History/Microbiology Podcast 3 – Typhoid Fever in a Rural Village of Porto Rico Due to a Surface Well [1]

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History/Microbiology Podcast 3 – College of the Holy Cross

Typhoid Fever in a Rural Village of Porto Rico Due to a Surface Well

By: Angel Carrillo, Adeline Gutiérrez Nuñez, Louis Hurtado, Maria Claudia Schubert-Fontes, and Rossangelly Toro Carrillo.

ADELINE: Welcome to Que Paso? Una edición sobre Puerto Rico. A podcast where history and microbiology come together to decolonize Academia. Today we'll be discussing Garrido Morales' 1929 article, "Typhoid Fever in a Rural Village of Porto Rico Due to a Surface Well" in the American Journal of Public Health.

We'll be sitting down with four students- two microbiologists and two historians and one me, your host, Adeline Gutierrez Nunez. Welcome to the show! We'll dive into the role of the US in Puerto Rico in the 20th century, the background of typhoid fever, and the TRUE story behind this outbreak.

ADELINE: The village of Utuado, a coffee region, in central Puerto Rico in 1929 suffered an outbreak of Typhoid Fever. But how exactly did this bacterium spread? Before we get into all the fascinating details, we need to first gain some historical context as to what was going on in the island during this time. Rossangelly and Louis what was the relationship

between the island the U.S mainland?

LOUIS: That's a loaded question! To get to that, we have to go back to 1898 and talk about how the US even got involved from the start.

Following the Spanish American War, Puerto Rico became a US territory through the Treaty of Paris in 1898. Puerto Rico faced a period of Americanization and colonization that proved to be the cause of many issues the island faced in the early 20th century. In 1900, the United States Congress passed the Foraker Act which allowed for Congress to officially control and established a civilian government in Puerto Rico. This allowed full control for US specific needs and ideals which affected all parts of the Island in varying degrees. All federal laws of the United States were in effect on the island. Sponsored by Senator Joseph B. Foraker from Ohio, the established government had a governor and an 11-member executive council appointed by the President of the United States, a House of Representatives with 35 elected members, a judicial system with a Supreme Court and a United States District Court, and a non-voting Resident Commissioner in Congress. The Executive Council included only five individuals who were Puerto Rico residents which in turn allows for a 6-5 majority in members who were non Puerto Rican Residents with the non Puerto Rican governor being the head of the new government. This act also created a Puerto Rican citizenship, not United States citizenship which further marginalized the people of Puerto Rico as the "other" who had to follow US laws. This act was the foundation for what would excuse US involvement in Puerto Rico for the 20th century. For 17 years, not much changed within the government of Puerto Rico. The overall structure was the same until 1917 where the Foraker Act was eventually superseded by the Jones Act.

ROSSANGELLY: The Jones Act of 1917 granted Puerto Ricans statutory US citizenship. This act however only granted them a limited status in which not all US Constitutional rights applied to them. Many historians viewed this as "colonial citizenship" since Puerto Ricans did not have the right to vote or true representation in politics. This act was sought out by the United States government as a result for a need for more troops for World War I.. Granting Puerto Ricans U.S. citizenship also granted them the ability to serve in the U.S. armed forces. U.S. invasion of Puerto Rico has never been for the development of the island but instead for the development of the U.S.

Would you agree with this idea?

ADELINE: Well, in this article we can see the effects of the neglect of the U.S government in Puerto Rico as there was a typhoid fever outbreak in 1929. For example, on the U.S mainland Ty21, a thypoid fever vaccine, was already widely administered before it was available on the island. But, what is typhoid fever?

MARIA: Well Salmonella Typhi is a Rod-shaped bacterium that only grows in the intestines and blood of humans. A unique fact about typhoid fever is that it only passes from human to human. Salmonella Typhi's mode of transmission is, what a doctor would call, the fecal oral route. Meaning that the disease is transmitted when pathogens in fecal particles pass from one person to the mouth of another person This bacterium makes an exotoxin that produces all of the symptoms individuals experience.

ANGEL: So, what exactly happens when Salmonella typhi infects your body? Well, to recap, the Salmonella enters the body through fecal oral routes.

Therefore in order for the infection stage to occur, a person has to be exposed to contaminated food and water; specifically cold goods, such as milk, ice cream, room temperature water or other vegetables that are not boiled at a high temperature.

MARIA: Note that sharing a beverage or a meal with someone who might be an asymptomatic carrier (someone who is infected but does not develop typhoid fever) can also transmit the disease.

ANGEL: Now let's move into the incubation stage During the 2 weeks if incubation, the salmonella typhi attaches and grows inside of the tissue cell of the small intestine. This particular pathogen secretes a protein called typhoid toxin and force itself through the intestinal-tissue cells and ultimately make its way into the bloodstream. Then in the bloodstream, the white blood cells carry the microorganism to different organs of the body such as, the liver.

MARIA: FUN FACT: The typhoid toxin has two subunits: A-B toxins. The B subunit binds to the cell's surface receptors and then subunit A works as an active toxin to cause damage to the binded cell.

ANGEL: At first, one might feel uneasy due to symptoms of: abdominal pain, headache, high fever. BUT, what we should really be worried about are the more chronic symptoms. In the acute period the host experiences liver failure, kidney and bladder infection and other less common/ life threatening complications.

ADELINE: Thank you for the explanation. Let's tie these two things together. How does that history component in neglecting the needs of Puerto Rico during this time translate into the lack of sewage infrastructure and ultimately the epidemic of Typhoid Fever?

ROSSANGELLY: With the Foraker Act, the United States was able to start projects to develop infrastructure such the building of roads, irrigation systems, hydroelectric plants, a telegraph system and much more. The problem here however was that this was only limited to mostly urban areas and areas of specific crop cultivation. The lack of equally distributed resources and development projects among the island left much of the poor and rural populations at risk for inadequate living conditions that led to both lack of economic development and lack of resources pertaining to health measures. The interior department worked on modernizing the island through different public works project not for the development of the island, but for the attraction of U.S. corporations and investors. Prior to 1912, the United States had not implemented any sort of sanitation service or project due to the fact that Congress had failed to authorize funds for it. Sanitary conditions for island natives were not a priority for the U.S. government, but instead the focus was to eradicate tropical diseases for safety of U.S. soldiers and government officials.

LOUIS: The focus of the Interior Department was mainly on the Southern Region of the island as this is where sugarcane cultivation took place which was seen as the most promising export. Utuado does not fall into either of these categories as it is a rural district in the Central region of the island with a focus on coffee cultivation. As the article discusses, Utuado had no main water source or sewage system. It was reliant on that of a nearby town and a surface well.

ADELINE: So let me get this correct, The U.S neglected developing the infrastructure of the central region. How do we see the lack of infrastructure play a role in the spread of Typhoid in Utuado.

MARIA: Well as Louis pointed out just now, the lack of state presence within Utuado resulted in improper sanitary systems, such as water treatment through chlorination, waste disposal, or sewage treatment. Morales illustrates the presence of these conditions within the article. As he describes that following the hurricane, the town lost their three main sources of water and had to acquire water from a surface well. When Morales begins to estimate the incidence of the disease he estimates that about 42 cases were reported where patients showed symptoms of typhoid fever, following the hurricane.

ANGEL: Even though only half of the town used the contaminated surface well as their source of water, once that population was contaminated it led to the infection of the rest of the population. According to Morales' research, "Although the people who used water from this well formed only 51% of the total population of the village, this group contributed 92% of the cases." So although only half of the town used the surface well, once that population of individuals was contaminated, they spread the disease to the rest of the town through person to person contact. Morales goes on to state that, "Infection in 2 out of only 3 cases who did not use this water supply was definitely contributed to contact with previous cases of the disease" Thus we can surmise that although the surface well may have been the reservoir of the typhoid bacteria, through person to person contact, the disease spread further.

ADELINE: I am interested in learning more about the source of the water. Are there any other factors in infrastructure that could have contributed to the spread of this disease. I remember you both mentioning the role that sewerage systems play in spread of disease.

MARIA: Although Morales does not provide context on how the hurricane resulted in water contamination, we can surmise that flooding from the hurricane could have played a significant role. Morales states that "about 83.33% of people in the town were using outside latrines," which were largely vulnerable to the impacts of the flooding.

ANGEL: The wide use of outdoor latrines points to a lack of waste disposal system and a lack of a sewage treatment system. And this could have contributed to the contamination of the surface well, as the contents of the various latrines were likely overflooded.

ADELINE: Within the article Morales also attempts to measure the economic and sanitary status of the community residing in Utuado. How do we make sense of this with a historical analysis?

LOUIS: Morales discusses the sanitary conditions of the patients and controls during his research and sums it up using four different criteria. He uses “good”, “fair”, “poor”, and “very poor” as the standards for the conditions. These standards are very abstract. There are no specifics as to what each of these means which can skew the data immensely. In our perspective, we were unsure what standards of measurement were used to determine standards of living. As we spoke about during our history portion, there wasn’t much development in these regions so what was the benchmark? Did he go by what he saw in rural regions in the US or did he compare it to the major cities in Puerto Rico? Although we inherently understand the infrastructure was not developed as his data points out, the way he goes about it does not fully encapsulate the region due to this poor standardization.

Prior to this study, Morales mentioned that there were no records present in the town that documented the incidence of typhoid fever prior to the hurricane. In an attempt to gain further information on the incidence rate of typhoid in the town before the hurricane, Morales canvassed house to house asking each family about the prevalence of typhoid disease. However, the author is unclear about how information was gathered or presented to families questioned.

From a microbiology lens, how do you both understand this method of collecting data? Can we effectively assume that typhoid was not present prior to the hurricane?

MARIA: well this method would not hold up by current standards. Therefore, if data concerning the prevalence of the disease is not available it is difficult to gage whether the disease could have been endemic to the area prior to the hurricane. Ultimately, we know that neither history nor biology can be entirely impartial so when reading a text from this time it is important to keep this in mind, regardless of the field of study.

ADELINE: Well thank you all for joining us again for Que PASO? Where microbiology and history come together to decolonize academia. Thank you to our special guests and we’ll see you next time.

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