

# HONORS BIOLOGY IA

NATIONAL CENTER FOR CASE STUDY TEACHING IN SCIENCE

## Revolt on the Tuberculosis Ward

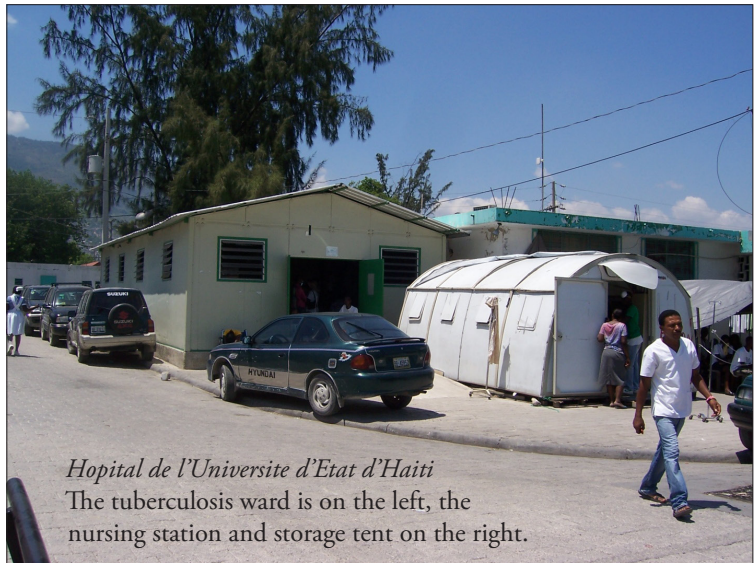
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Type out the 8 questions that follow  
and answer them -- 40 total points

### Part I – Introduction

The following case describes the experiences of a woman living in Port au Prince, the capitol city of Haiti, two years after a devastating earthquake. The January 12, 2010, earthquake affected more than three million people, killed hundreds of thousands, and left over a million people homeless.<sup>6</sup> Two years later, half a million people remain in temporary camps mainly in Port au Prince, living in tents or under tarps. International relief organizations were quick to provide food and clean drinking water after the earthquake, but few Haitians have sustained access to basic services and many face food insecurity. Half of the rubble from the earthquake has been removed and most of the remaining buildings are in some state of disrepair. Roads are damaged, but mostly passable, with traffic congestion and chaos the norm.

Unemployment is estimated at 70 percent, a grossly discouraging situation for Haitians hoping to secure housing, food, and water.<sup>6</sup> Most of the employed are small scale farmers or street side vendors. Daily life often involves temporary work for very little money and a meager existence based on securing food and water on a day to day basis. Despair is evident.



*Hopital de l'Universite d'Etat d'Haiti*  
The tuberculosis ward is on the left, the nursing station and storage tent on the right.

### Part II – Monique's History

Monique is a 30-year-old Haitian woman with a diagnosis of advanced bilateral pulmonary tuberculosis. She was married briefly, but her husband left her after the birth of their child. Her daughter is four years old and, until recently, they lived with her parents in a two-room hillside slum dwelling in a congested area of Port au Prince. Over the past year, Monique became so tired that any activity drained her energy and precipitated coughing fits that were difficult to control. Her mother took over childcare and cared for Monique in their home while Monique was still able to ambulate independently.

Her family is among the 40 percent or more of Haitians who have no regular access to healthcare. One year after the earthquake of 2010, several new primary care sites were established with sponsorship from the international community, and Monique was able to schedule an appointment to see a doctor. She thought that the doctor would cure her condition. Her chest x-ray revealed cavitory lesions and infiltrates. She was diagnosed with advanced tuberculosis, given medicine, and told to go home. This was only the second time in her life that she had seen a doctor, and she had her hopes up for medical intervention. She had no history of preventive care or immunizations.

Tuberculosis (TB) is the leading cause of death from bacterial infections globally. It is estimated that one-third of the world's population is infected with the bacterium, *Mycobacterium tuberculosis*, therefore affecting 1.8 billion people per year.<sup>12</sup> According to the United States Agency for International Development (USAID), Haiti has the highest per capita tuberculosis burden in the western hemisphere. After HIV/AIDS deaths, TB is Haiti's most prevalent infectious disease cause of mortality.<sup>7</sup> In 2010, the World Health Organization estimated that there were 31,000 people infected with tuberculosis bacteria in Haiti.<sup>12</sup>

The mental burden of Monique's diagnosis put further strain on her relationship with her parents. The combination of stress at home and rapid progression of tuberculosis led her family to admit her to Sigüeneau Sanatorium in Léogane, a coastal town 30 kilometers west of Port au Prince with a prognosis of less than one year to live. The Sigüeneau Sanatorium is one of four tuberculosis hospitals in Haiti sponsored by Haiti's Ministry of Health National TB and HIV/AIDS program and the International Red Cross. As her condition worsened, she would likely suffer from an increase in respiratory symptoms along with possible spread of the bacteria to her bones, brain, or other organs.

### Part III – Worsening of the Tuberculosis

A few weeks after Monique's admission to the sanatorium, her coughing, pulmonary edema, and weight loss suddenly increased. She experienced night sweats and increased shortness of breath. A doctor inserted a chest tube into her right pleural space to drain the pleural effusion that was accumulating. A chest tube is a long, semi-stiff, clear plastic tube that is inserted between the ribs and sutured in place in order to drain excess fluid or air that may have accumulated in the space between the pleura. A sealed water drainage system prevents air or fluid from entering the pleural space. Four days later, Monique began to vomit and became increasingly lethargic and febrile. She was transferred by car to the tuberculosis unit at the largest public general hospital in Port au Prince, Hopital de l'Universite d'Etat d'Haiti.

The University Hospital of Haiti, Hopital de l'Universite d'Etat d'Haiti, is the largest public acute care hospital in the country. It is also the only teaching hospital and has the only 24-hour emergency room in the country. Most of the buildings that comprise the hospital are mottled with grey and brown spots and obvious cracks. Metal bars stick out of other walls where structures once stood. The hospital campus is fenced and guarded, yet mobs of people linger about. Greyish water lines some streets and the odor of urine and feces prevails. Some patients are moved about in wheelchairs that look like they should have been discarded long ago in which often a white plastic chair without legs has replaced the wheelchair's once soft seat and back. Pavement connects buildings and few trees remain. Small tents are strategically placed for administrative services. Patients and families sit on the ground in the hot sun waiting for services.

Unlike the rest of the hospital buildings, the tuberculosis ward was built after the earthquake with sponsorship from Meharry Medical College of Tennessee and the United Methodist Committee on Relief (UMCOR) to respond to an anticipated surge in tuberculosis cases. The new building is basically a metal shell with electricity for lighting. It has no plumbing and few chairs. Family members sit on the floor in the narrow spaces between the beds. The need for care is so great that at night cots are lined up in the center aisle for additional patients. These patients are more mobile, so they are told to sit outside during the day. There isn't room for the cots when the nurses are busy caring for those who are more acutely ill. Volunteer nurses and a doctor from the United States, coordinated through UMCOR, work alongside four Haitian clerical staff from an adjacent small cramped supply tent.

At the hospital Monique's bed was lined up side by side with the other 26 patients in an open room. There were no dividers or privacy curtains between beds. Most of the patients were hooked to large oxygen tanks with plastic nasal tubing. Her chest tube insertion site was inflamed and draining copious amounts of purulent, foul smelling drainage. Monique was sitting on her bed in a slouched-over position. The past few days of unrelenting shortness of breath, coughing, and general malaise had drained her of any energy. In this new facility she felt alone and afraid. Her family had not been notified of her hospital admission, nor did she think they would care to see her in this condition. Nurses were working with her evaluating her condition while the other patients watched but did not attempt to socialize with her.

After a couple of hours, other patients on the ward were complaining of a fetid smell. There were a few fans running, but with the hot humid weather they were not effective in circulating the air that was already filled with odors from the buckets used as bedpans and the lack of sanitation on the hospital grounds. Patients on the ward were terminally ill, mostly very poor, and therefore very discouraged. They did not welcome Monique. "This place is making me sick," one patient called out in native Creole. "It's the new girl and she smells bad," another one yelled back. Monique began to cry and slumped further over, resting her head on her knees. Now all the patients were glaring at Monique and demanding that the nurses do something. They wanted her moved out of their unit. Those who were able to get out of bed walked outdoors to get away from the fetid smell. Many patients were sitting outside on the cement ground, and the rest of the patients inside had covered their faces with pieces of clothing. Their level of agitation and noise was increasing. Some of the nurses feared that the patients would throw Monique out onto the street during the night when staffing and supervision were lacking. The medical team was faced with a dilemma. Should they remove her chest tube or leave it in?

### Diagnostic Test Results

*Blood Pressure:* 110/70

*Temperature:* 100.4 F

*Oxygen Saturation:* 75% on 2 liters/min of oxygen delivered by nasal cannula.

*Chest radiogram:* Advanced bilateral tuberculosis, cavitary lesions, diffuse pulmonary infiltrates characteristic of advanced tuberculosis, right chest tube between the fourth and fifth ribs on the right projecting into the pleural space, pleural effusion on right.

*Respiratory Rate:* 30 and shallow.

*Culture of drainage from the chest tube:* Anaerobic Gram negative bacilli consistent with *Bacteroides fragilis*.

*Sputum Stain:* Acid-fast bacilli.

*Sputum Culture:* Inconclusive after 12 hours.

*Auscultation:* Diminished breath sounds throughout both lungs, with markedly diminished sounds on right middle and lower lobes.

**Questions** Type out the questions under each heading and provide an answer -- final work must be shared with me via gmail by Saturday, November 8th, NOON.  
**Epidemiology**

1. Define *incidence*, *prevalence*, and *mortality*.
2. Use the World Health Organization statistics to compare the incidence, prevalence, and mortality rates of TB in Haiti to the United States.

### *Mycobacterium tuberculosis*

1. List three risk factors associated with tuberculosis.
2. Describe the microbial properties of *Mycobacterium tuberculosis*.
3. What type of precautions should you use when dealing with a patient who has active TB?
4. Describe in general terms the type of medication regimen for treating tuberculosis.
5. Draw and label the lungs and pleura showing the placement of the chest tube.
6. Why is tuberculosis so difficult to treat? Explain.

## *Bacteroides fragilis*

1. List at least three risk factors that apply to Monique's secondary infection with *Bacteroides fragilis*.
2. ~~What is the most likely source of her chest tube infection?~~
3. ~~What terms would you use to describe Monique's *Bacteroides fragilis* infection?~~
4. ~~Compare the microbial properties and pathogenesis of *Bacteroides fragilis* to *Mycobacterium tuberculosis*.~~
5. ~~Besides *Bacteroides fragilis*, what other secondary infections are common in patients who have tuberculosis?~~

## Social Issues

1. ~~How would Monique's situation have been different if she was an American who was covered by health insurance and had access to healthcare?~~
2. How likely was Monique to spread *Bacteroides fragilis* to those around her? Was she a risk to the other patients on the ward?
3. Why do you think the other patients showed no compassion toward Monique?
4. ~~If the patients were to throw Monique out of the building at night, what effect would that have on her health and prognosis?~~

## Summary

1. ~~What are the arguments that support immediate removal of the chest tube?~~
2. ~~What are the arguments that support the use of a chest tube in this patient?~~
3. ~~Considering this patient's age and medical condition, should the chest tube be removed? Explain your decision.~~

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