SLIDE 1

- Hello and thank you for joining me
    - I'll be speaking today on the various Osteological and Sociocultural considerations for Syphilis in Human Skeletal Remains
    - As social conditions can significantly affect health, including the likelihood of contracting an infectious disease, this presentation is a reflection of the plethora of scientific inquiry and research for infectious diseases in bioarchaeological populations
- Special focus will be paid to the skeletal modifications that develop in response to one of the treponemal diseases, commonly known as syphilis

SLIDE 2

Part I

- Syphilis, along with several other pathogenic infections, are caused by a bacterium belonging to the genus Treponema – a helically coiled, corkscrewed shaped bacteria
- Collectively these bacterial pathogens are commonly referred to as treponemal diseases.
    - Of the various treponemal diseases, four of these are human pathogens, which includes syphilis
    - These pathogenic treponematoses typically occur in three stages, starting with initial infection, and ending in a tertiary stage where bone remodeling can occur if medical intervention is not sought

Part II

- The four treponemal diseases affecting humans include Pinta, Yaws, Bejel (also referred to as endemic syphilis), and venereal Syphilis. With the exception of Pinta, all of these can cause skeletal modification if they reach the tertiary stage.
    - There is some theory that these three pathogens that can affect skeletal structures are caused by the same genus and species of bacterium, but three separate subspecies.
        - However, a challenge to this theory is the similarities that these pathogens share in the physical appearance of the bacterium, as well as the similar soft tissue and skeletal lesions they cause.
        - One means of distinguishing these forms of treponemal disease has been the geographical location and the age groups they appear in as their prevalence and modes of transmission are deeply tied to physical and sociocultural environmental conditions.
            - For example, venereal syphilis is most likely to be more prevalent in age groups that are more sexually active

SLIDE 3

- Of the extrinsic environmental conditions affecting the transmission of syphilis –both climate and geographical location play a significant role in the susceptibility of contracting the bacterium
    - Climate and geography can influence where the infection will enter the host and where it localizes. As treponemal bacteria need moist, warm environments, they can easily spread through simple skin contact in more tropical and warm climate geographical areas, especially as people are more likely to wear less clothing, increasing the exposure of skin to skin contact between people
    - In temperate climates, the bacteria adapts by seeking out warmer, and more moist areas of the body, including those that are typically protected from the cold by the use of clothing

- Venereal syphilis is the only treponemal disease that is not bound geographically bound due to its mode of transmission through sexual contact.
    - This factor of venereal syphilis helped to inform one of the three hypotheses related to the origin of syphilis – a point I will return to towards the end of this presentation

SLIDE 4

- As the spread of infectious diseases occur through both biological and sociocultural factors, it is essential to understand how human behavior can affect the transmission of syphilis
    - Factors such as migration, beliefs or attitudes about hygiene and health, population size, living conditions, and sociocultural practices all play a role in the transmission, spread, and adaptation of disease.
        - For instance, when human behavior such as migration leads to individuals moving to different environments and climates, the treponemal bacteria will also adapt and move to different areas of the body
        - Access to resources, nutrition, hygiene practices – including the ability to utilize hygiene practices – are all intimately linked to exposure to disease and the chance of contracting an infection
            - These factors also connect to social conditions, such as living in poverty, which often significantly increases health risks and susceptibility to infectious diseases
            - Additionally, individuals with poor immunity, or populations that have no prior exposure to a disease are more susceptible. Arguably, in paleopathological specimens, it is the individuals with good immunity that typically survive to the later stages of diseases such as syphilis

SLIDE 5

- Another means of differentiating treponemal diseases in skeletal populations is through the patterning of bone remodeling
- Here we can see the different skeletal elements that venereal syphilis and yaws commonly cause
    - Those areas shaded black are often heavily remodeled while the grey shading represents moderate or occasional remodeling
    - While there is some overlap in the skeletal elements affected by these two treponemal diseases, there are some key differences such as the greater rate and degree to which the skull is affected in cases of syphilis

SLIDE 6

- As previously mentioned, skeletal modification is typically restricted to the tertiary stages of syphilis, which can occur 20-30 years after the initial infection
- Those skeletal elements most affected in tertiary stages of both venereal and congenital syphilis frequently include the cranial vault, tibia in the lower leg, and the bones surrounding the nasal cavity.
    - Changes in these elements comprise approximately 70% of all tertiary syphilitic bone changes, though there is significant variation in the degree of severity as evident in the pictures shown here
- Each of these images shows different degrees of tertiary syphilitic change in the cranial vault.
- Changes initially start with isolated star-shaped lesions referred to as caries sicca, caused by a resorption of bone, seen in the first two images on the left.
    - Through a continual process of resorption and proliferation of bone should the disease persist untreated, these lesions can eventually coalesce

- As seen in the image at the far right, this process can eventually lead to complete resorption of bone in the cranial vault, which in turn, leaves the brain exposed.

- Despite the grisly appearance of these skeletal changes, and the serious symptoms they caused for the host, syphilis rarely kills. In fact, those cases that do result in death typically do not occur until the tertiary stages between 20-30 years after contracting the disease

SLIDE 7

- Syphilis has gone by many names related to its mode of transmission, as well as the similar symptoms it shares with other diseases and disorders

  - Some examples in historical accounts refer to syphilis as Cupid's Disease, indicating its mode of transmission through sexual contact

  - Due to the similar appearance of the rash-like skin lesions that appear in the initial stages of the infection, syphilis has also been referred to as the pox or the great pox, especially during the 16^{th} century as a means of distinguishing it from smallpox

  - Another telling name for syphilis has been "The Great Imitator", highlighting the challenges in determining a differential diagnosis of syphilis and other diseases with similar manifestations. For instance, syphilis has often been confused with leprosy in the past due to the similar destruction each can cause to the bone surrounding the nasal cavity

SLIDE 8

- Certain diseases such as syphilis have also been associated with considerable stigma and assigned blame for those who contract the disease
    - Due to the sexual mode of transmission in venereal syphilis, the blame of spreading the disease was often associated with immorality, female sexuality, and uncleanliness of the body and soul
        - This again is reflected in the term “Cupid’s Disease”, referring to its connection to intimate acts and is associated with people of supposed ‘weak or loose morals’ – which was especially directed towards women in early modern English
        - A ‘saddle nose’ that can occur in the later stages of syphilis due to the resorption of bone in and around the nasal cavity, seen in the center image, was perceived as a mark of shame, again indicating moral or bodily corruption. The images on either side of the center photo are prosthetic noses developed to conceal the ‘saddle nose’
        - During certain points of history, the stigma associated with syphilis has led to the use of private or back entrances to clinics and treatment centers to allow patients to enter, or for the patient to ignore the symptoms entirely
    - This practice of assigning blame has also been associated with the origin of syphilis. To use a term coined by medical anthropologist and physician Paul Farmer in his discussion of infectious diseases, the origin of syphilis has often been involved in a ‘geography of blame’, evident in the shifting of blame which associates the disease with different countries or groups of people
        - For instance
            - The French called it the ‘Spanish disease’, where as the Germans called it the “French Evil” and English and Italians called it the ‘French disease’, or the ‘French pox’

- These are just a few examples of this ‘geography of blame as the blame for syphilis has also been assigned to several other ethnicities and countries

SLIDE 9

- In paleopathological and osteological studies of syphilis in archaeological populations, there are three common hypotheses proposed for the origin of venereal syphilis and its subsequent global distribution
    - These theories focus on the origin of syphilis in either the Old World or the New World
    - The first of these is the Unitarian hypothesis, which proposes that syphilis was concurrently present in both the Old and New World, evolving simultaneously with humans, with the various manifestations of the treponemal diseases being produced by the different environmental and social conditions in each respective place. This theory is usually considered the least likely for the origin of syphilis among experts.
    - The other two theories focus on whether syphilis originated in the New World and was brought to the Old World by Christopher Columbus’s crew in 1493 upon their return, or if it originated in Europe prior to Columbus’s voyage and spread to the New World after his arrival there
        - The Pre-Columbian theory proposes that after Columbus’s returned to Europe in 1493 the infectious bacterium spread rapidly through the large, densely populated cities where there was no prior exposure or immunity.
            - In support of this theory, factors such as poverty, poor living conditions related to dense populations, nutrition deficiencies, and the lack of immunity are argued to be prime conditions for the rapid spread of syphilis in the Old World
            - Additionally, the practice of wearing more clothing in Europe during this time is argued to have significantly reduced the amount

of skin exposed, and in turn, the treponemal bacteria adapted from transmission through skin contact to a sexual mode of transmission

- Conversely, the Columbian theory proposes that venereal syphilis was present in Europe before Columbus's voyage, but was often mistaken for other diseases such as leprosy
    - It is hypothesized through this theory that a more virulent and acute strain developed in Europe due to sociocultural factors such as increasing population density, and that again this hardier strain evolved to be transmitted through sexual contact to overcome things such as temperate climates, decreased skin contact, and improved living standards in Europe.
- While there is still debate over which of these theories is the most correct, many experts feel that the Pre-Columbian theory is most likely the more accurate, though the treponemal bacterium may have started as a non-venereal form.
- Regardless of origin, it is important to recognize the complicated nature of infectious disease, including the contributing physical and sociocultural environmental conditions, as well as the challenge of determining a differential diagnosis of syphilis in skeletal remains due to the overlap in patterns of skeletal modification observed in various infectious diseases.

- I want to thank you for taking the time to join me today and I hope you enjoyed the presentation.