**BAD BUGS**

Presented by

The Groundwater Foundation

**COMMON WATERBORNE PATHOGENS**

- *E. coli* (notably serotype O157:H7)
- *Legionella*
- *Cryptosporidium*
- *Giardia*
- Noroviruses (Norwalk-like viruses)
BAD BUGS AND THEIR GANGS

- Bacteria
  - *E. coli*
  - *Legionella*
  - *Campylobacter*

- Protozoa
  - *Cryptosporidium*
  - *Giardia*

-Viruses
  - Noroviruses (Norwalk-Like Viruses (NLVs))
  - (also Hepatitis-A, though no major documented cases of waterborne outbreaks in recent history)

BAD BUGS = BAD NEWS

- *E. coli* O157:H7
  - Bloody diarrhea without fever
  - Extreme cases may lead to hemolytic uremic syndrome (HUS) which may cause kidney failure
  - Note: serotype O157:H7 is just one strain of large family of *E. coli* bacteria, several others also pathogenic

- *Legionella*
  - Diseases called Pontiac Fever, Legionnaire’s Disease
  - Respiratory infection
  - Pontiac Fever is less severe form of disease
  - Legionnaire’s Disease is marked by development of respiratory infection into pneumonia
BAD BUGS = BAD NEWS

- *Campylobacter jejuni*
  - Diarrhea (may be bloody), cramping, abdominal pain, nausea, vomiting
  - In immune-compromised patients, may lead to life-threatening blood infection; may also lead to Guillain-Barre syndrome which may cause temporary paralysis
  - *C. jejuni* causes most human illnesses; however, other species of *Campylobacter* cause about 1% of documented illnesses

BAD BUGS = BAD NEWS

- *Cryptosporidium*
  - Diarrhea
  - Abdominal discomfort

- *Giardia*
  - Diarrhea
  - Abdominal discomfort
BAD BUGS = BAD NEWS

- Noroviruses (Norwalk-Like Viruses (NLVs))
  - Fever
  - Headache
  - Gastrointestinal discomfort
  - Diarrhea

BAD BUG PROFILE
NAME: ESCHERICHIA COLI O157:H7
(AKA E. COLI O157:H7)

CRIMINAL HISTORY:
CAUSED ILLNESS IN 781 PEOPLE AND 2 DEATHS IN WASHINGTON CO., NY IN 1999; CAUSED ILLNESS IN 600 PEOPLE AND 7 DEATHS IN WALKERTON, ONTARIO IN 2000.

M.O.:
CAUSES BLOODY DIARRHEA, OFTEN WITHOUT FEVER, IN VICTIM

IDENTIFICATION NOTES:
PRODUCES “SHIGA-LIKE” (SIMILAR TO SHIGELLA) TOXIN WHICH MAY LEAD TO HEMOLYTIC UREMIC SYNDROME IN VICTIM. KNOWN TO HANG OUT IN UNDERCOOKED BEEF.

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- FIRST IDENTIFIED AS PATHOGEN IN 1982 WHEN OUTBREAK OF DIARRHEA WAS TRACED TO UNDERCOOKED HAMBURGERS
- MOST INFECTIONS OCCUR FROM CONSUMPTION OF UNDERCOOKED BEEF
- SYMPTOMS BEGIN 3-9 DAYS AFTER EXPOSURE, THOUGH SHORTER INCUBATIONS NOT UNCOMMON
- ILLNESS LASTS 5-10 DAYS
- ANTIBIOTICS AND ANTI-DIARRHEAL MEDICATIONS ARE NOT RECOMMENDED

- 2-7% OF INFECTIONS LEAD TO HUS, OF WHICH 1/3 MAY EXPERIENCE LONG-TERM KIDNEY MALFUNCTION, AND 8% MAY HAVE LIFELONG COMPLICATIONS LIKE HIGH BLOOD PRESSURE, SEIZURES, BLINDNESS, PARALYSIS
- E. COLI O157:H7 IS PRESENT IN GASTROINTESTINAL TRACT OF HEALTHY CATTLE AND INFECTED ANIMALS
- FIRST LINE OF DEFENSE: PREVENTING ANIMAL WASTE FROM ENTERING DRINKING WATER SOURCE
NAME: LEGIONELLA PNEUMOPHILA (AKA LEGIONELLA)

CRIMINAL HISTORY: CAUSED OUTBREAK OF LEGIONNAIRE’S DISEASE IN TORONTO NURSING HOME, 2005; RESULTED IN 127 ILLNESSES AND 21 DEATHS

M.O.: CAUSES RESPIRATORY ILLNESS WITH HIGH FEVER SOMETIMES LEADING TO PNEUMONIA. MAY ACT MILDLY, CAUSING PONTIAC FEVER

IDENTIFICATION

NOTES: MOSTLY OPERATES AS AIRBORNE DROPLETS THROUGH VENTILATION SYSTEMS; IDEAL HIDEOUT IS IN SWIMMING POOLS AND HOT TUBS

- FIRST IDENTIFIED OUTBREAK IN 1976 AT AMERICAN LEGION CONVENTION IN PENNSYLVANIA
- LEGIONNAIRE’S DISEASE (MORE SEVERE FORM, LEADS TO PNEUMONIA) MAY CAUSE DEATH IN UP TO 5-30% OF PATIENTS
- SYMPTOMS BEGIN TO OCCUR 2-14 DAYS AFTER EXPOSURE
- PONTIAC FEVER (LESS SEVERE FORM) LASTS 2-5 DAYS, NO TREATMENT USU. NECESSARY
- LEGIONNAIRE’S DISEASE TREATED WITH ANTIBIOTIC
- VICTIMS WHO SURVIVE MAY SUFFER PERMANENT PHYSICAL OR MENTAL IMPAIRMENT
- MOST OUTBREAKS ARE NOT LARGE, AFFECTING 1-2 VICTIMS AT A TIME
- CDC ESTIMATES 10,000 TO 15,000 CASES IN THE US ANNUALLY
- COMMON LONG TERM EFFECTS INCLUDE FATIGUE AND LACK OF ENERGY, MAY LAST MONTHS
One of the most common causes of diarrheal illness in the U.S. occurs more frequently in summer than winter. Campylobacter is fragile and cannot tolerate cold temperatures, drying (may even be killed by oxygen). Does not commonly cause death, but may cause up to 100 deaths per year. Most victims can recover without treatment, though in some cases, antibiotics may be used.
NAME:
CRYPTOSPORIDIIUM PARVUM
(AKA CRYPTOSPORIDIIUM)

CRIMINAL HISTORY:
CAUSE OF CRYPTOSPORIDIIOSIS OUTBREAK IN MILWAUKEE, WISCONSIN IN 1993; OVER 400,000 PEOPLE ILL

M.O.:
CAUSES DIARRHEA, ABDOMINAL DISCOMFORT IN VICTIM

IDENTIFICATION NOTES:
PROTOZOAN, DEVELOPS OOCYST (FUNCTIONS LIKE BULLET-PROOF VEST) WHICH AIDS PERPETRATOR IN RESISTING INACTIVATION FROM CONVENTIONAL DISINFECTION METHODS

CRYPTOSPORIDIIUM NOW IDENTIFIED AS ONE OF THE MOST COMMON PATHOGENS IN DRINKING WATER AND RECREATIONAL WATER

ILLNESS OCCURS APPROXIMATELY 2-10 DAYS AFTER EXPOSURE (AVERAGE 7 DAYS)

SYMPTOMS LAST 1-2 WEEKS; MAY SEEM TO GET BETTER AND THEN WORSEN

SOME PRESCRIPTION DRUGS AVAILABLE FOR TREATMENT, THOUGH INDIVIDUALS WITH HEALTHY IMMUNE SYSTEMS USUALLY RECOVER WITHOUT TREATMENT

EFFECTS OF PRESCRIPTION DRUGS ON THOSE WITH COMPROMISED IMMUNITY (AIDS, CANCER PATIENTS, ELDERLY AND YOUNG) IS UNCLEAR

CRYPTOSPORIDIIUM LIVES IN INTESTINES OF WARM-BLOODED ANIMALS, INCLUDING CATTLE, SHEEP, DEER AND BEAVERS

FIRST LINE OF DEFENSE: PREVENTING ANIMAL WASTE FROM ENTERING DRINKING WATER SOURCE
**NAME:**

GIARDIA LAMBLIA

(AKA GIARDIA, GIARDIA INTESTINALIS)

**CRIMINAL HISTORY:**

CAUSED ILLNESS 324 PEOPLE IN RENO, NEVADA IN 1982

**M.O.:**

CAUSES DIARRHEA, ABDOMINAL DISCOMFORT IN VICTIM

**IDENTIFICATION NOTES:**

PERPETRATOR MAY CAUSE ILLNESS FOR 2 WEEKS UP TO 2 MONTHS. LIKE CRYPTOSPORIDIUM, FORMS PROTECTIVE OUTER BARRIER LIKE BULLET-PROOF VEST

- IDENTIFIED AS ONE OF MOST COMMON PATHOGENS IN DRINKING WATER AND RECREATIONAL WATER
- SYMPTOMS BEGIN TO OCCUR 1-2 WEEKS AFTER EXPOSURE (7 DAYS AVERAGE)
- ILLNESS LASTS 2-6 WEEKS, OCCASIONALLY LONGER
- PRESCRIPTION DRUGS ARE AVAILABLE FOR TREATMENT
- CHILDREN AND PREGNANT WOMEN ESPECIALLY SHOULD DRINK PLENTY OF FLUIDS TO AVOID DEHYDRATION DURING ILLNESS
NAME: NOROVIRUS

CRIMINAL HISTORY: CAUSED RELATIVELY SMALL OUTBREAK AT WYOMING SNOWMOBILE LODGE IN FEBRUARY 2001; LARGE OUTBREAK AT ITALIAN RESORT (344 ILL) IN JULY 2000

M.O.:
CAUSES FEVER, HEADACHE, GASTROINTESTINAL DISCOMFORT, DIARRHEA IN VICTIM

IDENTIFICATION NOTES:
ORIGINAL STRAIN WAS NORWALK, FIRST NOTED CRIMINAL ACTIVITY IN 1968; SINCE THEN, SEVERAL OTHER STRAINS IDENTIFIED AND ARE COLLECTIVELY CALLED NOROVIRUSES

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SYMPTOMS OCCUR WITHIN 24-48 HOURS OF EXPOSURE, SOMETIMES AS LITTLE AS 12 HOURS
ILLNESS LASTS 1-2 DAYS
NO ANTIVIRAL MEDICATION OR VACCINATION AT PRESENT
INFECTED PERSONS ARE CONTAGIOUS FROM ONSET OF SYMPTOMS, TO UP TO 2 WEEKS AFTER RECOVERY
VIRUS IS HIGHLY CONTAGIOUS, PRESENT IN STOOL AND VOMIT OF VICTIM

- NORWALK VIRUS FIRST IDENTIFIED IN 1972, FROM 1968 OUTBREAK OF GASTROENTERITIS IN SCHOOL CHILDREN AND TEACHERS IN NORWALK, OHIO
- SINCE 1972, SEVERAL SIMILAR STRAINS IDENTIFIED AND COLLECTIVELY CALLED ‘NORWALK-LIKE VIRUSES,’ RECENTLY OFFICIALLY CALLED NOROVIRUSES
GETTING RID OF BAD BUGS

- Chemical treatment
  - Chlorination: Most common form of treatment
    - Effective against bacteria, but not as effective against viruses or protozoa cysts
    - Disinfection byproducts are a growing concern
    - Water chemistry must be assessed/altered

- Non-chemical treatment
  - Ultraviolet
    - Effective against bacteria and viruses, but will not deactivate protozoa cysts
    - Water quality must be assessed/altered

PREVENTING BAD BUG ACTIVITY

- Virtually all bad bugs found in human or animal fecal matter
- Preventing bad bugs from entering drinking water sources includes:
  - Proper onsite waste management
  - Runoff prevention/interception
  - Fencing around surface water sources
  - Proper well construction (including well casing extension in floodplains)
  - Placing wells away from potential sources
ONSITE WASTE MANAGEMENT, RUNOFF PREVENTION/INTERCEPTION, FENCING

- Proper placement of septic systems
- Regular pumping and inspection of septic systems
- Proper containment of animal waste (lagoons)
- Filter strips around surface water sources – effectiveness assessments are mixed
  - Slow runoff and filter out sediments (including attached pathogens); but create habitat for wildlife at shore/bank
  - Fencing around surface water sources to keep large animals out

WELL CONSTRUCTION AND PLACEMENT

- Well should be located ‘uphill’ (up-stream) of potential contamination sources
- Wells should be cased with impervious (steel or plastic) material
  - Nebraska standards dictate this, though older wells may have clay/brick casing
  - Older wells should be abandoned properly and new up-to-standard wells should be constructed
- Top of well casing should be at least 12 inches above ground
  - May need to be taller in floodplain areas (so that top of casing is above flood waters)
  - Area around casing should slope away from well