Public health is often invisible and unremarked when it works well; when it fails, our neighbors sicken and die.

Glasser RJ, We are Not Immune. Harper’s Magazine July 2004
Infectious Disease Risks

- Emerging/Re-emerging Infectious Diseases
- Bioterrorism Threats
- Sociopolitical Pressures
- Declining Public Health Budgets and Infrastructure
- Super bugs
Emerging Infectious Diseases

• 60.3% of emerging diseases have originated in wildlife (zoonotic)
• 53% are from bacteria or rickettsia
  – Vector borne
  – Antibiotic resistant bacteria
• More risk for new diseases at lower latitudes where monitoring, reporting and resources are scarce
• 30 new diseases
  – Legionnaires' disease
  – Human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS)
  – Hepatitis C
  – Bovine spongiform encephalopathy (BSE)/variant Creutzfeldt-Jakob disease (vCJD)
  – Nipah virus
  – Several viral hemorrhagic fevers
  – Most recently, severe acute respiratory syndrome (SARS) and avian influenza
Re-emerging Diseases

• Tuberculosis
• Cholera
• Reflect changes in human ecology
  – Migration from rural to urban (overcrowding, slums)
  – Increase in travel/trade
  – Changes in personal behavior
  – War and conflict
  – Human-induced global changes
  – Widespread clearing of forests
  – Political ignorance, as with AIDS
  – Use and misuse of medical technology, drugs
Spreading Disease

- endemic - present in a community at all times but in relatively low frequency, usually controlled

- epidemic – (sudden outbreak) spreading rapidly and extensively by infection and affecting many individuals in an area or a population at the same time

- pandemic - an epidemic that becomes very widespread and affects a whole region, a continent, or the world
Super Bugs

- MRSA - Methicillin Resistant Staphylococcus Aureus
- VRE - Vancomycin Resistant Enterococcus
- VISA / VRSA are newer super bugs
  - Vancomycin Intermediate Staphylococcus Aureus
    - Takes stronger dose
  - Vancomycin Resistant Staphylococcus Aureus
Droplets from a Sneeze

Source: Jennison, 1942
What is Infection Control?

Infection Control encompasses the processes and activities that identify and reduce the risks of acquiring and transmitting infections among individuals.
Normal Defense Mechanisms

- Antigens: cause a **specific immune response** that protects the body from a specific type of infection
  - Antigens are foreign proteins that enter the body
  - They initiate the formation of antibodies
  - The antibodies attack the foreign proteins
Normal Defense Mechanisms

• Acquired immunity (specific)
  – The formation of antibodies after exposure
  – Prepares body for future invasion by the same antigens (viruses, bacteria, toxins)
  – Vaccinations
    • Provide acquired immunity
    • Introduce dead organisms, live attenuated organisms, or toxins to stimulate manufacture of antibodies
  – The immune system has memory
    • Goes to work quickly if exposed to same antigens again
Normal Defense Mechanisms

• Nonspecific immune defenses
  – Do not depend on prior exposure to antigens
  – They include
    • Skin
    • Normal flora
    • Mucous membranes
    • Physiological reflexes
      – Coughing
      – Sneezing
    • Elimination
    • Acidity
    • Inflammation
Normal Defense Mechanisms

- **Inflammation**
  - Redness, warmth, Swelling, Pain/tenderness
  - Non-specific response to tissue injury caused by bacteria, trauma, or other substances
  - The tissue changes are called the *Inflammatory process*
    - Localizes and neutralizes the irritating agent
    - Signs & Symptoms of inflammation are similar to signs & symptoms of *infection*
      - Redness
      - Heat/warmth
      - Pain/tenderness
      - Swelling
      - and Pus
Two Types of Infections

• Localized
  – Ear infection
  – Wound abscess

• Systemic
  – Throughout the body
The influenza (Spanish Flu) pandemic of 1918-1919 killed more people than World War I, estimates are up to 100 million people. It has been cited as the most devastating pandemic in recorded world history.
Chain of Infection

• Name Six Factors in the chain of infection
Chain of Infection

• Six Factors:
  – Infectious agent
  – Reservoir
  – Portal of exit
  – Mode of transmission
  – Portal of entry
  – Susceptible host
1. Infectious Agents

- Bacteria

- Viruses

- Parasites
1. Infectious Agents

- Fungi

- Protozoa
2. Reservoirs for Microorganisms

- Humans & Animals – bodily fluids
- Food
- Water
- Soil
- Fomites – objects
- Vectors – biological (usually insects)
3. Portals of Exit

• Human
  – Skin
  – Eyes
  – Blood
  – Respiratory tract- nose, mouth
  – Mucous membranes
  – Genitourinary tract- urethra, vagina
  – Gastrointestinal tract- mouth, rectum

• Other
  – Mosquito snout
  – Tick bite
  – Animal feces
4. Mode of Transmission

• How a pathogen is transmitted from reservoir to susceptible host
  – Contact
    • Direct (bodily fluids, vector-borne)
    • Indirect (fomite, HCW- nosocomial)
  – Droplet- >5 microns, travel 3-6’, flu
  – Airborne- < 5 microns, suspend in air, TB
5. Portal of Entry

- **Human**
  - Skin
  - Eyes
  - Blood
  - Respiratory tract - nose, mouth
  - Mucous membranes
  - Genitourinary tract - urethra, vagina
  - Gastrointestinal tract - mouth, rectum

- **Other**
  - Mosquito snout
  - Tick bite
  - Animal feces
6. Susceptible Host

- Requires capability of becoming infected
  - Immunocompromised
    - Medication- steroids, chemotherapy
    - HIV/AIDS
  - Age- elderly, young
  - Ethnicity
  - High risk behaviors
- Microorganisms must be present in high enough quantity to cause infection
- If a potential host has an already weakened immune system, it is easy for opportunistic infections to occur
How Can The Spread of Disease Be Stopped?
• Break the chain of infection at any point:
  – Disable the infectious agent*
  – Eliminate reservoir
  – Interrupt portal of exit
  – Interrupt transmission*
  – Protect portals of entry
  – Host as healthy as possible*

• * the 3 primary methods of breaking the chain
BREAKING THE CHAIN OF INFECTION

INFECTION AGENT
Bacteria  Fungi  Viruses  Rickettsiae  Protozoai

Rapid, accurate identification of organisms

RESERVOIRS
People  Equipment  Water

Employee health
Environmental sanitation
Disinfection/sterilization

PORTAL OF ENTRY
Mucous membrane  GI track  Respiratory track  Broken skin

Aseptic Technique

Susceptible Host
Immunosuppression  Diabetes - Surgery - Burns  Cardiopulmonary

Recognition of high-risk patients

PORTAL OF EXIT
Excretions  Secretions  Skin  Droplets

Proper attire
Handwashing
Control of excretions & secretions
Trash & waste disposal

MEANS OF TRANSMISSION
Direct Contact  Fomites  Ingestion  Airborne

Isolation
Food handling
Air flow control

Sterilization

Handwashing

Catheter Care
Wound Care

Treatment of underlying diseases
Disable/Control the Source

- Rapid identification/isolation of sources
- Pest/vector control
- Environmental disinfection
- Behavior change
  - Respiratory hygiene/cough etiquette
  - Frequent Hand washing
  - Use of barrier protection (PPE)
  - Consider every patient as a source of infection (Standard Precautions)
- Rapid delivery of effective treatment/vaccination
Interrupt Transmission

Promote personal infection control:
hand washing, cough hygiene, reduce risk factors, personal habits, vaccination, prophylaxis, self-isolation

Contact management
Hand washing, PPE, isolation, quarantine

Individual and mass prophylaxis
Flu shot programs, vaccinations

Activity restrictions
close public venues; suspend public gatherings; restrict travel
Reduce Host Susceptibility
Stay Healthy

• Healthy diet
• Exercise
• Sleep
• Avoid Risky behaviors
• Vaccinations
• Hand washing
Take Precautions
CDC and OSHA Guidelines

Standard Precautions
– Treat everyone as a potential source of infection

Expanded Precautions:
- Contact
- Droplet
- Airborne
Standard Precautions:

Basic preventive measures to be used with all patients at all times.

– Gloves for contact and keep skin intact
– Hand washing
– Patient placement
– Other PPE based upon anticipated exposure
– Safe Work Practices:
  • Sharps
  • no mouth-to-mouth
– Environmental measures: cleaning
PPE/Personal Protective Equipment

• Includes
  – Gloves
  – Gown
  – Masks
  – Goggles

• Change PPE and wash hands between patients
Resuscitation

• Use a mouthpiece or resuscitation device to avoid mouth-to-mouth contact
Expanded Transmission-Based Precautions

• To Be Used In Addition to Standard Precautions
  – Additional precautions specific to specific disease

  – Contact Precautions
  – Droplet Precautions
  – Airborne Infection Isolation
Expanded Transmission-Based Precautions

Contact Precautions

- Private room, if needed
- Wear gloves (gown, if needed) for all contact with patient or with potentially contaminated surfaces or items
- Gown, mask, & goggles if possibility of blood splashes
- Use disposable patient care items whenever possible
  - If patient care items must be shared, disinfect between patients
- Clean patient room at least daily and disinfect high touch surfaces
Expanded Transmission-Based Precautions

**Droplet Precautions**

Respiratory droplets generated when coughing, sneezing, talking or during cough-inducing procedures

- Patient placement - private room
- Wear a surgical mask for close patient contact
  - For SARS (Severe Acute Respiratory Syndrome
    - Wear PAPR (powered air purifier respirator)
- Limit patient transport
  - Instruct patient to wear a surgical mask
  - Notify visitors of precautions
Expanded Transmission-Based Precautions

**Airborne Infection Isolation**

- All persons who enter room must wear respiratory protection (NIOSH approved N-95 respirator mask)

- Tuberculosis (< 4 microns)
  - Bacteria
  - Private room with negative pressure air flow
  - High-Efficiency Particulate (HEPA) air filter mask
Reverse Isolation

- A patient with weak immune system wears mask to prevent others from spreading airborne disease to the patient
- Visitors wear mask to protect patient
• Who needs reverse isolation?
Immunocompromised Patients Need Reverse Isolation

• Easy targets for opportunistic infections
  – Depressed immune system
    • Chemotherapy
    • Radiation treatment
    • Burns
    • Low WBC
    • Leukemia
    • HIV/AIDS
Biohazard Waste & Safety

• Red Biohazard waste can in room or entry

• Yellow for laundry

• Sharps containers - needles, vials, scalpels
  – NEVER recap used needles!!!!
Handling Lab Specimens

• Biohazard
  – Containers
  – Into bags
Biohazard Disposal

- expensive
Medical Asepsis

• Is clean technique
  – Reduces number of organisms
  – Examples: Hand washing, antiseptics, disinfectants

• Antiseptics: Skin

• Disinfectants: Objects
Surgical Asepsis/Sterile Technique

- Eliminates all organisms, including spores
- Example: sterilization of surgical instruments
Sterile Field Practices

• Used for
  – Surgery
  – Some dressing changes
  – Procedures

• Mitten, forceps, or drop items onto sterile field
• All but outer 2 inches is considered sterile
• Never reach across sterile field, or touch it with non-sterile items
• Never take eyes off of it (don’t turn your back)
• Don’t lower hands below level of field
• Hands away from body, above waist
Sterile Field

• What should you do if you spill a solution on the sterile field?
Sterile Field

• What should you do if you spill a solution on the sterile field?

• Discard equipment and start over
Sterile Field

• What should you do if you suspect an article is contaminated?
Sterile Field

• What should you do if you suspect an article is contaminated?

• Start over
Visitors’ Signs

• On door to Patient’s room
Role of Surgical Masks?

A surgical mask is **NOT** respiratory protection

- **1° intent:** preventing wound contamination by infectious droplets from HCW’s respiratory tract
- **2° use:** barrier protecting HCW’s nose and mouth from large droplet splashes, sprays of infectious material

Particles can enter at edges of mask

Some not constructed using particulate filter media

Source: Rosie Sokas, MD MOH UIL at Chicago
N-95 Filtering Facepiece Respirators
Benefits of fit testing

- Study: 25 volunteers, 21 models of N-95 respirators
- **Without** fit testing, 95% had up to 33% leakage
- **With** fit testing, 95% had no more than 4% leakage
Recap

• Chain of Infection:
  – 6 factors required for infection to occur

• Infection Control focus:
  – Break the chain

• Infectious disease primary control points:
  – Contain/control the source/agent
  – Interrupt transmission
  – Reduce host susceptibility

• Use
  – Standard Precautions for everyone
  – Transmission-based Precautions for specific diseases
Infection Control Lessons

• The **details** of prevention and control measures **always** matter

• **Personal habits may make the difference** between acquiring, evading, or spreading an infection
Donning PPE - Procedure

- Gather supplies
- Remove jewelry
- Wash hands
- 1. Face mask & goggles, or mask & shield
  – Cover mouth & nose, pinch
- 2. Gown, tie
- 3. Gloves, over cuffs
Removing PPE - Procedure

• Book
  – Remove
    • 1. Gloves, inside out
    • Wash hands*
    • 2. Gown - Reach inside gown shoulder, pull down
      – Hold gown away & fold inside out
      – Place in biohazard waste
    • Wash hands*
    • Remove mask & goggles: only touch strings
    • Wash hands*

• Alternate practice
  – Remove
    • Gloves & gown simultaneously & fold inside out
    • Place in biohazard waste
    • Wash hands*
    • Remove mask & goggles: only touch strings
    • Wash hands*
What germs are on our hands?

Don't spread these germs! Wash your hands after going to the bathroom and before eating!

Handwashing is the single most important thing you can do to stop the spread of infection! This message brought to you by Fairmont General Hospital. Visit our website at www.fghi.com or www.labs.net/schools/marion/mms/health.htm.
When Should You Wash Your Hands?

1. When arriving and before leaving a healthcare facility
2. Before and after every patient contact
3. Before moving from a contaminated body site to a clean body site on same patient
4. Any time hands become contaminated during a procedure
5. Before applying and immediately after removing gloves
When Should You Wash Your Hands?

6. Any time gloves are torn or punctured
7. Before and after handling specimens
8. Before you eat or drink
9. After personal use of the bathroom
10. After you cough, sneeze, or use a tissue
11. Before or after any contact with your mouth or mucous membrane (eating, drinking, inserting contacts, etc.)
Group Discussion

• Do all healthcare workers practice all of these handwashing standards all of the time?

• Based on what you have learned, would you guess that nosocomial infections are almost always preventable, often preventable, or occasionally preventable?
How to wash your hands properly

1. Wet your hands
2. Liquid soap
3. Lather and scrub - 20 sec
4. Rinse - 10 sec
5. Dry your hands
6. Turn off tap

DON'T FORGET TO WASH:
- between your fingers
- under your nails
- the tops of your hands
THE BEGINNING