Caselet #1:

A 25 year old woman has pain on micturition with frequency and urgency for the last 48 hours. The urine is cloudy and malodorous.

1. **What kind of infection is likely?**
   - Urinary tract infection (UTI) most likely
   - Differential diagnosis may also include sexually transmitted infection (i.e. Chlamydia, gonorrhea)

2. **What bacteria are the usual suspects?**
   - Important to note that all uropathogenic bacteria must be capable of firm attachment to urothelial cells via pilli in order to prevent regular flushing by micturition
   - The two most common are:
     1) E. Coli (Escherichia Coli)
        → Most common (80-85% of UTIs)
        → Gram-negative rod-shaped bacteria
        → Normal flora of large bowel
        → Fecal transmission
     2) Staphylococcus saprophyticus
        → Second most common (10-20% of UTIs)
        → Gram-positive spherical bacteria
        → Not naturally found in humans, but in animal carcasses, therefore transmissible through improperly prepared food
        → Resistant to novobiocin, but susceptible to common antibiotics

3. **What risk factors contribute to this kind of infection?**
   - Female
     → shorter urethra (shorter distance for microbes to travel)
     → urethral opening in close proximity to anus (cross-contamination)
     → post void residual volumes due to incomplete emptying of bladder (re. emptying via gravity vs. muscular contraction)
     → males protected by antibacterial substances in prostatic secretions
   - Abnormalities of the urinary tract that obstruct the flow of urine (i.e. kidney stones, tumours)
   - Immunosuppression
   - Diabetes
   - Frequent sexual intercourse
   - Recurrent urinary tract infections

4. **What is the natural history of this condition?**
   - Bacteria mainly enter the urethra from the bowel reservoir and may ascend to the bladder depending on the adhesion capability of the pathogen
   - If left untreated, the bacteria may reach the kidney via:
     → retrograde ascent
     → reflux due to edema associated with cystitis
     → reduced ureteral peristaltic function caused by some gram negative bacteria and endotoxins
     → alteration of urinary tract pathway (common in pregnancy)
   - If bacteria reaches the renal pelvis it may continue to ascend toward the renal parenchyma
   - Bacteria in kidneys may cause:
     → pyelonephritis
     → renal abscess
     → kidney damage and/or failure
     → uro-sepsis
   - Treatment generally is a course of antibiotics (i.e. nitrofurantoin, trimethoprim, amoxicillin, etc.)
   - The effectiveness of cranberry juice and hydration is questionable
COMMON BACTERIAL PROBLEMS: Caselet #2

While on holiday in Mexico, you suddenly feel that you must visit the toilet fast. You have a series of watery bowel movements and severe cramps.

A) What kind of infection is likely?

The most likely infection is travelers' diarrhea (TD) from contaminated food or water. This is the most common travel-related illness, and affects up to 50% of travelers from the developed world who visit developing regions. The travel destination is the strongest predictor for whether or not an individual develops TD. High risk regions include parts of Africa, Asia, and Latin America. TD is not usually life-threatening, and episodes will often resolve without any direct intervention. However, dehydration is a potential concern. Classic TD involves the “passage of three or more unformed stools in a 24 hour period”. Abdominal cramping is a common symptom of TD. Some patients may also experience fever, vomiting, or blood or mucus in the stools. The symptoms can vary depending on the type of microbe which caused the infection.

B) Are the usual suspects bacteria, protozoa or viruses?

The most common cause (85% of TD infections) of TD is bacterial, with enterotoxigenic Escherichia coli (ETEC) being the most common. Common causes vary with location visited.

Both viruses and protozoa can also cause TD, although this is less common:

- Protozoa (10-15% of TD infections)
- Viruses (up to 5% of TD infections) – typically in settings like cruise ships, etc.

C) What are the usual suspects?

ETEC is the most common bacterial cause of TD accounting for up to 50% of cases. It is a Gram negative bacterium that is commonly found in soil, water, and milk. There are three specific toxins that can cause E. Coli to become ETEC:

- Heat-labile enterotoxin (LT)
- Heat-stable enterotoxin A (STA)
- Heat-stable enterotoxin B (STB)

Shigella is a bacterium in approximately 15% of TD cases. However, it is more common in areas that experience natural disasters, social upheaval, and when clean water is hard to find. Moreover, the major symptom caused by Shigella is bloody, mucus-laden diarrhea which is inconsistent with this scenario, and thus, not the likely cause.

Entamoeba histolytica is a parasite that is prevalent in Mexico as well as India, Africa, and Central and South America. Entamoeba histolytica produces small stools with blood and mucus and therefore, is also not a likely cause in this scenario.

Noroviruses (Norwalk-like viruses) are increasingly becoming the cause of diarrhea in Mexico and Guatemala and on cruise ships. Although E. coli is more common in these areas than noroviruses, the symptoms of TD caused by noroviruses are more similar to this scenario. In addition to causing watery diarrhea and abdominal cramps, other symptoms may be nausea, abdominal pain, malaise, and low grade fever. The incubation period for noroviruses is usually 24-48 hours and symptoms can last from one to three days.

D) Are the local residents likely to have similar problems?

Adults seem to develop immunity to pathogens in unsanitary water. Because it takes time to develop immunity, children in developing countries frequently suffer from diarrhea (caused by the same organisms that cause TD). Several studies have been completed on this topic:

- Study #1: Children in developing countries experience 280 million episodes of diarrhea due to ETEC annually
- Study #2: Over 90% of children in Bangladesh and Egypt experience their first episode of pathogen-associated diarrhea by 14 months of age and ETEC accounts for 66% of these episodes
- Study #3: Forty U.S. students spent a month in Mexico. During the first 2 weeks: 13 had asymptomatic ETEC colonization, 14 had symptomatic infection, while in the second 2 weeks, 31 had asymptomatic ETEC colonization, 4 had symptomatic infection
- Study #4: Medical students studying in Mexico. Over time, these students developed immunity to ETEC. After returning to the U.S. for 6-8 week vacation, the student’s immunity was lost and the student’s became susceptible to TD again.
GROUP 3 – CASELET 3

3. A 19 year-old male university student goes out to the racetrack and blows $800 on long shots. Although he did not drink alcohol, the next morning he has headache, fever, drowsiness and neck stiffness.

A) What kind of infection is likely?
- meningitis, which is an inflammation of the meninges in the CNS
  - can be bacterial, viral, or caused by fungi or amoebae (rare)
  - bacterial is usually the most serious
- triad of symptoms (neck stiffness with headache and change in mental status) make this the most likely diagnosis
- potentially manic behaviour just prior to onset may suggest a causative agent (Neisseria meningitidis or meningococcus)

B) What are the usual suspects?
- We would guess that Neisserium meningitides is the bacteria (heterotrophic gram-negative diplococcal bacterium) causing the infection due to patient’s age
  - Teenagers the second-most affected age group (after young children)
  - Meningitis may have be caused by different organisms
    - Streptococcus pneumonia more common in infants, young children and the elderly
    - Haemophilus influenza also unlikely since there is currently a vaccine; also usually follows ear infections
    - Listeria usually only causes illness in the immuno-compromised
    - Group B strep in neonates
- Viral meningitis caused by enteroviruses (polio, herpes, CMV, EBV, west Nile, HIV) seems less likely
  - More common, but usually does not cause serious symptoms (and often resolves by itself)
  - Other symptoms include rash and sore throat (which are not identified in this patient)

C) How would you make a definitive diagnosis?
- The most definitive way is through a lumbar puncture:
  - note anatomy: meningial membrane
  - check CSF for cloudiness: should be clear
  - opacity caused by protein, WBCs, RBCs or bacteria
  - analysis of CSF
  - cells: see WBC types; clue to viral (lower WBC count, mononuclear) or bacterial (higher WBC count, PMNs) meningitis
  - culture: gram-staining; bacterial vs viral cultures; takes time
  - concentration of glucose: if lower than normal, from the hypermetabolic inflammatory state (you can remember it by thinking about the bacteria eating it); most sensitive marker of bacterial meningitis
  - ? PCR: see type of bacteria/virus
- May do CT or MRI to see inflammation of meninges, especially with change in mental status

D) What public health measures would you recommend?
- Prophylaxis for people in contact with the bacterial meningitis infected individual
  - Only when there has been intimate and prolonged contact (casual contact is not a risk factor) or
  - for people who are immunocompromised
- for those under 2 years and their care givers
- people otherwise at risk

People in contact with viral meningitis do not require special treatment

- Antibiotics (Ex. Rifampicin 600mg BID for two days, Single dose of 500mg ciprofloxacin)

- Vaccines for bacterial meningitis (in US)
  
  o Meningococcal vaccines (Neiseria meningitides)
    - 1) Meningococcal polysaccharide vaccine (MPSV 4 or Menomune)
    - 2) Meningococcal conjugate vaccine (MCV 4 or Menactra)
  
  o Pneumococcal vaccines (Streptococcus pneumoniae)
    - 1) Conjugate vaccine (PCV 23 or Prevnar)
    - 2) 23-valent polysaccharide vaccine (PPV 23 or Pneomovax and Pnu-Immune)
  
  o Hib vaccine (Haemophilus influenzae serotype b)
    - Often given to children, who are at greater risk
Caselet 4: A Sore Throat (Pharyngitis)
A nine year-old boy has a sore throat. There is intense erythema of the oropharynx

1. What are the usual Suspects?
   i. In children, 70-85% of pharyngitis cases have a viral etiology
      • Rhinovirus, adenovirus are most common, but many others.
   ii. Bacteria account for another 10-15%
      • Streptococcus pyogenes most common, but many others.
   iii. Remaining cases result from trauma, chronic disease, allergy, and neoplasia

2. What diagnostic and therapeutic measures would you undertake?
   i. The main goal of diagnostics is to determine if pharyngitis has a bacterial or viral etiology.
      • Bacterial Infection Confirmed by:
        I. Rapid Streptococcal A antigen testing (10-20mins)
        II. Throat swab and culture for definitive answer, but takes longer.
           o If nothing grows on the culture, then it is likely a viral cause.
      • Specific Viral Infection Confirmed by:
        I. Monospot test can confirm mononucleosis, which can become very serious if not detected.
   ii. While antibiotics (pref. cephalosporin) are a responsible treatment option for bacterial infections, treatment of a viral infection should focus on symptom management only. The use of antibiotics in viral throat infections is an example of irresponsible use of antibiotics and contributes to the emergence of antibiotic-resistant bacteria.

3. What complications can ensue from the most common bacterial cause?
   i. Common complications of Streptococcus pyogenes infection are rheumatic fever, scarlet fever, sinusitis, pneumonia, tonsillitis, and streptococcus toxic shock syndrome.

4. What is the natural history of this condition?
   i. Transmission occurs via mucous droplets from an infected person.
   ii. Untreated patients are most infectious for 2-3 weeks after onset of infection, but are non-infectious within 24 hours of treatment.
   iii. Symptoms occur after an incubation of period 2-4 days. Symptoms are generally self-limited within 3-7 days.
      • Primary symptoms: Sore throat
      • Secondary symptoms: Fever, headache, abdominal pain, nausea, vomiting, enlarged lymph nodes and suppurative lesions
   iv. Left untreated, additional complications may occur.
A 30 year-old man experiences severe epigastric pain and burning. This is relieved by eating, and taking antacids but is aggravated by spicy foods and alcohol.

A) Is this likely to be an infection?
Pain could be due to several reasons:
1) Gastric ulcer
   - Probably not—since eating food often worsens pain
2) Duodenal ulcer
   - MOST LIKELY—eating food helps as well as antacids

B) What are the usual suspects?
1) NSAIDs—non-steroidal anti-inflammatory drugs which inhibit Cox-1 and Cox-2
   - Over-consumption limits mucous secretions
2) Alcohol —increases gastric secretions
3) Genetic—predisposition to hypersecretion of gastric acids
4) Helicobacter pylori—spiral shaped Gram negative bacteria (MOST LIKELY)
   - Creates ammonia due to its urease activity—helps it survive in low pH environment
   - >50% of world’s population have H. pylori in upper GI tract – most asymptomatic

C) What is the pathogenesis of this condition?
   H. pylori produce:
   - adhesins which helps the bacteria attach to the gastric epithelial cells
   - ammonia (due to urease) which damages gastric epithelial lining
   - proteases and phospholipases which break down mucosal defense

   Certain strains also secrete virulence factors (cytotoxins) which damage gastric epithelial cells and increase risk of developing ulcers

   H. pylori colonization results in chronic inflammation and a Th1 immune response

   Chronic inflammation can stimulate gastrin production by G-cells which increase acid secretion by parietal cells. Increased acid + decreased mucosal defenses → cell damage and ulceration

   Immune response rarely clears the infection and may be responsible for some of the pathogenesis

D) What is the treatment?
- Triple treatment consists of:
   2 antibiotics of the following that will eliminate the bacteria
     o Amoxicillin, tetracycline, clarithromycin
   1 of the supplementary treatment methods:
     o Proton-pump inhibitor (PPI) which decrease acid secretion —or—
     o Bismuths which coats stomach like antacids —or—
     o H2-receptor antagonists that decrease gastric secretions.

- For more aggressive treatment (quadruple treatment) 2 antibiotics and 2 of the supplementary treatment methods.
- Dietary restrictions such as limit intake of alcohol, caffeine, and spicy foods may decrease discomfort.
GROUP 6 – CASELET 6

PART A

Food poisoning falls into two categories:

1) Food infection: symptoms are caused by the microbes invading across the intestinal epithelial cell barrier

2) Food intoxication: symptoms are caused by a chemical or exotoxin released by bacteria

   a. If organism makes the toxin in the food prior to consumption: rapid onset of symptoms (6-12 hours) à staph aureus, bacillus cereus, botulism

   b. If organism makes toxin after they have been ingested: later onset (>24 hours), causes watery (V. cholerae, enterotoxigenic E. coli) or bloody (Shiga toxin-producing E. coli) diarrhea

Infection vs Intoxication:

- Infection involves a longer incubation period because microbes need time to colonize and reproduce

- Fever may accompany infection, but intoxication is only associated with vomiting & diarrhea

PART B

Bacterial:
Staph aureus
Bacillus cereus
Salmonellae
Campylobacter
Escherichia coli (E coli)
Clostridium botulinum
Vibrio cholerae
Listeria

Viral:
Enteric viruses (Norovirus, rotavirus)
Hep A

Parasites (rare):
Giardia (beaver fever)
Cryptosporidium

PART C

- Since it’s a picnic and many people are affected showing similar symptoms - common source = most likely food poisoning
- Incubation period/Time of onset *MAIN*
- *staph aureus or bacillus cereus*: 1 – 6h (others have much longer times) = most likely staph because food sources for that are salads, dairy, meats (picnic foods) rather than bacillus where its mostly starchy foods like rice (non picnic foods)

**PART D**
This problem is caused during the preparation of food and it is likely that the symptoms will be gone by the time the individual(s) seek medical attention. Therefore, we should focus on how to educate the food handlers so that this problem doesn’t happen again. The staph aureus is pre-formed and the toxin is being produced on the food. The food has not been kept hot enough [60°C (140°F) or above] or cold enough [4°C (40°F) or below]. Foods that are associated with staph food poisoning include:

- Meats.
- Poultry and egg products.
- Salads such as egg, tuna, chicken, potato, and macaroni.
- Bakery products such as cream-filled pastries, cream pies, and chocolate eclairs.
- Sandwich fillings.
- Milk and dairy products.

You have to keep in mind three separate principles: (1) safe storage, (2) safe preparation and (2) safe cooking.

1) **Safe Storage**
- Refrigerate foods and dispose of foods past expiration dates
- Make sure refrigeration appliances are set at appropriate temperatures: fridge = 4°C, freezer = -17°C (turnover very slow)
- Keep raw meats separate from other food
- S. Aureus toxin is heat-stable and is commonly found in dairy, produce, meats, eggs and salads so heat won’t prevent intoxication

2) **Safe Food Preparation**
- Wash hands thoroughly before and after handling raw meat and poultry
- Do not cross-contaminate (keep raw meat, fish, poultry and their juices separate from each other)

3) **Safe Cooking**
- Heat (so bacteria cannot proliferate)
  - Ground meats = 160°F
  - Ground poultry = 165°F
  - Beef, veal and lamb steaks, roasts and pork chops = 145°F
  - Poultry = 180°F
- Keep everything clean
Case 7: Three weeks after obtaining a new pet parrot, a 40 year-old woman develops fever, chills and severe headache. The parrot is healthy. Her doctor orders a chest X-ray and there are extensive pulmonary infiltrates.

Differential Diagnosis:
- Pneumonia – viral or bacterial
- Tuberculosis
- Influenza or mononucleosis prior to appearance of pneumonitis
- Psittacosis – *Chlamydoophila psittaci*osis infection
  - history of exposure to birds may be only clinical basis for differentiating psittacosis from other infections
  - Also referred to as: Parrot Fever, Ornithosis, Chlamydiosis

What form of infection is likely?
- *Chlamydoophila psittaci*osis – most common in parrot family
- Incubation period of 5 to 14 days
- Presents with:
  - Shaking Chills
  - Fever
  - Splenomegaly is common
  - Pneumonitis is not a prominent symptom in most cases
  - Headache is most notable symptom - diffuse and excruciating and often patient’s chief complaint
- Common modes of transmission: through aerosolized bird feces depositing in lungs of human recipient or beak to mouth contact

How would you confirm this diagnosis?
- Physical Exam – taking note of symptoms and history of bird exposure
- Chest X-Ray is nonspecific – Note: infiltrates or dense consolidations
- Diagnosis by isolation of causative microorganism
  - Bacterial culture from respiratory secretions
  - Note: Require Biosafety Level 3 Lab. Difficult to culture this organism.
- Microimmunofluorescence test (Micro IF Test): Preferred diagnostic technique. Able to discriminate for *C. psittaci*
  - Note: increased IgM antibodies against *C. psittaci*

What treatment would you recommend?
- Tetracyclines (Doxycycline) can be used
- Treatment should continue for 10 to 14 days
- Fever abates 24 to 48 hours after beginning medication
- Erythromycin: used in patients who are allergic or intolerant to Tetracyclines
  - Children <9 years old and pregnant women should avoid Tetracyclines

What public health measures would you recommend?
- Report case to public health center
- Isolate bird for 6 weeks and/or euthanize bird
- Keep bird in ventilated area
- Add Antibiotic (Chlorotetracycline) to feed – used mainly for poultry flock rather than pets
- Burn or double bag fecal waste for disposal
- Avoid dry sweeping when cleaning the cage
- Use a disinfectant such as ammonium, alcohol, formaldehyde to clean the cage
Infection and Immunity Caselet #8 – “Rat bite fever”

A) What form of infection is likely?
   Group 3 bacterial infection – breaking the skin and penetration of the mucosa

B) What are the usual suspects?
   Actinobacillus muris (Formerly known as: Streptobacillus moniliformis):
   - Found in Africa, Australia, Europe, and North and South America
   - Gram negative, filamentous chains interspersed with bead-like swellings. Looks like a “necklace”.
   - Found in the normal, oropharyngeal flora of rats and other rodents, such as squirrels, weasels, and gerbils.

   Spirillum minus:
   - Found in Japan
   - Gram negative, Spiral-shaped.
   - Found in the blood or conjunctiva of rats. Can be transferred to the saliva of the rat if there are lesions on its oral mucosa.
   - Cannot be cultured.

Other possibilities (less likely): Leptospira spp., Yersinia pestis, Rabies (Lyssavirus genus of the Rhabdoviridae family)

C) What other problems can develop?
   Streptobacillus moniliformis:
   - Myocarditis
   - Endocarditis
   - Pneumonia
   - Meningitis
   - Hepatitis
   - Nephritis
   - Abscess formation
   - Parotitis
   - Tenosynovitis
   - Arthalgia

   Without treatment, mortality rate may be 10-25%

   Spirillum minus:
   - Myocarditis
   - Endocarditis
   - Meningitis
   - Hepatitis
D) What preventative treatment would you recommend?

- Wound should be thoroughly cleaned
- Oral antibiotics (amoxicillin or clavulanic acid. If it’s more severe, use IV penicillin)
- Tetanus prophylaxis
- Rabies prophylaxis
- Education about sanitation and rat control

Colby’s Comments:
C: Actually the first two are better treatments then penicillin unless you’re going IV-you going to admit this kid to hospital?

A: depending on how severe it is.

C: Any bite has a risk for tetanus, so tetanus shot is something you should really check. Start antibiotics because all bites have bacteria. Amoxillin and clavulanic acid is great because it’s anaerobic coverage.
Check case history again. Does child have rabies?

A: 7 days later presenting

C: Well incubation period would work to your advantage here. If child had rabies, it would kill the child-only 2 cases of rabies were found not to be fatal. But if child grasps the animal, and it bit in self defense, then probably not rabies. Rats can be infected, but it’s not really found. So the fact that this is a provoked bite shows that it’s probably unlikely.
Many people will succumb to the mother’s pressure for treating this even when not likely. There has been a world wide shortage of rabies vaccine.
Group 9 – Lyme Disease

Likely form of infection:

The patient is likely to have contracted Lyme disease caused by the *Borrelia burgdorferi* bacterium, which is passed via a tick bite. The patient was recently in a wooded area and had contact with deer, on which infected ticks are commonly found. Additionally, the symptoms, particularly the erythematous eruption, are consistent with Lyme disease infection following a tick bite.

Infection transmission route:

*Borrelia burgdorferi* exists in the bloodstreams of infected mice, squirrels, birds and other small animals. It is transmitted to human hosts through ticks, which pick-up the pathogen when they feed on the blood of infected animals and maintain it in their gut, transferring it to the human bloodstream at a subsequent feeding. The outer surface protein C (OspC) of *B. burgdorferi* binds with the tick salivary-gland protein 15 (Salp15); the tick in turn must attach to the new host for a minimum of 24 hours to transmit the infection.

The two main species of ticks that act as vectors in Canada: the western blacklegged tick in British Columbia and blacklegged ticks in other areas of Canada. They have three feeding stages: larvae, nymph, and adult; the nymphs most commonly bite and infect humans since they are able to avoid detection and feed for longer. Infections are mostly common in late spring/early summer when nymphs are eagerly seeking blood meals and humans engage in outdoor activities. Lyme disease is commonly associated with deer as they play a large role in transporting and maintaining tick populations.

Person-to-person contact, breast milk, pets with Lyme disease, and eating deer meat are not modes of transmission.

Confirmation of Diagnosis:

The characteristic erythema migrans (EM) lesion alone is enough to confirm the diagnosis, provided that it is an early Lyme disease and the patient has been exposed to high risk area. Patients at this early stage will likely be seronegative since the lesion often appears before there is a diagnostic level of adaptive immune response.

If patients present without EM or in patients with early disseminated or late disease, a two-step serological test should be done. An enzyme-linked immunosorbent assay (ELISA) should be performed first, followed by the Western blot. Both tests are used to determine levels of IgM or IgG to the bacterial antigens. If both tests are positive, it is a confirmatory diagnosis. If the ELISA test is negative, no further testing is necessary.

Treatment:

For a tick bite alone, prophylactic antibiotics are not recommended. If symptoms and exposure in endemic tick area suggest Stage I Lyme Disease, use of appropriate antibiotics is recommended. This treatment shortens the clinical course and improves the prognosis. The choice of antibiotic, mode of administration, and duration of treatment depend on the stage of the disease, the clinical manifestations and the age of the patient. Current standard of treatment at Stage I in adult patients is doxycycline (100 mg taken orally 2 times/day) or amoxicillin (500 mg taken orally 3 times/day) for two weeks. If a patient presents in a later stage, additional antibiotics - some of which require IV - would have been used: typically combinations of ceftriaxone, cefotaxime, and penicillin.
Caselet 10

A 60 year-old man presents to the emergency department with fever, hypotension and a severely infected wound on the left forearm. He looks gravely ill. The wound was due to broken glass six days prior. The man was previously healthy and swims in the ocean daily for exercise.

A) What form of infection is likely?
   - non-healing, traumatic wound with bacterial infection
   - sepsis-induced hypotension
   - likely a water-borne infection due to exposure to marine environment

B) What is the most likely culprit?
   - *Vibrio vulnificus* (or one of other less common *Vibrio* species)
   - part of normal ocean flora
   - can infect individuals through open wounds or by eating oysters
   - can cause abrupt onset of illness including inflammation at site of wound and sepsis
   - more likely to affect men over the age of 50
   - can be seen in healthy individuals but risk of infection, particularly from oysters, is greater for patients who are immunocompromised, on corticosteroids, have cirrhosis or underlying liver disease, or have other chronic illness
   - can see necrotizing fasciitis (severe infection including subdermal tissues)
   - one of most virulent organisms known to medical science
   - high mortality (about 40% for *V. vulnificus* infections overall)
   - nicknamed “monster of the deep”

C) What is your initial management?
   - admit to hospital, may or may not need to be in ICU
   - broad-spectrum antibiotics (recommended combination of a third-generation cephalosporin and a tetracycline such as doxycycline)
   - supportive therapy for sepsis and associated hypotension
   - topical wound care or possible surgical removal of necrotizing tissue (amputation of affected limb sometimes necessary)

D) How would you confirm your diagnosis?
   - send samples from blood and wound to be cultured, noting history of exposure to seawater
   - gram negative, motile, oxidase-positive, curved rods
Information for Gonorrhea/Chlamydia

Gonorrhea (Neisseria gonorrhoeae) and Chlamydia (Chlamydia trachomatis) are both bacterial infection commonly associated with sexual transmission; they are commonly referred to as sexually transmitted infections (STIs).

Gonorrhea and Chlamydia have similar symptoms; both have clinical manifestations (in males) of white-yellow discharge from the penis, and dysuria (pain upon micturition). Chlamydia also causes irritation or soreness around the urethra and has a 1-3wk incubation period. Symptoms of gonorrhea may present 2-30 days post-infection. Both STIs are commonly attributed to unprotected sex.

In females, both STIs mentioned above may cause no symptoms (also true for males, but less common) in more than 50% of patients. Gonorrhea may cause discharge from the vagina, lower abdominal pain, irritation of the genitals, dysuria, and some abnormal bleeding. Chlamydia can cause white-yellow vaginal discharge, burning or itching of the vaginal area, dysuria, redness, swelling or soreness of the vulva, pain during intercourse and abnormal bleeding. If either STI is suspected, a urine, blood, or cervical (women) specimen test is recommended for better treatment.

The recommended treatment for a person presenting with Chlamydia or Gonorrhea is to give a single dose of azithromycin and doxycycline and wait for Chlamydia serology test to come back. At this point, more targeted treatment may take place. Concomitant Chlamydia treatment is recommended with suspected or confirmed cases of Gonorrhea infection.

Once the case is confirmed, the public health authorities must be notified, and the person is put on antibiotic treatments and advised not to engage in sexual intercourse until the treatment is complete. Contact tracing must also be performed so as to determine who may also be infected.
Handout for Case 12

A 35 year-old female presents with a fine maculopapular eruption infecting her entire body except for the palms and soles and above the mid axillary level. The demarcation between involved and uninvolved skin is very sharply defined. Several days before she attended a party which she describes as “a bit wild.”

What form of infection is likely?

- When a generalized eruption occurs, the palms of the hands and the soles of the feet should be checked; hardly anything affects them because there are no follicles there to provide entry; examples of diseases that will affect the palms and soles include rocky mountain spotted fever and secondary syphilis.
- **Pseudomonas folliculitis (also known as hot tub folliculitis): This is the most likely diagnosis.** Folliculitis is an inflammation of the hair follicle. In this case, bacteria enter the hair follicles, which explains their absence on the palms of the hands and the soles of the feet. It has been reported in persons using hot tubs, whirlpools, saunas, swimming pools, waterslides and physiotherapy pools.

What is the likely culprit?

- The likely culprit is Pseudomonas aeruginosa. This saprophytic gram-negative, rod-shaped aerobic bacterium thrives in moist and warm areas; in hot tubs, desquamated skin cells provide organic nutrients that allow its rapid growth. Hot water temperatures cause perspiration, which enhances penetration of the skin by the bacteria.
- It can also colonize warm, moist areas such as skin folds, areas beneath nails, ear canals.
- Further complications are unlikely, however possible in immunocompromised patients, and may include bone, joint, liver, lung, urinary tract infections, and sepsis.
- It adheres to host cells through their surface carbohydrate chains that terminate in fucose, galactose, mannose, and sialic acid.

What treatment would you recommend?

- In this case the infection is common and not serious, and no treatment is needed because it will resolve on its own. A β-Lactam antibiotic, like penicillin or ciprofloxacin, could be used for more severe cases, unless the patient is immunocompromised. In that case, a second antibiotic such as aminoglycoside should be added. Application of warm compressors to the affected area is beneficial as well.

What public health measures are indicated?

- Proper maintenance and control of the pH and disinfectant levels (chlorination and bromation) will prevent the growth of Pseudomonas aeruginosa in hot water supplies. The hot tub can be completely drained if the organism is present.