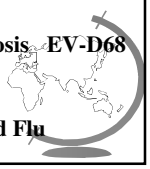
Do clinic personnel wear appropriate eye protection appropriately?





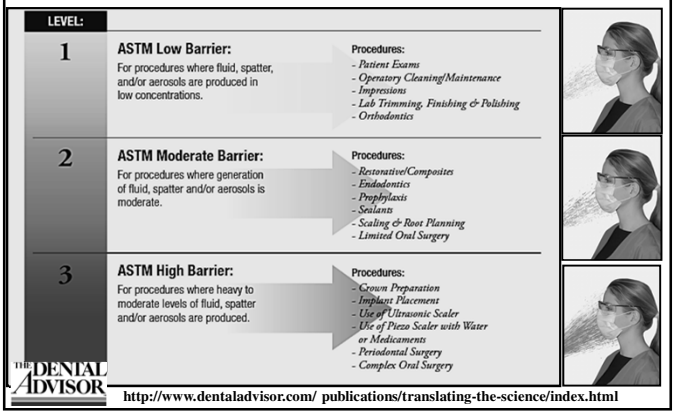
Representative Occupational Respiratory Infections

- ⇨ "Classic" Respiratory Risks
  Tuberculosis Influenza Bacterial Pneumonia
  Pertussis Common Cold
- ⇨ New "Emerging" Diseases
  MERS-CoV A(H7N9) Influenza Legionellosis EV-D68
- ⇨ Future Threats
  SARS A(H5N1) Bird Flu

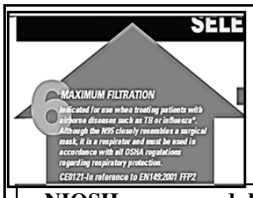


Masks: What to Wear & When

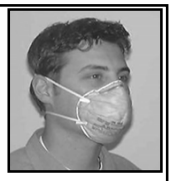
Molinari & Nelson. TDA (2014)



http://www.dentaladvisor.com/ publications/translating-the-science/index.html

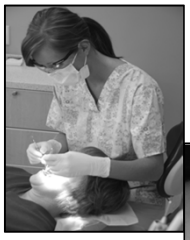


N – 95 Respirators

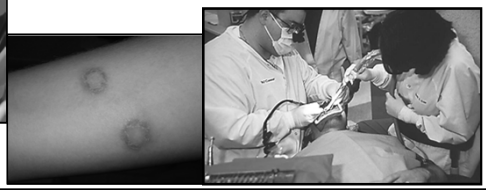


- NIOSH – approved disposable respirators – type of particulate respirator mask (PRM)
- For: HCW working in close contact c pts with A/H1N1 influenza or influenza-like illness
- More efficient than masks used for routine pt treatment
- Work best when fitted properly - employers to ensure
- Note: more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

Do clinic personnel wear protective clothing and change when necessary ?



"Wear protective clothing that covers personal clothing and skin (e.g., forearms) likely to be soiled with blood, saliva, or other potentially infectious materials." CDC



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

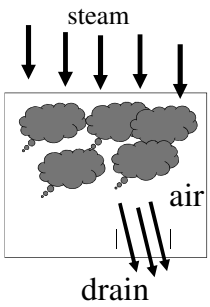
- Can sterilize items that would be damaged by heat
- Relatively inexpensive compared to heat sterilization

STOP
DANGER
HAZARD

Disadvantages

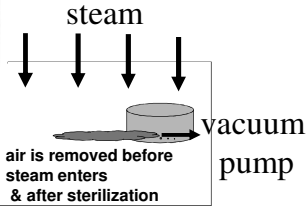
- Less reliable than heat methods
- Very time-consuming & limited use-life
- Expensive
- Cannot be spore tested
- Fumes may require ventilation
- Potential for allergic reactions
- PPE required during use
- Cannot package items
- Sterilized items must be rinsed off with STERILE water
- Inst corrosion or rusting
- Possible glut. alternatives

Gravity Steam Sterilizers



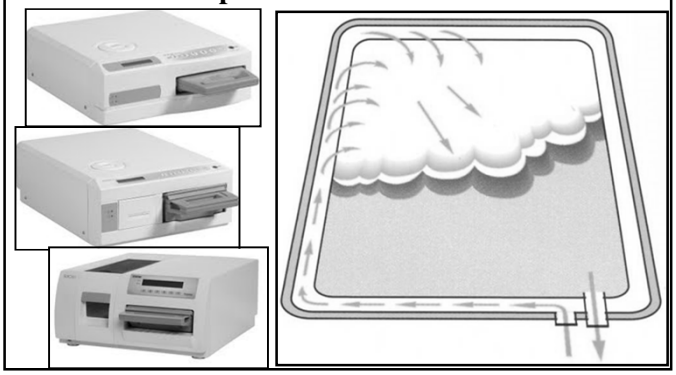
⇨10 to 25 minutes exposure time at 132° - 135°C (270°F to 275°F)
⇨15 to 30 minutes exposure time at 121° - 123°C (250°F to 254°F)
⇨Drying times vary according to load configuration, materials, contents

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

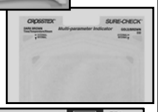
Steam Injection & Positive Pressure Pulse Displacement Autoclave



Monitoring Indicators & Integrators

Class I *(Process Indicators)*	Tapes or strips used only as external indicators to distinguish processed from unprocessed items (e.g. autoclave tape)
Class II *(Bowie-Dick Indicators)*	Used as quality control indicators for vacuum steam (Class B) sterilizers to assess air removal during cycle
Class III *(Temperature Specific Indicators)*	Indicate attainment of specific minimum temperature within sterilization chamber during a cycle; not sensitive to other parameters (i.e., time)
Class IV *(Multi-Parameter Indicators)*	Provide integrated color change to the temperature, pressure, time sterilization parameters (e.g., ***Sure-Check Sterilization Pouches***, *Crosstex*)
Class V *(Integrating Indicators)*	Strips that contain a chemical ink which reacts to all three sterilization parameters during the sterilization cycle; when the indicator bar moves left to right and enters the blue "SAFE" zone, it provides immediate notification to the user of sterilization cycle success or failure







Is sterilization equipment properly monitored and records maintained?

- **CDC recommends weekly biological monitoring**
  - **In case of a positive spore test**
    - **Remove the sterilizer from service**
    - **Do not use the sterilizer until inspected and working properly**

Error	Problem
Improper instrument cleaning and potentially compromise the sterilization process	Biological and other debris can shield adherent microbes and potentially compromise the sterilization process
Improper packaging	Examples: wrong type material for method; too many items in package; excessive amounts of wrap material
Overloaded sterilizer	Can prevent thorough contact of sterilizing agent with all items in unit
Inadequate Maintenance	Critical area; example issues include worn gaskets and seals
Improper sterilization equipment	Use of non-FDA approved equipment

Sterilization Process Problems

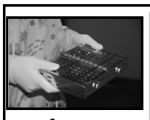
Person in Charge !!

Single-Use Disposable Devices

- **Introduced in 1960's -- promoted as convenient & easy to use**
- **Designed for use on 1 patient & then discarded**
- **Not intended to be cleaned & sterilized for reuse on another patient**
- **Not heat tolerant & cannot be reliably cleaned**
- **More recyclables and biodegradables available**




Harte & Molinari



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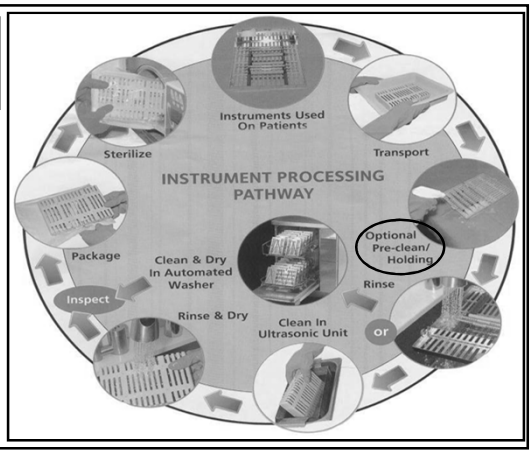
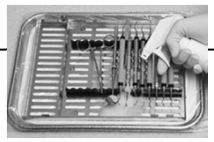


Holding Solutions or Foam Sprays (optional step)

- **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

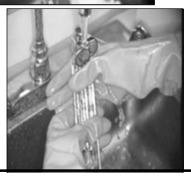



Cleaning Instruments: Options

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

Mechanical (Hand Scrubbing)



Ultrasonics

Inst Washer / Disinfectors

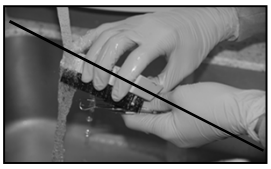
Sterilization and Disinfection of Patient-Care Items

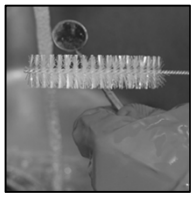
C. Receiving, Cleaning, and Decontamination Work Area

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

If hand scrubbing is performed, is long handled brush utilized and utility gloves worn?



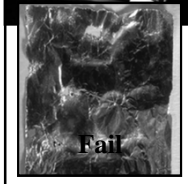


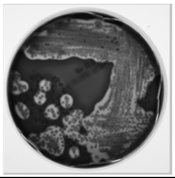
- ✓ Not as efficient as ultrasonic cleaners
- ✓ Dangerous – increased potential for sharps exposure when scrubbing instruments
- ✓ Wear utility gloves & other PPE
- ✓ Use of cassettes – manual cleaning not necessary

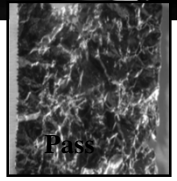
Ultrasonic Cleaners

- **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**

When ultrasonic is utilized, are enzymatic solutions used, & is testing performed?







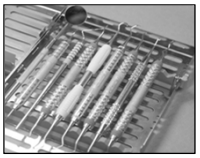
Automated Instrument Cleaning

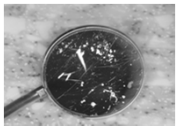
- ⇒ **effective**
- ⇒ **efficiency**
- ⇒ **↓ exposure to blood & body fluids**
- ⇒ **↓ exposure to sharps**

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….

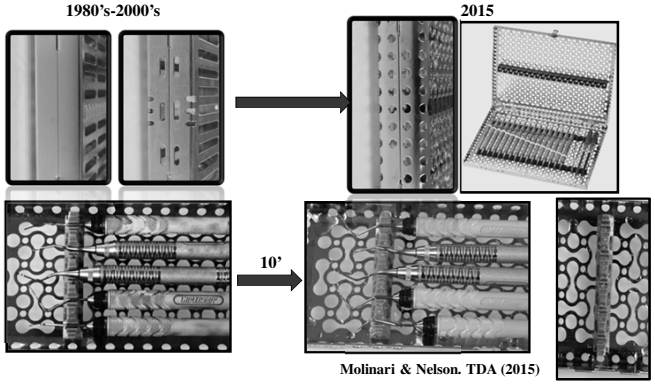




Evolution of Instrument Cassettes

1980's-2000's

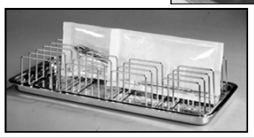
2015



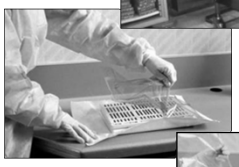
10'

Molinari & Nelson. TDA (2015)

Is the sterilizer loaded such that sterilant may reach all surfaces of the package?



Sterilized Wrapped Instruments



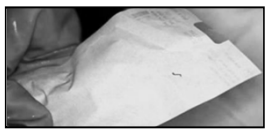
Keeping Instruments Wrapped Until Patient Treatment

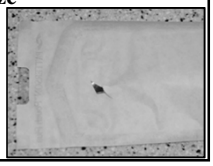
The Pay – off : Patients Note Sterile Packages (Perception & Reality)

Are wrapped instrument packages inspected to insure they are intact?

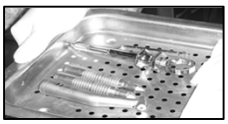
Event- vs. Date-related sterilization:

- Date & maintain as sterile until use
- Stored in clean, dry location in manner to prevent contamination during storage
- Inspect packages for integrity & dryness before opening
- If compromised, clean, package, re-sterilize





If instruments are sterilized unwrapped, are they handled aseptically and used immediately?



- *Immediate use (i.e. flash)* sterilization
- Use chemical indicator in each cycle
- Allow to dry & cool in sterilizer before handling
- Handle aseptically during removal
- Use instruments ASAP
- Do not sterilize implantable devices unwrapped.

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"
- 1990: 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)**

Are handpieces cleaned, lubricated, and sterilized between patients?

1. **Flush air/water lines 20-30 sec. (bur in place)**
2. **Clean and dry handpiece**
3. **Lubricate**
4. **Expel excess lubricants (prevents "gumming")**
5. **Clean fiber optics**
6. **Package and heat sterilize**

Environmental Surface Asepsis: Role of Hospital Surfaces in HAI

- **Surface contamination plays important role in MO transmission**
- **Well-established for MRSA & VRE**
- **New evidence for noroviruses, *C. difficile*, & Acinetobacter**
- **Extent of pt-to-pt transmission proportional to level of environmental contamination**

Weber, Rutala, et al. Am J Inf Cont (2010)

Microbial Persistence on Dry Inaminate Surfaces

Microorganism	Duration of Persistence
Staphylococcus aureus, incl. MRSA	7 days – 7 mos.
Mycobacterium tuberculosis	2 days – 4 mos.
Bordetella pertussis	3 – 5 days
Enterococcus sp. (incl. VRE)	5 days – 4 mos.
Clostridium difficile spores	up to 2 yrs.
Escherichia coli	1.5 hrs. – 16 months
Influenza viruses	1 – 2 days
Rhinoviruses	2 hrs – 7 days
Herpes simplex viruses (HSV)	4 hrs. – 8 wks.
Hepatitis B Virus (HBV	> 1 wk. (in blood)
Hepatitis C Virus (HCV)	16 hrs. – 6 wks. (in blood)
Hepatitis A Virus (HAV)	2 hrs. – 2 mos.
Human Immunodeficiency Virus (HIV)	few min. – 7 days**

Environmental Stability of HBV & HCV

- **HBV can survive in dried blood on environmental surfaces for at least 1 week.**
- ***In vitro* studies have shown HCV can remain infective on dry surfaces for up to 6 weeks.**
- **HBV & HCV transmission via contact with environmental surfaces has been demonstrated in investigations of outbreaks among patients & staff of hemodialysis units.**

Bond, et al. Lancet (1981); Kamili, et al. Inf Con Hosp Epid (2007); Paintsil. JID (2014)

Categories of Patient Items

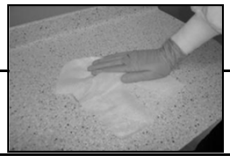
- **-- Critical**
- **-- Semi-Critical**
- **-- Noncritical**

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; cleaned on regular basis**

Are Clinical Contact Surfaces Covered or Cleaned & Disinfected Between Patients?

- -- Cleaning
- -- Sanitization
- -- Disinfection
- -- Sterilization



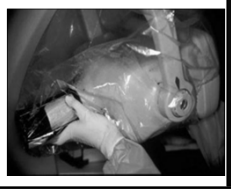
Surface Covers:

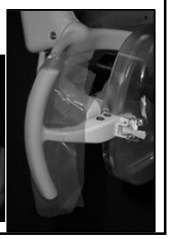
Advantages

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

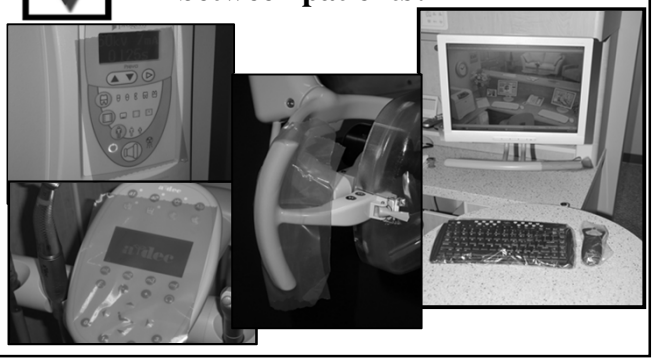
Disadvantages

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





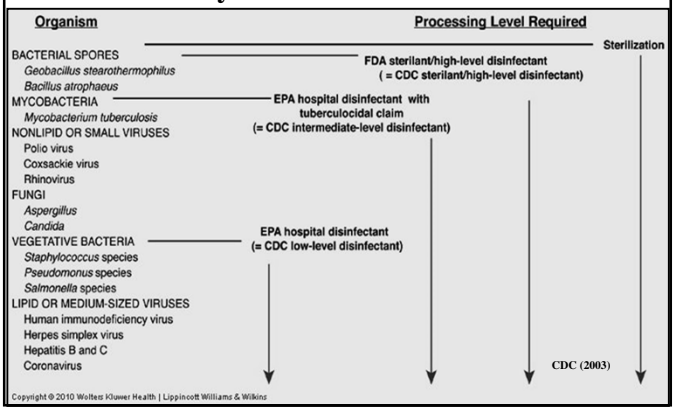
Are surface barriers changed between patients?



Properties of an IDEAL Surface Disinfectant

- -- broad antimicrobial spectrum
- -- rapid, lethal action on all vegetative forms
- -- not affected by physical factors (i.e. active in presence of organic matter)
- -- non-toxic; non-allergenic; easy to use
- -- surface compatibility: should not compromise integrity of equipment & metallic surfaces
- -- residual effect on treated surfaces (reactivation of agent when moistened)
- - odorless
- -- eco-friendly (does not add "damaging" chemicals to environment)

Efficacy of Chemical Germicides

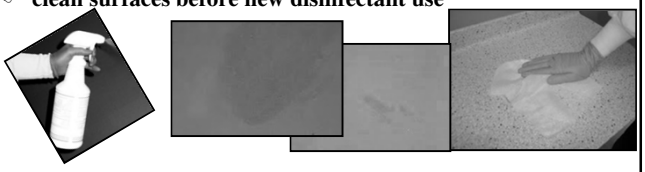


Environmental Surface Asepsis

- ☐ Important Terms:
  - -- cleaning
  - -- disinfection
  - -- clinical contact surfaces
  - -- housekeeping surfaces
  - -- high - level disinfectant
  - -- intermediate - level disinfectant
  - -- low - level disinfectant
  - -- tuberculocidal
  - -- Do Not Make Your Own Wipes From Disinfectants Approved As Sprays Only !

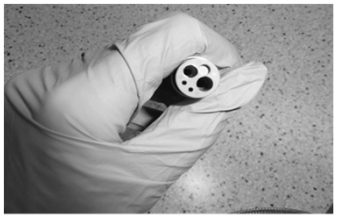
Potential Surface Disinfectant Problems

1. **Surface stains after switching surface disinfectants**
   - **most common going from sprays to wipes**
   - **accumulated disinfectant ⟶ chemical rxs**
   - **clean surfaces before new disinfectant use**



2. **Unpleasant odor when using surface disinfectant**
   - sulphur in gloves reacting c chemical
   - not present in most gloves; sulphur can be removed

Does the dental unit water meet EPA regulatory standards for drinking water?



Use water that meets regulatory standards for drinking water (< 500 CFU/ml of heterotrophic water bacteria) for routine dental treatment output water. CDC (2003)

Dental Unit Waterline (DUWL) Asepsis

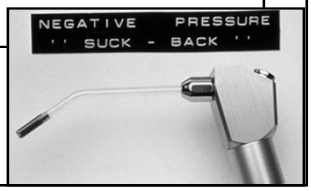
- **Sanitized, Potable, Drinking Water (PH Standards): 500 CFU/ml of heterotrophic bacteria**
- **Most untreated dental unit water samples: 1,000 to 10,000 CFU (some DUWL > 1,000,000 CFU documented)**
- **CDC Recommendation (2003): Use water that meets regulatory standards for drinking water (fewer than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

DUWL Concerns & Challenges

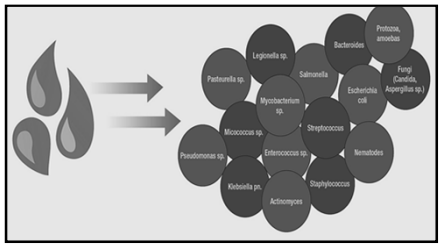
Water coming into dental offices from city supplies contain bacteria and nutrients that support their growth	*Dental unit waterlines contain long lumens, with a high surface area for biofilms to develop*	*Biofilms thrive in moist and warm environments, making the dental unit waterline a perfect environment*
Untreated dental units cannot reliably produce water that meets drinking water standards	*Microbial counts can be > 200,000 cfu/ml within 5 days of DUWL installation*	*Dental water exiting unit can be 100's to 1000's times more contaminated than incoming tap water*
Waterline contamination consists of slime-producing bacteria, fungi and protozoans	*Immune compromised patients are at a greater risk of opportunistic infections*	*In their natural habitat, 99.9% of all bacteria live as a community and attach to surfaces as biofilms*

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.**



Representative Isolated DUWL Microbes



- **waterborne infections & disease in hospital /public health settings many involve medical devices (nebulizers, endoscopes)**
- **most DUWL MO's from public water supply, & do not pose high risk for HEALTHY persons (i.e. opportunistic pathogens)**
- **increasing # of immune compromised dental pts – common waterborne MO's involved as increased infection / illness risks**

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

- **LANCET (February 18, 2012)**
- **82 yr. old woman died from Legionnaires disease**
- **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)

Shocking Waterlines

Shock treatment clears deposits and bacterial contamination from dental unit waterlines. It's a step that's recommended whenever test results are greater than your water quality action level.

A-dec recommends that you use a dental unit waterline shock treatment product registered with the U.S. Environmental Protection Agency (EPA). If you're located outside the U.S., contact your authorized A-dec dealer for product recommendations that are compatible with A-dec equipment. Whenever applying a shock treatment, be sure to adhere to the product instructions provided by the manufacturer.

After completing the shock treatment—including flushing with water—resume your waterline maintenance protocol with ICX.

A-dec Waterline Maintenance Guide (2012)

Are Evacuation Lines Cleaned Routinely & Suction Traps Changed?

- ❒ Fluid retraction (backflow) possible - closed lips around LV tip
- ❒ Can cause decrease in vacuum line pressure – previously evacuated fluid can flow backwards -- into pt's mouth?
- ❒ Potential cross-contamination source - *JADA* 1993 study
- ❒ No documented cross-infections

To Do:

1. Do not use low vacuum evacuation – rely on HVE
1. Pt's **NOT** to close lips around saliva ejector tip
2. Do not use LV saliva ejector simultaneously with HVE
3. Flush & clean evacuation lines daily
4. Have routine schedule for changing traps- (weekly?)

JAM (4/2015)

Microbes will continue to evolve and adapt in order to survive and thrive -- sometimes at the expense of susceptible human hosts

↓

Emerging Infection Control Challenges

↑

We must constantly remain aware of impending infectious disease threats which may challenge our current infection control precautions

Thank You

Any Questions ?

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