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Case 12

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# CASE STUDY

Mateo is a pilot for a large commercial airline. He has had a cough for some time but has not felt ill. His routine tuberculin skin test indicates he has been exposed to TB. More information is needed to determine what strain of TB he has, but his work is immediately suspended. Additional laboratory tests will determine if the strain he has is drug resistant. He has visited his family in Mexico relatively recently but does not know how he contracted the disease. He feels strong, in the prime of his life, and wants to get back to work. His family must figure out their next steps as well since they could have been exposed along with him.

# HEALTH

## What is Tuberculosis (TB)?

Tuberculosis (TB) is a bacterial disease caused by a microbe called *Mycobacterium tuberculosis*. Tuberculosis, or *Mycobacterium tuberculosis*, is a bacterium that typically infects the lungs, but sometimes the kidney, brain or spinal cord, and is typically curable with antimicrobial treatments. If an individual is infected with the bacteria, it may stay latent in their system until their immune system is compromised, which could then trigger the bacteria to become active and cause symptoms. Approximately one third of the world population, more than two billion people, are infected with latent TB but only have a 10% chance of it becoming active. Once it is active, symptoms such as sneezing, coughing, fever, chills, night sweats and weight gain are common. Without treatment there is a two-thirds chance that the actively infected individual will die from the disease (World Health Organization, 2018).

## Mycobacterium tuberculosis

TB in humans is caused by members of the species *Mycobacterium tuberculosis* complex (MTBC), which includes *Mycobacterium tuberculosis* (Mtb), the etiologic agent of TB in humans, *M. africanum*, that causes TB in humans only in certain regions of Africa; *M. bovis*, *M. caprae,* and *M. pinnipedii*, causing TB in wild domesticated animals; and *M. microti* that causes TB only in voles (Delogu, Sali, & Fadda, 2013). The bacteria has been hypothesized to have evolved from a soil bacteria that evolved to live in mammals. *Mycobacterium tuberculosis* then is thought to have then moved from the cattle that humans kept to then infect humans over 4,000 years ago so the disease has been a threat for a large part of human history (Stephen Gordon, 2018). *Mycobacterium tuberculosis* is an aerobic bacterium that can appear either gram negative or gram positive. One major feature of Mtb is its cell wall structure that provides an exceptionally strong and impermeable barrier to harmful compounds and drugs, which ultimately plays a role in its virulence (Delogu et al., 2013). Mtb contains an outer membrane, functionally similar to what is seen in gram-negative bacteria, made of an asymmetric lipid bilayer. This bilayer contains long fatty acids (mycolic acids) on its inner portion and glycolipid and waxy components on its outer layer. Between the two layers, there is a thin peptidoglycan space, which contains arabinogalactan and lipoarabinomannan, both of which are covalently linked to mycolic acids. Isoniazid and ethambutol, two of the most effective anti-TB drugs, target the synthesis of the mycolic acids and arabinogalactan, respectively, which shows how important understanding mycobacterial cell walls is (Delogu et al., 2013).

The main reason contributing to Mtb’s virulence is its protein secretions. Five protein secretion systems have been identified in Mtb: ESX1-ESX5. The most notable of the secretion systems is ESX1. ESX1 secretes antigens that interfere with the integrity of the phagosomal membrane, leading to phagosomal rupture and bacterial emission into the cytosol. ESX5 is present only in slow growing mycobacteria (such as *Mtb* and *M. marinum*) and it is thought to be involved in the secretion of proteins (PPE and PE-PGRS) with immunomodulatory properties. ESX3 is involved in Zinc and Iron uptake and homeostasis and as such is essential for growth. The role of ESX2 and ESX4 remain still unknown (Delogu et al., 2013).

## Latent vs. Active TB

Latent tuberculosis (LTB) is the state where humans are infected with *Mtb* without any clinical symptoms, radiological abnormality, or microbiological evidence. During latent infection, a dynamic equilibrium between the bacteria and host immune responses is established, and any event that weakens cell mediated immunity may lead to active bacterial replication, tissue damage, and the onset of disease (active TB) (Delogu et al., 2013). One-third of the world’s population is infected with TB, and the prevalence rate of LTB in low or middle-class countries is estimated to be as high as 51.5% while in high-income countries is around 28.1% (Lee, 2016).

Active tuberculosis is a condition in which the body’s immune system is unable to fight off or defend against the *Mtb* bacterium. This inability causes an infection of the lungs, which is the most common presentation, or infections in other parts of the body. Apart from the respiratory system, the organ systems most commonly affected include the gastrointestinal system, the musculoskeletal system, the lymphoreticular system, and the reproductive system, as well as the skin, and the liver (Jilani, Avula, & Siddiqui, 2019).

## Active Disease Symptoms

Active tuberculosis can cause major symptoms such as: a bad cough that lasts 3 weeks or longer, chest pain, and coughing up blood or mucus (CDC, 2019). Other symptoms may occur including fatigue, weight loss, loss of appetite, chills, fever, and sweating at night (CDC, 2019).

## Drug Resistant TB

There are forms of TB that are drug-resistant. Drug resistant TB does not respond to at least one of the main tuberculosis treatment drugs. This means a person is infected with TB bacteria that are resistant to the drugs that are typically prescribed for treatment. Drug-resistant TB spreads the same way that drug-susceptible TB does (WHO, 2019). Drug-resistant TB can occur due to misuse or mismanagement of treatment drugs. This could include things such as: failure to complete a full course of TB treatment, prescription errors, and poor quality drugs (CDC, 2016). Another way people acquire drug resistant TB is through direct transmission of drug resistant TB from person to person (Tbfacts.org, 2019). Within the category of drug-resistant tuberculosis, there are two main types: MDR-TB and XDR TB (Tbfacts.org, 2019). MDR (multi drug resistant) TB is the type of TB when the bacteria that are causing it are resistant to at least isoniazid and rifampicin, which are two of the most effective tuberculosis treatment drugs. XDR-TB or extensively drug resistant TB is defined as strains resistant to at least the drugs rifampicin and isoniazid. These strains are also resistant to one of the fluoroquinolones, as well as at least one of the second line injectable TB drugs (Tbfacts.org, 2019). MDR-TB and XDR-TB do not respond to the standard six months of TB treatment with “first line” anti TB drugs. Treatment for these types of TB takes more time and requires more money.

## TB Transmission

When a person with TB of the lungs or throat coughs, sneezes, sings or talks, droplets containing the bacteria are released into the air. *Mtb* usually enters the alveolar passages of exposed humans as an aerosol droplet, where its first contact is thought to be with resident macrophages (Smith, 2003). Additionally, dendritic cells play a key role in the early stages of infection because they are better antigen presenters than macrophages and play a key role in activating T cells with specific *Mtb* antigens. Additionally, because dendritic cells are migratory, they may be responsible for the spread of TB to other areas of the body (Smith, 2003).

If *Mtb* makes it past the lung’s first line of defense of killing bacteria, it will start replicating inside of macrophages. From there, *Mtb* will diffuse to nearby cells, including endothelial and epithelial cells, undergo exponential growth, and reach numbers that cause a burden to the body. After this, the adaptive immune system kicks in, and neutrophils, lymphocytes, and other immune cells form the cellular structure of a granuloma. Eventually, the granuloma becomes calcified, and bacteria remains trapped inside and protected by the host immune response. This complex is often considered to be the “sanctuary” of *Mtb* during latent infection, with bacteria persisting in a dormant, non-metabolically active state for years, decades, or most commonly, lifetimes (Delogu et al., 2013).

## Vaccination

There is a vaccine available to help prevent the spread of tuberculosis, the Bacille Calmette-Guerin vaccine. While the vaccine is not commonly used in the United States due to the low rates of tuberculosis, the Bacille Calmette-Guerin vaccine is used in countries where tuberculosis is more prevalent. The vaccine struggles with variable effectiveness against adult pulmonary TB and interference with the tuberculin skin test. The vaccine does not interfere with a blood test for tuberculosis so that can still be used to test for the disease in those that have received the vaccine. The Bacille Calmette-Guerin vaccine is only recommended for those who meet specific criteria and often times the vaccine is recommended for children (Centers for Disease Control and Prevention, 2016b).

The Bacille Calmette-Guerin vaccine is only recommended for children who test negative for a tuberculin skin test and who are continuously exposed to those infected with tuberculosis. The vaccine is only given to children that cannot be removed from homes where adults have untreated tuberculosis that has some forms of antibiotic resistance. The vaccine is also not recommended for healthcare workers if they don’t meet similar criteria to children. The healthcare workers must be in contact with patients that have certain forms of antibiotic resistance and ongoing risk of infection to healthcare workers (Centers for Disease Control and Prevention, 2016b).

## TB Diagnosis

There are two kinds of tests to detect TB in the body: the TB skin test and TB blood tests. However, these tests only reveal if the bacteria is present in the body, not if the person has latent TB or active TB infection. Other tests, such as a chest x-ray and a sample of sputum, are needed to see if the person has a TB infection (Centers for Disease Control and Prevention, 2016).

The Mantoux test is the traditional skin test used to determine the presence of TB in the body. The Mantoux test consists of injecting the individual with a dose of purified protein derivative and observing the skin for specific reactions. Patients are then classified into three groups based on the size of the induration and the risk of exposure. These 3 groups include: low risk, intermediate risk, and high risk (Centers for Disease Control and Prevention, 2016).

For people with a low risk skin test result, they have a minimal probability of exposure to TB. The Mantoux test is only considered positive if there is a significant induration of 15mm or higher following the skin test administration. People in this group include those with no history of travel to a TB-endemic region, no history of military service, no contact with a patient with a chronic cough, no history of steroid use, no known occupational exposure, are negative for HIV, and are not a resident of a TB-endemic country (Lee, 2016).

High risk people have a greater probability of exposure to TB. If the presence of TB is detected in the body, other diagnoses are needed to determine whether it is latent TB or active TB. Their test results are considered positive if the measured induration is greater than 10mm. People in this group include those who are residents of TB-endemic countries such as Asia, Latin America, and Africa, residents or workers of shelters, those who reside in overcrowded vicinities, and medical personnel (Lee, 2016).

High risk people have a significant probability of exposure to TB. Their test results are considered positive if the measured induration is greater than 5mm. People in this group include those who are immunocompromised and cannot mount a sufficient immune response to the purified protein derivative test (HIV-positive patients, those on chronic steroids), patients with frequent exposure to those with persistent cough, and patients with evidence of a prior TB infection, such as a healed scar seen on X-ray (Lee, 2016).

## Treatment and Management

The treatment for Mycobacterium *tuberculosis* infection varies on if the bacteria responsible for the infection are drug resistant and if the infection is latent or active. If the infection is active infection is referred to as Tuberculosis disease. For people with active TB, a combination of drugs is needed. First-line medications are most commonly used for active TB and include medications such as Isoniazid, Rifamycin, Ethambutol, and Pyrazinamide. The treatment for drug susceptible tuberculosis disease is an antibiotic regimen that can vary depending on the antibiotics a particular patient is allergic to, an individual's ability to take antibiotics regularly and HIV status.

For patients receiving treatment, directly observed therapy (DOT) is recommended. With this type of therapy, patients on 4-medication combination could be switched to two to three times per week-dosing, after completing an initial 2 weeks of daily dosing. Those taking medication two times per week must not miss any doses. Daily therapy should be prescribed for patients who are on self-administered medication (Lee, 2016).

The medications that are taken as a first line treatment are in a drug class called antituberculosis agents. The first line medications include: Isoniazid, Rifamycin, Ethambutol, and Pyrazinamide. These antibiotics can cause digestive upset while they are being taken so consideration must be taken while on them. In addition when somebody is on these medications they cannot drink alcohol. Isoniazid in particular can be dangerous because it can cause Drug Induced Lupus Erythematous in about one percent of patients. The cause of Drug Induced Lupus Erythematous from Isoniazid is currently unknown but genetic predisposition is currently unknown (Shar et al, 2016). These medications are known to be metabolized through the liver so they should not be taken with medications that can be harsh on the liver such as acetaminophen (brand name Tylenol). There is a consideration if somebody is pregnant or breastfeeding they should not be taking these medications so mothers that are breastfeeding children would possibly have to stop breastfeeding while on these medications. People can have life threatening reactions to any of these medications if they are allergic to any of them so they should be monitored after they take them (United States National Library of Medicine, 2016: Centers for Disease Control and Prevention, 2016).

# CULTURE

Although Tuberculosis (TB) is considered to be rare and hard to contract, infections can still occur. Infections began to seriously arise around 1985, partly due to the emergence of HIV—the virus that causes AIDS (Mayo Clinic, 2019). Additionally, TB continues to be a threat around the world, especially in homeless communities and foreign nations, such as Mexico. Because the United States is the only country that seriously prioritizes TB as a public health issue, there is a lot of pressure put on the U.S. to control the issue.

## Populations affected

In the United States, four states in particular had half of all TB cases reported in 2014, including California, Florida, Texas and New York (Kanabus, 2018). The national incidence rate in 2014 was 3 cases per 100,000 people, with some states averaging much lower and some much higher, with these four states accounting for 4,795 of all TB cases in the US in 2014 (Kanabus, 2018).

Certain populations are more affected by TB, such as foreign-born people, with 66% of cases of TB in the U.S. in 2014 being among foreign born individuals (Kanabus, 2018). The origin countries that are most commonly affected by TB are Mexico, the Philippines, India, Vietnam and China (Kanabus, 2018). Their infection occurrences in the US are assumed to be from a reactivated TB infection that the individual had previously been infected by and not by receiving the TB infection while in the United States. It is important for public health officials to remember to take extra steps at catching latent TB in people who immigrate here to find ways of decreasing these incidences or monitoring their possible spread (Kanabus, 2018). In Texas, specifically, 53% of all reported cases of TB were among Hispanics and higher rates of TB incidence are seen along the Texas-Mexico border (Texas Health and Human Services, 2019).

For international travelers, the chance of contracting TB is relatively low despite the high incidence rates in some other countries (Centers for Disease Control and Prevention, 2018). Those infected with HIV are more at risk if they happen to come in contact with a TB infected individual and should avoid any settings where this may occur. TB cannot be spread through handshakes, sharing food or drink, touching ben linens or toilet seats or kissing, but to be safe, there should be caution when a TB patient is nearby (Centers for Disease Control and Prevention, 2018). Some of the high-risk areas for possibly contracting TB are crowded hospitals, prisons and homeless shelters where sanitation is low (Centers for Disease Control and Prevention, 2018). Air travel does not increase the likelihood of contracting TB and is relatively low risk. If there is a chance a traveler is at a high risk setting, they should consult infection control or occupational health experts and ask about procedures for preventing exposure and additional safety measures like personal respiratory protective devices (Centers for Disease Control and Prevention, 2018). Another risk factor for contracting TB is injection drug use, which could involve needle sharing and transmission of bodily fluids (Centers for Disease Control and Prevention, 2018).

## Why the stigma?

There are different trends in geographic and cultural variation in the stigmatization of TB. Most research identifies that the perceived contagiousness of TB is a main reason for its stigmatization (Courtwright & Turner, 2010). Lack of information and knowledge about transmission of TB may also contribute to TB stigma (Courtwright & Turner, 2010). The societal perceived risk of catching TB can lead to stigmatization and isolation of individuals with TB. TB is also often associated with HIV. In places where HIV is prevalent, TB co-infection is common and the link between the two diseases has added to the stigmatization of TB. TB-infected individuals perceive themselves to be at risk for a number of stigma-related social and economic consequences (Courtwright & Turner, 2010). TB disproportionately affects the poor and marginalized groups of society around the world. Reducing stigma around TB could help to alleviate its impacts.

## TB and HIV/AIDS

Of the estimated 33.4 million people living with HIV in 2008, nearly 30% were estimated to have latent or active TB infection (Kwan & Ernst, 2011). Because so many people living with HIV/AIDS develop TB, and TB has negative effects on HIV progression, TB care and prevention should be of high priority concerns for HIV/AIDS programs. As for TB programs, HIV/AIDS prevention and care should be priority concerns (World Health Organization).

HIV infection is the strongest known risk factor for TB. High HIV prevalence rates are significantly correlated with high TB incidence rates, and the confluence of these two epidemics has hit hardest in sub-Saharan Africa, which constituted 79% of all cases of incident TB in persons with HIV infection in 2007 (Kwan & Ernst, 2011).

HIV-associated TB accounts for a disproportionate share of TB-associated mortality. In 2008, HIV-associated TB accounted for 29% of deaths among incident TB cases, although it only contributed to 15% of all incident TB cases. The estimated case-fatality rate of incident TB was more than 2-fold higher for people infected with HIV (37%) than for those without HIV (16%) (Kwan & Ernst, 2011). The higher case-fatality rate of TB in HIV-infected individuals is likely due to a combination of factors associated with HIV coinfection:

* The rapid disease progression due to the failure of immune responses to prevent the growth of *Mtb*(Kwan & Ernst, 2011)
* The delayed diagnosis and treatment of TB infection due to atypical presentation and lower rates of sputum smear positivity(Kwan & Ernst, 2011)
* The delayed diagnosis of HIV infection due to stigma or insufficient uptake of HIV testing in TB clinics (Kwan & Ernst, 2011)
* The delayed start or lack of access to combination antiretroviral therapy (Kwan & Ernst, 2011)
* The higher rates of multidrug-resistant TB leading to a delayed initiation of effective therapy (Kwan & Ernst, 2011)

Of the estimated 2 million HIV-related deaths in 2008, TB accounted for almost one quarter of these deaths. And, for people living with HIV in low or middle-income countries, TB is the leading cause of death. In 2007, the burden of deaths from HIV-associated TB was highest in South Africa, Nigeria, India, Zimbabwe, Ethiopia, the United Republic of Tanzania, Mozambique, Uganda, and Kenya (Kwan & Ernst, 2011).

## TB and Homeless Populations

Homeless people are at increased risk of TB, have higher default rates, and have worse treatment outcomes (including mortality) compared to the general public (Figueroa-Munoz & Ramon-Pardo, 2008). In many industrialized countries, TB rates among the homeless can be up to 20 times higher than the general population. The majority of TB cases in urban homeless populations are attributable to ongoing transmission in shelters (Figueroa-Munoz & Ramon-Pardo, 2008). Poor compliance among homeless populations, regarding TB treatment, results in (Figueroa-Munoz & Ramon-Pardo, 2008):

* low effectiveness of drug therapy
* high default rates
* poor treatment outcomes
* high mortality (often related to poor nutritional status)
* associated illnesses, including HIV.

Furthermore, hospitalization rates are higher and for longer periods, resulting in higher healthcare expenditures. Additionally, contact tracing and identification is challenging, particularly for individuals living on the streets at the time of diagnosis (Figueroa-Munoz & Ramon-Pardo, 2008).

Cost-effective strategies to decrease TB incidence in homeless populations include (Figueroa-Munoz & Ramon-Pardo, 2008):

* increasing case detection
* mandatory screening in shelters
* using incentives to improve TB skin testing reading compliance or treatment
* prophylaxis adherence.

Furthermore, a competent referral system is critical to coordinate efforts and ensure treatment success. Providing housing and social services may reduce hospital utilization and improve treatment completion. Additionally, supervised housing may be effective in increasing treatment compliance, resulting in substantial cost savings (Figueroa-Munoz & Ramon-Pardo, 2008).

## TB in Mexico

The majority of TB cases and TB deaths result in middle income countries such as Mexico (Rodríguez-Leyva, Gomez, & Sierra, 2017). In Mexico, even though a general downward trend has been observed since 1997, TB is still a public health challenge, especially due to the high prevalence of risk factors such as diabetes mellitus, smoking, living in dangerous environments, malnourishment, and people living in overcrowded settings (Rodríguez-Leyva et al., 2017). Diabetes mellitus was reported at 9.2% for the general population, and according to the National Institute for Respiratory Diseases of México (INER), almost 11 million Mexicans are smokers. Additionally, people living in dangerous environments, especially those exposed to silica dust (such as in the mining industry), the malnourished population, and people who live in overcrowded settings, such as in urban slums and prisons, are at high risk for TB (Rodríguez-Leyva et al., 2017).

Since 2003, there has been an increase in meningeal TB, primarily seen in the migrant populations (Rodríguez-Leyva et al., 2017). Migrants have several risk factors that make them more susceptible to this disease—the most common is the rural-urban internal migration, but external migration is also a constant, complex and changing social phenomenon that can generate new social scenarios (Rodríguez-Leyva et al., 2017).

Migrants are people who find it hard to remain stable in a community. Additionally, they have limited access to health services and face difficulties related to political and economic aspects of social protection and education (Rodríguez-Leyva et al., 2017). When migrant people return to Mexico, after living a period of time out of their country, in poor health conditions, they can spread the disease to susceptible populations. Furthermore, migrants initially treated in Mexico for TB, that travel to other countries, cannot complete a proper treatment schedule like Directly Observed Treatment (DOT), which can lead to increases in TB cases (Rodríguez-Leyva et al., 2017).

TB remains to be a silent public health issue along the United States/Mexico border (Valencia, Ernst, & Rosales, 2017). Yuma County is a U.S. county located on the Arizona/Mexico border. In 2015, Yuma County reported an incidence rate for TB of 9 per 100,000, which greatly exceeds the Arizona state TB incidence rate of 1.1 cases per 100,000 people in 2015 (Valencia et al., 2017). In 2015, Mexico’s aggregate country level data suggest a TB burden rate of 21 per 100,000 people. In 2010, the highest TB incidence rates for Mexico were reported in the Northern border states. Sonora is the Mexican Northern border state adjacent to the state of Arizona. In 2010, the TB incidence rate in Sonora was reported to be 32.9 cases per 100,000. Of the cases of TB identified in Arizona, 35.4% of them were among people born in Mexico (Valencia et al., 2017).

One study indicates that U.S.-funded efforts to support TB treatment programs in Mexico may be helping to control the disease within Mexico, as well as reducing TB-related morbidity and mortality among migrants to the United States (Fitchett, Vallecillo, & Espitia, 2011). Currently, not all visitors to the U.S., whether from Mexico or countries with even higher TB incidence/prevalence, are screened for TB. Although TB incidence and prevalence is relatively low in both the United States and Mexico, TB incidence in Mexican migrants to the United States remains steady. Screening for TB in the country of origin and following up after arrival in the United States is an efficient transmission prevention method (Valencia et al., 2017).

Key improvements in TB surveillance along the border must include (Valencia et al., 2017):

* A case definition and registry of cases
* A system to find infected patients
* Increased funding for services
* Laboratory support (with emphasis on TB testing in migrants)
* Contact tracing

High-risk populations must be identified and have access to quality, continuous, and consistent health care. In areas populations with high migration and TB drug-resistance, patient follow-up to ensure treatment completion and diagnostics are crucial to lowering TB prevalence rates (Valencia et al., 2017).

## Challenges and Prevention

Because TB is hard to diagnose and treat, it is also hard to control. With little resources to keep prevention efforts in full effect, there is a capacity for how much can be done for TB control along with the many challenges faced by the TB infected individuals as they seek help or attempt treatment. This is because the duration of treatment is lengthy and most individuals would rather not continue taking the medications for such long periods of time, especially if they experience adverse side effects or feel healthy again. Socioeconomic factors also impact health outcomes, including issues of poverty, housing and transportation, unemployment, and access to healthcare. These barriers to treatment make it more difficult for health agencies to control TB and ensure that these people have the correct resources to maintain daily treatment and healthy lifestyles.

Researchers at the Rollins School of Public Health at Emory University examined the state level relationship between social capital, poverty, income inequality, and TB case rates in the United States (Holtgrave & Crosby, 2004). In bivariate analyses, poverty, income inequality, and social capital were all significantly correlated with TB case rates (Holtgrave & Crosby, 2004).

Economically poor and vulnerable groups are at greater risk of infection with TB compared with the general population due to factors such as (World Health Organization, 2005):

* overcrowded and substandard living or working conditions
* poor nutrition
* intercurrent disease (such as HIV/AIDS)
* migration from (or to) higher-risk communities or nations.

In addition, for isolated ethnic communities such as indigenous groups in Latin America and North America, the risks may be particularly high given relatively recent initial population exposure to TB bacteria. This can result in high rates of initial infection and development of disease (World Health Organization, 2005).

Because some individuals may lack transportation to the health department for daily DOT, a worker from the health department then has to visit the patient in their home each day, which takes extra time for the worker and costs the health department the gas money rather than having the infected individual carry that burden of transportation cost (Caitlin Ray, personal communication, Nov. 18, 2019).

Another reason these barriers prevent effective treatment is due to the lack of financial resources the individual may have to be able to afford safe housing and healthy food options, which are optimal for recovery. If the patient lives with a large family, has little room or ability to keep up with regular house maintenance, it can prevent the patient from having the opportunity to recover fully and safely, and can increase daily stress. This is multiplied when they are also dealing with unemployment and cannot rely on any paid sick days, employer health insurance or a reliable income to pay for housing and food.

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# RESOURCES

## Clarke County Health Department

345 North Harris Street, Athens, GA 30601

Phone: 706-389-6921

Clinic Hours:

Monday/Wednesday/Thursday: 8am - 5pm

Tuesday: 8am - 7pm

Friday: 8am - 2pm

Website: <https://publichealthathens.com/wp/clinics/health-departments/clarke-county/>

Some resources provided by the Clarke County Health Department include TB testing at no cost with treatment if necessary (Northeast Health District, 2019). Direct Observation Therapy (DOT) is the standard practice of the Georgia Department of Public Health and the nurses at the health department are trained to provide DOT (GA TB Reference Guide). The state pharmacy provides the drugs needed to treat tuberculosis free of cost (GA TB Reference Guide). The health department also collects data for use in the study and prevention of tuberculosis at both a state and national level. Screening is also performed with those that are at high risk and were in regular contact with the infected patients (GA TB Reference Guide). All patients, either those that are being treated for tuberculosis or those that are screened, are provided with education about the disease, as well as consultation on effective risk management (Georgia TB Reference Guide). Once the individual has been given the correct treatment, there is a TB Discharge Policy that he/she must follow, developed by Grady Memorial Hospital (Georgia TB Reference Guide). This protocol outlines the necessary steps that should be taken before release from the hospital, which includes the endorsement from the hospital TB social worker and local health department representative (Georgia TB Reference Guide).

Additionally, all treatment and services provided by the Health Department are free of charge (Caitlin Ray, personal communication, Nov 18, 2019). According to Caitlin Ray, a TB specialist at the Athens Clarke County Health Department, the Health Department will not even ask about insurance or mention any fees or costs. Everything is handled and paid for by the state (Caitlin Ray, personal communication, Nov 18, 2019).

## Step-by-step Process at the Athens Clarke County Health Department

Usually, it is unlikely that people go to the Health Department because they suspect they have TB. Normally, it is because they have to be screened for work, or for some other purpose. They come in seeking a purified protein derivative (PPD) skin test, and if that is positive, the Health Department will do a symptom screen, which will check the person for any of the tell-tale signs of TB. Next, the Health Department will refer them for a chest X-ray at the hospital.

The Health Department pays for chest X-rays for individuals who have a positive PPD skin test. In Athens, GA, individuals will usually go to Piedmont Athens Regional Hospital to get their chest X-ray done. From there, if the chest X-ray is clear, meaning the individual probably has latent TB, the individual will go back to the Health Department and get treatment. If the chest X-ray is not clear, there are a few other steps involved. The Health Department will consult with some pulmonologists to make sure, especially if it is a complicated case, and once that happens, if the Health Department believes it is an active case, they will put them in isolation and start immediate treatment (Caitlin Ray, personal communication, Nov 18, 2019).

Isolation means that individuals cannot leave their house, unless under certain circumstances. In serious cases, if the infected individual lives with someone, or small children, those individuals need to be removed from the household. In some circumstances, the Health Department will pay for hotel rooms for the non-infected individuals to go to, if they cannot find other housing. If there is no other care for small children to be put into, the Health Department will pay for those children to be taken care, away from their parents. In non-serious cases, the infected individual will just need to wear a mask in the house, and he/she is not allowed to leave, except if he/she is going to the Health Department or another medical appointment. Additionally, because isolation can be seriously taxing for people who are dependent on working to pay their bills, the Health Department will assist in paying for rent, food, utilities, and more (Caitlin Ray, personal communication, Nov 18, 2019).

To come off of isolation, the infected individual needs to complete two full weeks of four-drug therapy, show signs of clinical improvement, and have three consecutive negative acid-fast bacilli (AFB) smears. Treatment involves direct observed therapy (DOT). This is when a medical official watches the infected individual take his or her medication. If the individual does not have means of transportation, the Health Department will deploy a TB worker to his/her house. For active TB, DOT is required for either six, nine, or twelve-month therapy, even when isolation has ended. Regarding the AFB smear, this is when the Health Department collects a sputum sample, sends it to the lab, and if no *Mycobacterium tuberculosis* is seen, then the individual’s smear is negative. When all three of these criteria are met, the individual can come out of isolation (Caitlin Ray, personal communication, Nov 18, 2019).

After isolation, the individual is placed on appropriate treatment. For people with active TB, this can be a six, nine, or twelve-month regimen. It can start out with taking medication every day and lessen down to two or even once a week. For people with latent TB, they are required to take a big dose of pills, once a week (Caitlin Ray, personal communication, Nov 18, 2019).

Additionally, if people do not follow through with their treatment regimen, the Health Department can respond in a couple different ways. For people with latent TB, there is a certain window of time in which they will be okay with skipping treatment. According to Caitlin Ray, individuals can skip two to three DOT sessions before they have to completely start over. For individuals with active TB, if they are simply refusing to comply with treatment, they have made a legal agreement with the Health Department and certain legal actions can take place (Caitlin Ray, personal communication, Nov 18, 2019).

## Piedmont Athens Regional Medical Center

1199 Prince Ave, Athens, GA 30606

Phone: [706-475-7000](https://www.google.com/search?sxsrf=ACYBGNSWNBD4OHgKgjrBCgaMBXmyppTwSQ%3A1574312003330&ei=QxjWXc7ZE824ggfjxoroBw&q=piedmont+athens&oq=piedmont+athens&gs_l=psy-ab.3..0j0i20i263j0l8.10828.11595..11881...0.3..0.192.755.1j5......0....1..gws-wiz.......0i71.Cjm5GZiMepo&ved=0ahUKEwiOh-WdwfrlAhVNnOAKHWOjAn0Q4dUDCAs&uact=5)

Website: <https://www.piedmont.org/locations/piedmont-athens/piedmont-athens-home>

Although it is recommended to receive all testing and treatment for TB at the health department, any chest x-rays will need to be done at a local hospital. The health department will cover the costs of any treatment or screening done outside of their clinic in regards to Tuberculosis testing or treatment (Caitlin Ray, personal communication, Nov 18, 2019). Piedmont is a common spot for getting these x-rays done and can potentially provide testing for TB for those who need an examination and decide to visit the hospital first. If any TB test is determined to be positive they will ultimately refer you to the health department for treatment unless hospitalization or quarantine are needed in severe cases.

# IMPACT

Mateo will be out of work for at least the first two weeks of treatment, since he will be in isolation. If he has sick days saved up, this will not be a problem, but it could be a problem if he does not. The Health Department can help negotiate with his employer about the time off work he needs to help them understand the importance of isolation (Caitlin Ray, personal communication, Nov. 18, 2019). Mateo may struggle during this time, since he wants to get back to work as soon as possible and may potentially be completely isolated from his family.

Mateo’s isolation also extends to his family. His family in America will also be tested, and if positive, put through the same treatment as him. The Health Department will pay for a hotel room to put his family in if they do not have anywhere else to stay, so they do not need to be concerned about homelessness during this time (Caitlin Ray, personal communication, Nov. 18, 2019). His family in Mexico will all need to be tested, and because they reside in Mexico, they are more at risk for complications, since the American healthcare system puts more of an emphasis on TB treatment than Mexico does. His family in Mexico may face increased stigma, due to heightened TB-related stigma in Mexico (Valenca et al, 2014).

Mateo will need to go every day to the Health Department for his DOT. During the isolation period, this will actually be the only time he is allowed out of his home. Mateo probably either has a car that he can use, or he can afford to purchase transportation since his salary from Delta is quite significant. In the event that he cannot afford transportation, the Health Department can either arrange treatment or have a healthcare professional come to his house for DOT (Caitlin Ray, personal communication, Nov. 18, 2019: GA TB Reference Guide: Delta MEC Scheduling Committee, 2018).

By far, the most significant impact will be arranging DOT with his pilot schedule. The most effective treatment therapy is a daily drug regimen, and this may not be possible on a pilot's schedule. The first two weeks of all types of treatment regimens require daily doses, so he will at least need to coordinate his schedule so he is back in his hometown, each day. This means that he cannot spend the night in another city, which can be common for pilots. This could lead to him losing his job, depending on the demands of Delta. His coworkers will not be a significant risk after Mateo has been let off isolation (Caitlin Ray, personal communication, Nov. 18, 2019: GA TB Reference Guide: Delta MEC Scheduling Committee, 2018).

# SUSTAINABILITY

Federal communicable disease laws form the basis of how the U.S. government is allowed to protect the public through prevention and treatment of communicable diseases, including those from overseas (CDC, 2009). Due to this, there is a commitment to ensure that anyone in need of treatment or testing has the available resources from a government agency, typically the local health department. The commerce clause allows the legal basis for the Public Health Service Act which permits the Health and Human Services department to ensure there is no transmission or spread of TB into the United States or across state boundaries, resulting in increased TB related resources within each state (CDC, 2009). Additionally, due to more TB specific laws that delegate certain powers to local governments for TB control programs and other TB prevention and treatment measures, there is a guaranteed effort from the government to ensure healthy populations and provide adequate equipment for testing and treatment, which will never be kept from any citizen in need (CDC, 2009). All cases of tuberculosis must be reported to public health agencies where they are subsequently forwarded to national databases for monitoring purposes (CDC, 2018).

In 1989 the CDC implemented a multistep approach to reduce the incidence of TB in the United States. The plan included training of healthcare professionals, increasing research efforts, universal genetic testing for antibiotic resistance of TB, implementing infection control in laboratories and other healthcare settings, and strengthening the state and local level health departments monitoring of treatment (CDC, 1989). This program lowered the rate of TB in the United States and positively affected net savings for the financial burden of TB (Castro et al, 2016).

The current system of TB control in the United States is a financially sustainable practice with estimated savings of $6.7 to $14.5 billion dollars of savings due to averted TB cases. Furthermore, the prevention efforts in the United States have resulted in an estimated 144,852 to 318,948 thousand cases prevented due to TB prevention and surveillance efforts. These prevented cases not only resulted in the significant economic changes noted previously, but also prevented additional TB related suffering and death. The United States appears to have a highly sustainable and effective system of TB prevention (Castro et al, 2016).

## Ending TB, sustainably

The World Health Organization (WHO) has released a strategy to sustainably end TB. The strategy provides a unified response to ending TB death, disease, and suffering. Additionally, it builds on three strategic pillars, supported by several key principles (World Health Organization, 2015).

The first pillar promotes integrated, patient-centered care and prevention. This pillar focuses on early detection of TB including universal drug-susceptibility testing, and systematic screening of contacts and high-risk groups. It promotes the treatment of all people with TB, including drug-resistant TB, and patient support. Additionally, it allows preventive treatment of persons at high risk and vaccination against TB. Lastly, this pillar forms collaborative TB/HIV activities and management of comorbidities (WHO, 2015).

The second pillar focuses on bold policies and supportive systems. This pillar strengthens health and social sector policies and systems to prevent and end TB. Additionally, it supports the implementation of universal health coverage, social protection, and regulatory framework. Furthermore, it addresses the social determinants of TB and tackles TB among vulnerable groups such as the impoverished, people living with HIV, migrants, refugees, and prisoners (WHO, 2015).

Lastly, the third pillar centers on intensified research and innovation. This pillar aims to intensify research from the discovery, development, and rapid uptake of new tools, interventions, and strategies. It pursues operational research for the design and implementation of innovations. Additionally, this pillar calls for an urgent boost in research investments, that new tools are developed and made rapidly available and widely accessible in the next decade (WHO, 2015).

To succeed, the strategy requires building on the gains made by current programs while moving beyond to a broader systems response. This includes elevated TB leadership, commitment, and collaboration within diverse settings. To roll-out the strategy, countries and all partners will need advocacy, baseline preparedness, and collaboration (WHO, 2015).

In terms of advocacy, countries will need to advocate for and achieve: high-level political commitment multisectoral collaboration, and high-level national mechanisms to direct the adaptation and implementation of the strategy. For baseline preparedness, countries will need to assess their current TB situation, current status of response and health system capacity, and policy and regulatory environment. Lastly, countries will need to focus on collaboration and work together across relevant ministries and departments, such as health, finance, education, food, social-welfare, justice, labour, transport, and migration; with patients, affected communities, and civil society; with the private sector; and with national and international supporters and partners (WHO, 2015).

# REFLECTIONS

## Jack Reynolds

I feel like I didn’t know much about TB besides that it was a respiratory disease. I feel as looking at how well it’s been treated in the U.S. I can understand why I haven’t heard much about it: it’s basically not a problem in the United States. We’ve done such a good job in our treatment and prevention efforts that the only real sources of TB are from immigrants coming into the U.S. and even then we treat them and it’s not a problem

I feel like we’ve done such a good job with managing TB in the U.S. is because we’ve gone to such bounds to make treatment available for everybody. Nobody has to pay for treatment and the health department will provide so much assistance to families while a member is being treated. The health department is even willing to put up the patient's family in a hotel to prevent the spread of the disease. The success isn’t due to a vaccination either, it’s due to our effective governmental programs.

This sustainable model makes me wonder why haven’t we instituted this into other forms of treatment. When Roger came to talk to us he talked about how everybody benefits when we provide accessibility for the blind and I feel like this same principle is at play here. *Everybody benefits from accessible treatment of any health condition.* I feel as if this success should motivate us to expand the health department's resources to diseases like HIV, where everybody would benefit from there not being any barriers to treatment.

Catlin Ray was a great resource for finding out the specifics of what would happen for somebody with TB. She listed out exactly what we needed and confirmed what we were questioning. She was also very willing to meet and seemed like she actually enjoyed talking with us.

## Abigail Adams

Gathering information from both online research and community agencies about Tuberculosis was an interesting process. We learned about the biological basis of Tuberculosis, TB transmission and treatment, and what resources are available to someone in Athens if he or she were to contract TB. For our case study, the local health department was the main and most viable resource for TB. Visiting the Athens Clarke County health department was a pleasant and valuable experience. The worker at the health department, Cailtlin, was extremely knowledgeable on the subject and provided helpful information for our final case study. She also seemed to be noticeably passionate about what she was doing, something I really took away from the site visit. It encouraged me to pursue a career related to infectious disease prevention and management, though I would prefer to focus in infectious disease epidemiology specifically.

I expected the resources at the health department for TB patients to be limited and less accessible than they are. After visiting, I realize that the health department does a great job of catering to the needs associated with an active TB case. I was pleasantly surprised about the quantity of resources that the health department provides for TB cases. According to the department, there are only a few active cases of TB in Athens each year and around seventy latent cases. The health department does a considerable amount to cater to these patients with active TB. Cost and transportation are two factors that the health department considers when treating active TB cases. For one, the health department sends someone to distribute TB treatment drugs to a patient’s home if he or she is not able to transport to the department. The staff and department make sure that the patient receives the medicine he/she needs, regardless of the patient’s own resources. The department also considers financial restrictions of patients and helps a TB patient financially if needed. This typically happens in the isolation phase, where the health department will help pay for accommodations for the family of the infected individual. The department also helps financially if the infected person misses work by providing gift cards to Walmart, among other places. Both of these things, transportation and financial limitations, are factors that the health department considers and works around. In the specific case study we had, the person, Mateo, did not appear to have financial limitations affecting his treatment for TB. Transportation was also not listed as a restriction for Mateo in the case study. Regardless of this specific case study and Mateo’s own resources, both the financial aspect and transportation aspect are two factors that the health department considers in treating TB patients.

Overall, I learned a lot about Tuberculosis on a biological level, cultural level, and resource level. The health department protocol for active TB cases is thorough and available to all, regardless of resource level. I really enjoyed learning more about TB, as I did not know this much detail on the disease before this case study. It was refreshing to hear that the main resource for TB in Athens is an accessible one with few barriers for those seeking TB treatment.

## Courtney Rambo

During my time researching tuberculosis and the resources available in Athens, I realized that I had a lot to learn about diseases that are lesser known among the public, since I knew almost nothing about tuberculosis beforehand myself. As I begin searching for answers about what TB is and how it is treated in the United States, I was happy to find abundant information about the bacteria but frustrated at the lack of information about what would happen if someone was diagnosed with TB. It was clear that the science was available to prove it existed and that there were medications and antibiotics available to treat it, but when it came to finding resources, it was almost as if there weren’t any. Over the course of the semester, our group slowly began to understand that when the prevalence of an illness is low, there is little attention given to it and therefore, it is hard to find information on it.

This frustration was new for me, since I had always been able to find resources on more common illnesses like diabetes, influenza and HIV/AIDS for past projects. In this case, I found that there were some major threats to our health that I had not been taught about so far, tuberculosis being one of those. I was fascinated while reading about the bacteria’s abilities to be drug resistant and how lengthy the treatment processes were. I was also amazed that the treatment was all under control by the health department based on federal requirements. It reminded me that within my life span, I have not experienced what the world was like during a time of high rates of communicable disease, but that there once was a major threat to the population from infections such as TB. There is not a federal mandate for TB treatment resources at local health departments for no reason and they were put into place because of the high level of importance and severity that accompanies TB. The dangers of drug resistance bacteria are more and more present and while writing this paper, I again was forced to keep this in mind and remember the importance of communicable disease control in the future as a health promotion specialist.

Overall, getting the opportunity to actually speak with Caitlin Ray at the Athens Health Department was eye opening and taught me a lot about TB that I couldn’t seem to learn from online resources alone. This is important because the reason we write needs assessments in the first place is to consolidate information and determine all the possible solutions to a given health issue within a community, but I even struggled to do this. If my group and I had to directly communicate with a tuberculosis specialist in order to find answers, then Mateo from our case study would have even more trouble. It is important that we continue to give the public better and more detailed information on health topics based on research without becoming overwhelming or hiding the information away that we think may be unnecessary. There will always be a few rare people somewhere that are in need of helpful and quick resources for the illnesses that do not get much spotlight. I will use this experience to continue to help give the public access to health information they can understand or at least point them in the right direction. There is always more to improve, but I believe informing the community is always a good place to start, and I will take that valuable lesson with me.

## Francesca Pagano

When I found out I was assigned to the tuberculosis case study, I was very excited. I love infectious diseases, so I was happy that I had been assigned to a case that would make me happy and excited to learn more. Learning about the health of TB was very interesting. I didn’t know that there were two form of TB—active and latent. I assumed that since TB is made to be such a big issue in the media that all forms of it were deadly and highly contagious. I was wrong about this too because I actually learned that it is very hard to contract TB in the United States.

Learning about the culture of TB was also very interesting to me. I never would have guessed that TB would severely affect the HIV/AIDS group, but after learning about why the immunocompromised are at such high risk, it makes a lot of sense. Additionally, it was eye-opening to see how TB affects vulnerable groups such as those living in poverty, the homeless, and even people in Mexico. At first, I was not sure how Mateo living in Mexico would affect our case study, but after doing research about how TB is an important issue in Mexico, I was enlightened. Learning about the issue in Mexico made me realize that while the United States does not have the best healthcare, we did prioritize TB so much as a public health issue that we made treatment free to anyone, regardless of income.

My favorite part of this case study was actually the resources section. Initially, I was feeling very doubtful and reluctant that we’d have a good resources section, since it was so hard to find information about TB in Athens, GA. We knew that our main source would be the Health Department, but we were having trouble finding information about TB on their own website. It made me think, if I can’t find information about TB, and I know pretty well how to use the internet, how do other people who are not well versed with the internet find the information the need when seeking resources? That was when I knew that we needed to create a good resources section about the Health Department, and we would get this information through our site visit.

Contacting the Athens Clarke County Health Department to set up a meeting was actually quite easy. There was no contact email on their website, so I used their automated contact form on their website. Within minutes, I had a response from Caitlin Ray, the tuberculosis specialist at the Athens Clarke County Health Department (and former student of yours too, Dr. Hein!). Contacting her and getting responses was very easy. The only issue we had was scheduling, since she had a week-long TB conference in Florida during the time our site visits were due.

When we finally met in person, it was awesome. She talked about many things that I did not know, regarding TB. For example, I did not know that TB treatment at the health department was free for all persons, even if you had amazing health insurance. That was extremely helpful to know. Additionally, I found it to be pretty amazing that the Health Department assisted in paying for rent, utilities, food, hotels, and more. To prioritize TB so much that the state would pay for not only treatment, but personal necessities, too, was pretty amazing to me. It made me think that if our state can prioritize TB on this level, why can’t we do it for other issues, too, that’d actually lower the risk of even developing TB?

Another thing that amazed me during our interview was learning that the Health Department can actually take legal action against an individual if he/she is not complying with the treatment regimen. I did not know that this could even be an option, so it was eye-opening to hear this information. Additionally, she shared some cool information with us that she learned during her conference. We learned that there is a new drug that could significantly shorten the duration of specific treatment regimens, which is amazing all around. Not only would it be beneficial to the victim, but to the Health Department, too.

Overall, I am very happy with our case study. I am happy that I chose something that I knew I would be passionate about, because it made me want to learn more about the issue. Expanding my knowledge about the different forms of TB to learning about how TB affects society has changed how I view TB. Additionally, seeing the priority that the U.S. places on TB has expanded my gratitude and admiration for public health officials in our country. I truly hope the rest of the world can prioritize and combat this issue, too.

# RESOURCE HANDOUT

## CLARKE COUNTY HEALTH DEPARTMENT

345 North Harris Street, Athens, GA 30601

Phone: 706-389-6921

The Clarke County Health department is a tax supported public agency. The Health Department is the main center for TB testing and treatment in this county. The Health Department offers all services for TB treatment at no cost whether or not a patient has health insurance. These services include: skin testing, direct observation therapy (DOT), TB medications, laboratory testing, TB screening for those in contact with the patient, patient education on TB, and helps with transportation if needed (Northeast Health District, 2019, GA TB Reference Guide). A patients will be under isolation until they receive clearance from a TB social worker and a Health Department representative. Patients must also pass a physical examination showing their symptoms are improving, including less pain, reduced coughing and a clear chest x-ray. The Health Department also collects data on TB for the study and prevention of TB. The Health Department can send out workers to a patient's house for DOT if the patient is unable to come to the health department. To cover expenses during work there are resources available to help pay bills and provide food for the family while the patient is under isolation. The Health Department will even pay to put the patient's family in a hotel while the patient is in isolation (Caitlin Ray, personal communication, Nov 18, 2019: GA TB Reference Guide).

## PIEDMONT ATHENS REGIONAL MEDICAL CENTER

1199 Prince Ave, Athens, GA 30606

Phone: [706-475-7000](https://www.google.com/search?sxsrf=ACYBGNSWNBD4OHgKgjrBCgaMBXmyppTwSQ%3A1574312003330&ei=QxjWXc7ZE824ggfjxoroBw&q=piedmont+athens&oq=piedmont+athens&gs_l=psy-ab.3..0j0i20i263j0l8.10828.11595..11881...0.3..0.192.755.1j5......0....1..gws-wiz.......0i71.Cjm5GZiMepo&ved=0ahUKEwiOh-WdwfrlAhVNnOAKHWOjAn0Q4dUDCAs&uact=5)

Piedmont Athens is a for profit hospital in Athens, Ga. The hospital offers most of the same services that the Health Department offers but will refer patients to the Health Department if they are diagnosed with TB. However, the Health Department will refer patients to the hospital if they need a chest x-ray, hospitalization and quartinine. The Health Department will cover all costs associated with receiving these services regardless of whether or not a patient has health insurance (Caitlin Ray, personal communication, Nov 18, 2019).

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