DISEASE ON THE WESTERN FRONTIER: CHOLERA AND TUBERCULOSIS DURING THE CALIFORNIA GOLD RUSH (1850-1900)

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by

Shannon Clinkinbeard

Fall 2014

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ABSTRACT

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Historic sites and historic skeletal remains offer the best opportunities for finding and examining infectious diseases. However, these assemblages are often not available for study due to their sensitive and recent contextual nature. Archival research seems to be a valuable, untapped resource that can fill the voids within historical demographic studies. This research attempts to showcase what these records can offer both academic and public communities.

The purpose of this thesis is to examine the presence and evolution of infectious disease during the California gold rush, a period in which studies of public health are few. This research focuses on data gathered from archival sources, and this analysis assesses patterns of disease prevalence and mortality due to infectious disease within two California gold rush populations: Nevada and Sacramento counties.

The results indicated that Sacramento displayed higher prevalence rates than Nevada County for both cholera and tuberculosis. The variable that affected these results most was that of population size. For both cholera and tuberculosis, the higher population numbers seen in Sacramento County allowed for easier transmission of the diseases and thus higher mortality numbers. Additionally, the sex comparison data demonstrated that more males than females succumbed to both diseases in each county. As there were more males than females in each county during this period, both cholera and tuberculosis had the ability to travel through the male population in elevated quantities. Furthermore, the age comparison data revealed that more young people (0-29 years) succumbed to both cholera and tuberculosis in each county. As this was the main demographic during the fifty-year period, they were the main group affected by these diseases.

CHAPTER I

INTRODUCTION

> The United States was originally regarded as a place to escape too, a land of health, wealth, principles and simplicity. With the extreme growth seen in U.S. cities, specifically California after the initial rush for gold, these newly established areas became slums with dirty water, poor sanitation and no reliable forms of justice. America was no longer desirable and diseases such as tuberculosis and cholera were rampant. (Rosenberg 1962:6-7)

The purpose of this research is to examine the presence and evolution of infectious disease during the California gold rush, a period in which studies of public health are few. Infectious disease was a large part of early California societies due to the establishment of new communities and the large influx of people that migrated for health and wealth during this time. Studying the progression of diseases offers insight into their effects on humans, their spread within human populations, and treatment strategies that people have employed to combat them.

Historic sites and historic skeletal remains offer the best opportunities for finding and examining infectious diseases in these populations. However, these assemblages are often not available for study due to their sensitive and recent contextual nature. Archival research seems to be a valuable, untapped resource that can fill the voids within historical demographic studies. This research attempts to showcase what these records can offer both academic and public communities. Furthermore, few resources have focused on infectious disease during the California gold rush. This research aims to

address this issue by studying the presence, evolution, and death rates of infectious disease through the large cultural event that was the California gold rush.

Archival records can offer researchers a wealth of information that may not be garnered from skeletal remains alone. These records can provide valuable insight into known, albeit not always accurate, demographic values, business, social, political, legal or medical statistics, as well as ideas or morals of the society in question at a particular point in time. Although analysis of skeletal remains is one of the best possibilities for finding evidence on the presence of infectious disease within a population, the availability of historic sites and historic human remains for study is low. There is also a gap in historical demographic studies that would otherwise supplement the limited access to historical skeletal remains. Therefore, this research focuses on data gathered from archival sources, and this analysis assesses patterns of disease prevalence and mortality due to infectious disease within two California gold rush populations.

The research questions for this study will center on two regions that played a major role in the California gold rush: Nevada and Sacramento counties. Even though gold was discovered in 1848, it took a few years for people to systematically begin migrating and establishing camps and communities, due to the remoteness of the area during this time. The populations in central and northern California were sparse and spread out, and when gold was initially discovered by the settlers, most did not believe it was real or that there was more to be found (Browne 1983:2; Chidsey 1968:24; Leland 1989:14; Rohrbough 1997:9; Rosen 2005:49; Thompson and West 1960:34 & 1970:34). It took time for word to spread, and for belief in the find and what it meant for the future, to reach the East coast, the newspapers and the politicians (Chidsey 1968:43; Ketchum

1996:6; Leland 1989:17; Rohrbough 1997:22, 24; Rosen 2005:95, 105). By the late 1850s the first official rush for gold in California had come to a close (Ketchum 1996:102; Rosen 2005:223). This was because, although still available, easy to find gold through placer mining techniques had shifted to the more advanced and expensive hydraulic and quartz mining methods (Rohrbough 1997:267). However, throughout the remainder of the century many smaller scale rushes occurred as people remained willing to try their hand at getting rich quick (Rosen 2005:223-224). Therefore, in order to present a before and after picture of disease patterns surrounding the California Gold Rush, the research questions will focus on a longer time period, and data from 1850 to 1900 will be presented.

Both Nevada and Sacramento counties began as small mining camps, but within a fifty-year period, they differed in their population growth patterns and incidences of infectious disease. Sacramento County became a major metropolitan area with a large population, while Nevada County became a thriving community with many smaller populations. As such, this research will examine differences in rates and types of infectious diseases between these two counties based on 1) differences in population size and 2) biological demographics.

Beginning in 1850, both counties contained new communities made of immigrants from many domestic and foreign locations. An influx of new people, in new areas, with a lack of established medical resources such as hospitals, medical offices or doctors with facilities for treatment meant new diseases that had the ability to spread quickly (Roberts and Manchester 2007:165). By 1900, these counties and their

communities had become more established but differed in their population sizes and access to resources.

Many infectious diseases were prevalent in the newly established communities due to both the working conditions and proximity of living quarters within these communities (Grob 2002:72). In the new mining towns that appeared in California after the discovery of gold, two infectious diseases were especially prevalent: cholera and tuberculosis (consumption) (Grob 2002:150-151). For the purposes of this study, examinations of infectious disease, particularly cholera and tuberculosis, will be evaluated based on prevalence within the growing populations of Sacramento and Nevada counties.

Research Hypotheses

There are four expectations for this research. The first expectation is that there will be similarities in types and prevalence rates of infectious diseases between the regions at the beginning of the fifty-year period with differences appearing between the regions at the end of the fifty-year period. The second expectation is that Sacramento County, with a larger population, will display more instances of disease overall, than the less populated Nevada County over the entire fifty-year time span. These differences will most likely be due to the varying establishment of cities and towns over time between the two counties and their ability to import medical resources.

The third expectation for this study is that although Sacramento is assumed to have more instances of disease, there will be an overall increase in both cholera and tuberculosis prevalence rates within each county from 1850 to 1900. This expectation is

based on the sheer quantities of people migrating to California during this period. It is assumed that the diseases making their way through the population would have overwhelmed the communities and their initial absence of medical resources and public health policies.

Biological demographics and individual risk factors also had a role in the types and prevalence rates of infectious diseases that were contracted during the gold rush. In 1850, most of the population in these two counties consisted of young adult males, and the fourth expectation will examine whether higher rates of cholera and tuberculosis occurred among this group during the beginning of the fifty-year study period. Toward the later half of the fifty-year timeframe, more women and children settled in the area, and so the expectation is to see an increase in infectious disease prevalence among these groups by 1900.

Outline of Thesis

To fully grasp the impact that the California gold rush had on the world and on those who were fixated on what it could offer, it is first necessary to understand California as it was prior to its inundation. Therefore, Chapter II will discuss California as it was during its pre-gold rush period. A brief history of California, as well as an introduction to the California gold rush and the major figures that had roles in its beginnings will be discussed. Additionally, as this research focuses on two counties that had large roles in peoples search for gold, brief histories of Nevada and Sacramento counties will also be presented.

New immigrants and the establishment of new communities introduce old and well-established diseases from their place of origin to their newly settled regions. Additionally, new habitats expose people to the threat of new diseases. The study of the progression of diseases helps us understand how they proliferate within the human body, how they spread between organisms, and how people have learned to treat and cope with them. Therefore, Chapter III will address several aspects of infectious disease evolution, including the biology of infectious disease, paleopathology and paleoepidemiology, the history of infectious disease in America, and in depth discussions on the two prominent infectious diseases examined for this research, cholera and tuberculosis.

As people migrated to and settled in the newly established regions of California, diseases became a prominent part of daily life. It became apparent that public health and medical practices would need to be instituted. Many individuals traveled west in the hopes of striking it rich, but most realized that this venture was a gamble and resorted to their previous professions. Most doctors and medical professionals in early California fell into this category. Chapter IV details a concise history of public health in the United States as well as California, and the prominent people that established public health policies in the new state.

Chapter V examines the materials and methods used to evaluate the prevalence rates of both cholera and tuberculosis in Nevada and Sacramento counties. Census records from 1850, 1852, 1860, 1870, 1880, and 1900 were reviewed in order to provide an overall picture of demographic information for each county. Additionally, archival records of death found from each county were assessed for those that were attributed to cholera and tuberculosis. Chapters VI and VII outline the results of the

census, death record, and prevalence data, as well as the chi-square test results for significance. Chapter VIII is a discussion of these results and includes a comprehensive conclusion on the research.

Summary

The California gold rush was a major cultural event in the state's history. It brought monumental waves of people to the West Coast to settle, work, and stake claims in the newly developing region of California. Unfortunately, the large numbers of immigrants also meant their diseases traveled with them. Neither cholera or tuberculosis was a new disease, but the hardship of traveling cross-country and settling into newly established, remote regions made dealing with these diseases more difficult than normal. This research aims to illuminate the struggles of the settlers of the California gold rush and the two main diseases that made their lives even more unbearable than first expected.

CHAPTER II

HISTORY OF THE CALIFORNIA GOLD RUSH

California officially became a state in 1851. It could nevertheless be argued that the defining moment for the beginning of California "history," as a state, was three years earlier with the start of the California gold rush. However, the true history began thousands of years prior with the settlement of Native American groups. The landscape changed once again in the 16th century with the colonization by the Spanish, which ultimately led to its succession to the United States. In order to fully understand the impact of the California gold rush on the world and on those who were immersed in it, it is important to understand and place California in its pre-gold rush historical contexts. Therefore, a brief history of California, as well as an introduction to the California gold rush will be discussed.

Once the Spanish conquered Mexico in 1519, and after further explorations to the northwest in 1535, they became the first Europeans to set foot in California (Thompson and West 1970:13). They made many attempts to settle in the lower half of this region but considered it to be barren and unlivable (Thompson and West 1970:13). When the Jesuits were expelled from Spain and all their colonial dependencies in 1767, the missions and properties in Mexico were given to the Franciscan monks, and the first Spanish mission was established in San Diego in 1769 (Leland 1989:2; Rohrbough 1997:

8; Thompson and West 1970:14). The Franciscan monks wanted to expand, and set their sights on northern areas, with Father Junípero Serra being named President of all missions that were to be established in Northern California (Thompson and West 1970:14).

In 1821, Mexico gained its independence from Spain and thus took control of California. The Mexican government then supplied the land to prominent families rather than the church or military (Leland 1989:3; Rohrbough 1997:8). These families largely lived along the southern coast in places such as Monterey or San Diego, but some migrated into the Central Valley region (Rohrbough 1997:8). California, as a Mexican territory, did not last long due to Mexico being unable to offer protection throughout the region, as well as being unable to extract its resources for themselves (Leland 1989:3). The war between the U.S. and Mexico began in 1846 and ended in February of 1848, with California passing to the American government (Leland 1989:10; Rohrbough 1997:10; Thompson and West 1970:21). The United States knew that California offered great potential in both land acquisition and untapped resources, but the real spoils of war had yet to be recognized.

The true discoverers of gold in California were most likely Native Americans, although as these metals were of no use to them, they were largely ignored (Hill 1999:20; Ketchum 1996:12). It has also been shown that to some degree the Spaniards and Mexicans had found and worked gold deposits as well (Browne 1983:1; Hill 1999:10). However, the real rush for California gold began with two men, John Augustus Sutter and James Marshall, and the building of a sawmill. John Sutter was born in Germany in 1803, grew up in Switzerland (Rosen 2005:3-4; Thompson and West 1970:29). After many

failed business attempts and years of accrued debts, Sutter left Switzerland and his family, and traveled to the United States, landing in New York in 1834 (Rosen 2005:3-4; Thompson and West 1970:29). Sutter made his way west and landed in Mexican controlled Yerba Buena (San Francisco) in July of 1839 (Rosen 2005:5; Thompson and West 1970:30). At this time, Sutter requested a meeting with Mexican Governor Alvarado, who granted him permission to settle in the Sacramento area as long as he came back to Mexico after one year to finalize land claims and citizenship (Chidsey 1968:11-12, 14; Leland 1989:5-6; Rosen 2005:7; Thompson and West 1960, 1970:30).

Sutter sailed up the American River and settled in Sacramento in August of 1839 (Chidsey 1968:11-12; Leland 1989:7; Rosen 2005:7; Thompson and West 1970:30). By September of the same year, Sutter had found a spot approximately five miles inland to build his fort and proposed town (Chidsey 1968:11-12; Leland 1989:7; Rosen 2005:7; Thompson and West 1970:30). Although claiming otherwise, Sutter had no military background, but built his fort in a military fashion (Chidsey 1968:12). His fort became a place of security for travelers that was self-sufficient, and became well known in the area (Rosen 2005:8; Thompson and West 1970:30). After one year, in 1840, Sutter traveled back to Governor Alvarado, became a Mexican citizen, and received a land grant under the name "New Helvetia," or New Switzerland (Chidsey 1968:14; Leland 1989:8; Rosen 2005:7; Thompson and West 1970:30). By 1844, Sutter had plans for building "Sutterville," and by 1845, his fort and surrounding businesses were thriving (Leland 1989:11; Rosen 2005:11; Thompson and West 1960:46).

James Marshall moved out west for the drier climate in order to recover from malaria, and appeared in Sacramento in July 1845 (Rosen 2005:12-13). He was a skilled

carpenter and blacksmith and immediately caught the eye of John Sutter who hired him (Chidsey 1968:15; Rosen 2005:13). Marshall was interested in farming and bought a ranch on Butte Creek while employed by Sutter (Rosen 2005:13).

By 1847, California's population was growing rapidly (Leland 1989:13). Mormons were migrating to the West Coast to search for new places to establish colonies under the direction of Mormon Elder Sam Brannan, and the U.S. and Mexico war had brought military and naval units to California (Leland 1989:13). Due to the growth around Sutter's Fort and Sutterville, Sutter wanted to build a sawmill in order to help with the growing lumber needs of new settlers and their homes and businesses (Leland 1989:13; Rosen 2005:11). Sutter and Marshall entered into a partnership in which Sutter would supply the men and materials, Marshall would build and operate the mill and they would share in the profits (Leland 1989:13; Rosen 2005:35).

In the fall of 1847, Sutter sent Marshall into the foothills to search for a location to build this new sawmill, and Marshall settled on a place called Coloma, which was approximately 50 miles northeast of Sutter's Fort (Chidsey 1968:15; Leland 1989:11, 13; Rosen 2005:32). Work began quickly and on the morning of January 24, 1848, just before the completion of the sawmill, Marshall performed an inspection on the tailrace and discovered a few gold flakes (Chidsey 1968:17; Ketchum 1996:1-2; Leland 1989:14; Rohrbough 1997:7; Rosen 2005:33, 37; Thompson and West 1960:46; 1970:33).

Marshall conducted a few tests to determine the validity of this find, and then traveled back to Sutter's Fort to show Sutter (Browne 1983:2; Chidsey 1968:19; Leland 1989:14; Rosen 2005:43-4; Thompson and West 1960:33; 1970:33). Sutter carried out a few of his own tests, traveled back to the sawmill with Marshall, found that the men

working there had discovered more gold, and swore them all to secrecy (Browne 1983:2; Leland 1989:14; Rohrbough 1997:9; Rosen 2005:48-9; Thompson and West 1960:34; 1970:34). However, the news of this find quickly leaked, but those living in Sacramento and San Francisco were not quick to believe the rumors (Browne 1983:2; Chidsey 1968:24; Leland 1989:14; Rohrbough 1997:9; Rosen 2005:49; Thompson and West 1960:34 & 1970:34).

The Mormon Elder Sam Brannan owned a newspaper in San Francisco, the *California Star*, as well as a store at Sutter's Fort (Browne 1983:2; Chidsey 1968:25; Leland 1989:14). Brannan heard of the discovery and went to the sawmill to see for himself. Understanding the immensity of the situation to come, he stocked his store with mining supplies, published the find in his paper, and ran through the streets of San Francisco holding a bottle of gold dust shouting "*Gold! Gold! Gold on the American River!*" (Browne 1983:2; Chidsey 1968:30; Leland 1989:15; Ketchum 1996:5; Rosen 2005:65). The rush for California gold had begun.

By April 1848, men were leaving nearby towns, and specifically Sutter's employ, to stake claims along the American River (Rosen 2005:67). Sutter was quickly losing workers to gold prospecting, and as a result, industry at his Fort and town halted, and he rapidly fell into debt once again (Leland 1989:16; Rosen 2005:67). By May 1848, Sutter was forced to close the sawmill as there was no one but Marshall to run it, and by summer, people from San Francisco, Southern California, Oregon, Utah and Hawaii were migrating to the gold fields (Ketchum 1996:5; Leland 1989:16; Rohrbough 1997:9; Rosen 2005:69).

Gold was discovered in January 1848 while California was still under Mexican rule. Once California shifted to the United States in February 1848, land ownership issues began to arise due to the replacement of political organizations. Sutter, having no legal title to the land in which his Fort and town were situated, had difficulties keeping prospectors at bay (Leland 1989:16; Rohrbough 1997:10; Thompson and West 1960; 1970:21). By spring of 1849, Sutter sold his Fort for $40,000 and retired to another of his properties on the Feather River (Leland 1989:18).

By the end of summer 1848, the news of gold in California had reached the east coast (Rohrbough 1997:22; Rosen 2005:95). Most easterners did not believe that the quantities of gold claiming to be found were possible and were leery of the stories being reported (Chidsey 1968:43; Rohrbough 1997:22; Rosen 2005:95). However, on December 5, 1848 President Polk delivered his State of the Union address to Congress, in which he confirmed the gold reports from the West, and officially kicked off the dash to the region (Chidsey 1968:43; Ketchum 1996:6; Leland 1989:17; Rohrbough 1997:24; Rosen 2005:105).

Mostly young men left their lives behind, changing forever the structure of families and communities (Ketchum 1996:6-7, 28, 66; Rohrbough 1997:1, 31). In the male dominated world of California in the mid-1800s, the presence of women in gold rush towns was more rare than gold itself (Holliday 1998:6, 12-13; Limerick 1998:32-33; Rohrbough 1997:91-94). However, this rarity of women often referred to white, Euro-American ladies of good social standing, that were married (Rohrbough 1997:97-98). Women of lower social classes or unfavorable values were more numerous, and worked

in various entertainment industries, as prostitutes, or in the bars and surrounding camps (Holliday 1998:6; Rohrbough 1997:98).

However, it was not uncommon to see some wives and children making the journey west with their husbands, and after a while these numbers began to increase as a result of further settlement of the region (Rohrbough 1997:97; Rohrbough 1998:28; Rohrbough 2000:27-28). The gold rush and the lack of established societies out west provided new opportunities for women and children that they otherwise may never have experienced (Rohrbough 1998:26, 28; Starr 1998:60). Although women in the mining camps were a rare sight, those that made the voyage were able to offer services that the migrant men had taken for granted back home (Ketchum 1996:60, 66; Rohrbough 1997:91). Men that made the trip west often realized fairly quickly that they were suddenly required to wash, cook, and sew for themselves (Rohrbough 1997:91, 95; 2000:36). Women that were willing to work were suddenly able to make money and provide for themselves and their families, a freedom and liberty that had previously been denied to them (Ketchum 1996:60, 66, 102; Rohrbough 1997:95, 98, 172). Women were paid fairly well for the domestic services that they could offer, and over time began to take on more non-traditional roles within the male dominated regions of gold rush California. Women mined for gold, ran businesses, and lived and worked on farms and ranches, and through these ventures, were able to erase the limitations of their past lives (Holliday 1998:10; Rohrbough 1997:174, 180).

Many ethnic groups began mass migrations into the new state in order to make easy money, escape poor living conditions, or both. However, Native Americans already living in California witnessed drastic changes, as well as an end to their way of

life, with the introduction of the gold rush (Ketchum 1996:12). Native American groups had been in the Sacramento area since approximately 5,000-6,000 B.C., but by the early 1850s there were twice as many whites as Native Americans (Ketchum 1996:99; Leland 1989:1). Native American groups were weakened by years of Spanish missions, the introduction of new diseases, physical attacks from outsiders and overall destruction of their natural habitats (Ketchum 1996:9; Rohrbough 1997:9-13). Therefore, it was difficult for these groups to resist the onslaught brought into California by the discovery of gold. Native Americans were displaced, relocated and removed as a result of mining, and many were used as sources of labor (Hill 1999:10; Limerick 1998:31). After the discovery of gold in 1848, some Native Americans fled the area while others stayed behind to offer services for pay to the incoming miners since they were familiar with the natural landscape and good locations for gold. This often backfired however, and many Native Americans ended up being cheated out of pay (Ketchum 1996:97-98).

Other groups had difficulties as well. European occupation in California began with the Spanish in the 1700s and their introduction of a mission in San Diego (Rohrbough 1997:8). Mexico led a revolution in 1821 and California subsequently fell into Mexican control. Mexicans mainly resided along the coast in places such as Monterey and San Diego, but some stretched into the central and interior valley areas (Rohrbough 1997:8). In 1848, Mexico ceded California and New Mexico to the United States with the signing of the Treaty of Guadalupe (Rohrbough 1997:12; Rosen 2005:66). When the first shouts of gold were heard throughout California, one of the first groups to respond in any great numbers were the native Californios, Mexicans who had settled in California as ranchers prior to California ceding to the United States (Ketchum 1996:3;

Rohrbough 1997:9). By the end of 1848, thousands had migrated into California, with most of the people at this time consisting of Californios, Mormons, Chinese, and Mexicans (Rosen 2005:95). Along with the Native Americans, Californios were greatly impacted by the influx of people into California. Native Americans lost their way of life and their land, and Californios lost their ranching lands to the American miners (Ketchum 1996:12-18).

Leaving war-torn China, Chinese immigrants began to arrive in California in large numbers after 1851, and ultimately became approximately ten percent of California's population by the 1870s (Choy 1971:269; Ketchum 1996:8; Rosen 2005:149, 190; Starr 1998:66). Most Chinese immigrants were young men that hoped to earn money quickly and return to China after success in the gold fields (Choy 1971:271; Ketchum 1996:86). Chinese miners typically worked in large groups, mined for long hours, seven days a week and were often able to extract gold from areas where others had given up (Ketchum 1996:89). As a result of this grueling schedule the Chinese had success where others were struggling. American and European miners began to retaliate, leading to attacks and discrimination against most "foreigners" throughout California (Ketchum 1996:89-91). The large numbers of Chinese migrating to the area and the large groups that were subsequently seen working together, led to the formation of many Chinese camps along the rivers and canyons in California's gold region (Choy 1971:270; Rosen 2005:190). Although Chinese groups may have had more luck than others in the gold fields, many did not reach the levels of wealth that they had hoped for. Many remained in California and opened restaurants, laundries, and markets, and often worked in gambling dens (Ketchum 1996:86). Since the Chinese were not recognized by California's state

laws and were often victimized by whites in the area, they ultimately began organizing their own unions that handled disputes, dealt with burials of their dead and cared for their sick (Rosen 2005:190). Despite this, the Chinese left few written records during their time in gold rush California, making their presence in this state difficult to trace (Ketchum 1996:85).

The first immigrations from the east coast began by sea in the spring of 1849, while the overland migrations began in the summer and fall of the same year (Chidsey 1968:50; Leland 1989:17; Rohrbough 1997:19). By the end of 1850, the features of mining in California were changing (Ketchum 1996:92-3; Rohrbough 1997:187). The surging numbers of miners meant less and less surface gold being easily found in rivers and streams, and a reduction in good claim locations due to competition over space (Ketchum 1996:92; Rohrbough 1997:187). If miners wanted to continue their luck, they were required to change their methods and technologies. Starting in 1850, miners had to shift toward digging into hillsides through the use of hydraulic and quartz mining methods, which utilized more complicated techniques, machinery and larger labor groups (Ketchum 1996:92-3; Thompson and West 1970:176-180). Also by 1850, the first two-way travel began to be seen within the mining communities (Ketchum 1996:93). People began leaving the mines after becoming discouraged, or not being able to keep up with the new technologies due to the cost of their establishment, while on the other hand others were still making their way in to try their luck (Ketchum 1996:93).

By 1858, the rush into California to find gold was over (Ketchum 1996:102). However, with the discovery of gold in California, California was discovered by the world (Rohrbough 1997:20). California had been forever changed by the massive influx

of people from all over the world, and new cities and communities had been introduced and permanently placed along its landscape. Two of these districts played an especially large role in the California gold rush: Nevada County and Sacramento County.

History of Nevada County

Nevada County began as a region centered on small mining camps and groups of men that ultimately formed small populations and communities. Over time Nevada County became known as the largest, richest and longest operating gold and quartz-mining region in California (Browne 1983:xi). In the fall of 1849 the first real prospectors, and the pioneers for mining in Nevada County, made their way into the area and spread themselves along Bear River, Deer Creek and the Middle and South areas of the Yuba River (Thompson and West 1970:53). Some of these men chose to stay and wait out the winter, others left planning on returning in the spring, but most had not given any thought to building any sort of city or township because all were focused on the job at hand: to strike it rich (Thompson and West 1970:53). Even though these trailblazers did not realize it at the time, by the spring of 1850, the area later to be known as Nevada County was brimming with life, swarming with mining activities and had officially become a settled region (Thompson and West 1970:53).

Mexico had originally divided California into 27 counties, and prior to the 1850s Yuba County incorporated all of present day Yuba County, Sierra County, Nevada County and some of Placer County (Thompson and West 1970:56). The county seat at the time was Marysville, and citizens further north or east found this city too far for conducting business, politics, and protection, and considered it to be a useless entity

(Thompson and West 1970:56). By 1850, many small mining camps and communities were well established, and cities and businesses were sprouting throughout the valley areas (Thompson and West 1970:56). People became interested in purchasing real estate and instituting newspapers, and therefore gained the attention of the legislators (Thompson and West 1970:56). By the time of the next legislature meeting, Nevada City had developed as a substantial town, and Grass Valley and Rough and Ready were also growing rapidly (Thompson and West 1970:56). On April 25, 1851, California's counties were re-divided, and Nevada County was born with Nevada City as its seat of justice (Thompson and West 1970:56).

The original government within the county was a County Judge and two Justices of the Peace (Thompson and West 1970:56). By 1855, the legislature transferred the government to a Board of Supervisors who over the next few years subdivided the county into nine townships: Nevada (City), Grass Valley, Rough and Ready, Bridgeport, Eureka, Little York, Washington, Bloomfield and Meadow Lake (Thompson and West 1970:57).

History of Sacramento County

Sacramento began as a river city for those traveling to the gold mines during the California gold rush. It quickly became the seat for Sacramento County, which also housed cities such as Galt, Folsom, Citrus Heights, and Elk Grove. Present day Sacramento County consists of over 20 cities, including the city of Sacramento, which is the county seat and state capitol. Although it was not as large or well known at its

inauguration, Sacramento has been a major center of activity since its establishment in 1850, due to the popularity of the California gold rush and its central location.

Prior to 1848, John Sutter had a well-established fort and a blossoming town named after him called "Sutterville." Sutter also owned land that incorporated the eventual city of Sacramento that he had developed as a river town (an embarcadero) for immigrants into the area (Leland 1989:16). When gold was found in January 1848, workers began to leave Sutter's Fort and Sutterville for the gold fields. The river town began to flourish, as it was a central location for those coming into the region to strike it rich (Thompson and West 1960:47). As Sutter attempted to preserve his land holdings, his son John Auguste Sutter Jr. arrived from Switzerland. Sutter Sr. gave him some of his property, including the area along the river in the hopes that he might have been able to help salvage some of his claim (Leland 1989:16).

Sutter Jr. along with assistance from Sam Brannan took four square miles of his father's land and called it "Sacramento" (Leland 1989:17). He laid out a nine hundred-grid block of streets and designated specific areas for public parks and public access to the river. He also labeled north-south streets alphabetically, east-west streets numerically and sold lots for approximately $200-500. Ultimately, he raised enough money to pay off most of his father's pressing debts (Leland 1989:17). As Sutter Sr. had wanted his Sutterville to be the center of activity, business, commerce, and living in this region, he was not pleased that his son had built such a quickly flourishing town that was immediately in competition with his own (Leland 1989:17; Thompson and West 1960:46).

By 1849, Sacramento eventually won in the trade war between itself and Sutterville, due to the thousands that were migrating into the Northern California region, as well as Sacramento being the natural landing and starting point for supplies (Leland 1989:17; Thompson and West 1960:47). Sutter Sr. could do nothing about the invasion of people on his lands, and eventually sold his fort and retired to Hock Farm, a property of his on the Feather River (Leland 1989:18). Sutter Jr. was also upset by the turn of events with his father as well as the state of the area, and left Sacramento in July 1850 and never returned (Leland 1989:18).

By 1849, the embarcadero at Sacramento was thriving as people docked, unloaded, and left for the foothill gold mines (Leland 1989:18). Sam Brannan, seeing the potential, built a store on the embarcadero, built Sacramento's first hotel, and bought a ship that was able to carry freight as well as passengers between San Francisco and Sacramento (Leland 1989:18). In April of 1849 the number of permanent residents in Sacramento was approximately 150, and by December of the same year the population had grown to about 3,500 (Leland 1989:18). The city lots that Sutter Jr. had sold for $250-500 increased by ten fold, and by the fall of 1849, stores, saloons, gambling houses and California's first theatre, the Eagle, were built (Leland 1989:18). Also by the end of 1849, Sacramento had established a local government with charters for a council, legal authority, and courts (Leland 1989:19; Thompson and West 1960:48).

Sacramento began as a basic mining supply pit stop for those going to the foothills to find their fortunes. Becoming the state capitol in 1854 permanently transformed Sacramento into a political and economic entity with a diverse population, complete with commercial fisheries, various shops and businesses, foundries that

supplied machinery for miners as well as produced lumber, quartz and cement, and mills that produced flour, coffee and spices (California Historical Society 1989-1990; Leland 1989:22-23). Although by the 1880s the rush for California's gold had concluded, mining was still a prosperous business in the foothills, and Sacramento had solidly substantiated itself as the center of California life and trade.

Summary

California was rich and diverse prior to the start of the gold rush. With the inundation of people into the state to try their hands at immediate wealth, this richness and diversity shifted towards greed and contamination. As individuals filtered in and settled into their new communities, the gold towns of California quickly became hotbeds for disease. These diseases were able to spread fast and virulently due to the distribution of the settlements and the close proximity of their inhabitants.

CHAPTER III

DISEASE

The California gold rush was an event that secured the state's place in the United States, and was a catalyst for introducing massive waves of immigrants to the West Coast. The influx of people also meant new and greater supplies, buildings, communities, an inundation of trade and commerce, and of course, infectious disease. New immigrants and the formation of societies brought a proliferation of known and unknown diseases (Roberts and Manchester 2007:165). New populations introduced old and well-established diseases from their place of origin to their newly settled regions, while the new habitats in turn exposed settlers to the threat of new diseases (Roberts and Manchester 2007:165).

The study of the progression of diseases helps us understand how they proliferate within the human body, how they spread between organisms, and how people have learned to treat and cope with them. Therefore, several aspects of infectious disease evolution will be addressed, including: the biology of infectious disease, paleopathology and paleoepidemiology, the history of infectious disease in America, and in depth discussions on two prominent infectious diseases of the period, cholera and tuberculosis.

Biology of Infectious Disease

Disease can be characterized as a condition that is likely to threaten the survival or well-being of an organism. An infectious disease is one that can be spread between living organisms through the environment (Anderson 2004:49; Buikstra and Cook 1980:439). On a biological level, infections can occur as the result of bacteria, viruses, fungi or parasites, and whether or not a person will become susceptible is based on both intrinsic and extrinsic factors (Inhorn and Brown 1990:90; Roberts and Manchester 2007:167). Intrinsic factors include age, sex, genetic predisposition and immune status (Inhorn and Brown 1990:90; Roberts and Manchester 2007:167). Extrinsic factors may include, but are not limited to nutritional factors, climate, occupation, trade, and sanitation (Buikstra and Cook 1980:443; Inhorn and Brown 1990:90; Roberts and Manchester 2007:167).

Two scenarios are possible as the result of contracting an infection. The infection will either resolve itself and the individual will survive with possible immunity in the future, or the individual will die as a consequence (Roberts and Manchester 2007:167). An infection is the pathological process of inflammation in the body, whether it is affecting soft tissue or the skeleton (Roberts and Manchester 2007:167). There are two types of infections, non-specific and specific. Non-specific infections are those in which the infection by one bacterium may not be distinguishable from that of another, while specific infections are those in which an exact causative organism can be established (Roberts and Manchester 2007:168, 182).

Inflammation is characterized as the cellular reaction of bodily tissues to an invading organism, and the manifestations of this process may include pain, swelling,

tenderness, or raised temperature (Ortner 2003:180; Roberts and Manchester 2007:167). Although not typical, infectious diseases can cause changes to bone (Magner 2009:3). When inflammatory bony lesions are present, it is an indication that the individual suffered with a chronic infection and had an immune response that was strong enough to fight the disease for a period of time. On the other hand, those suffering from severe infectious diseases usually die before a noticeable immune response can be generated, such as direct anatomical evidence (Ortner 2003:180-1; Roberts and Manchester 2007:167; Wood et al. 1992). It is important to understand disease on a biological level, but it is also of significance to recognize how diseases can be acknowledged and documented from past populations, as well as how they moved through these once-living communities.

Paleopathology and Paleoepidemiology

Paleopathology can be defined as the study of abnormal alterations found on human remains from archaeological contexts (Roberts and Manchester 2007:1). There are both primary and secondary types of evidence used to support findings within paleopathology. Primary evidence originates directly from observations of skeletons or mummified remains. This type of evidence is the only reliable form for demonstrating that a once-living person suffered a health affliction, even though the specific diagnosis may never be known (Roberts and Manchester 2007:1). Secondary evidence relies on documentary and iconographic data that comes directly from the time period under investigation. Regrettably, the authors and artists behind this data often focused on

documenting the visually dramatic, or sensational diseases of the time, rather than the more commonplace or mundane illnesses (Roberts and Manchester 2007:1).

For investigations into past populations, restrictions may be placed on whether skeletal evidence of infectious disease is present (Ortner 2003:180). When accessible, studying infections on skeletal material (primary evidence) should be done with careful analysis but can produce considerable information on human adaptations and responses to disease, as well as the antiquity and evolution of diseases themselves (Inhorn and Brown 1990:93; Ortner 2003:181). When skeletal material is not available for examination, as is the case with many historical age populations, historical documents (secondary evidence) can yield insights into disease patterns and human responses to those diseases.

Epidemiology is the study of incidence (or prevalence), distribution, and determinants of diseases in populations (Roberts and Manchester 2007:11). Paleoepidemiology is the application of these techniques on populations of the past. Paleoepidemiology examines skeletal assemblages, groups comprising of those buried in the same site over a period of time, in order to make some general assertions about the characteristics of the skeletal sample as a whole (Waldron 2007:27). In paleoepidemiology the "only valid measure of frequency" is prevalence, not incidence (Waldron 2007:11). Incidence can only be applied to modern populations as the denominator in this equation applies to living individuals (Waldron 2007:11). As such, prevalence rates are used when making examinations based on historical disease documents, as the population in question is based on a deceased group.

It is important to understand these biological pathways of disease processes in order to fully appreciate human responses to such situations. Also of importance are the historical circumstances in which infectious disease made its way through human populations, and of particular importance for this research, through human populations within America and specifically California.

History of Infectious Disease in America

Since Grob (2002) and Magner (2009) provide comprehensive evaluations of infectious disease in the United States, they will be the dominant sources utilized here. Infectious disease- causing microbes have flourished since before humans made their appearance on earth (Magner 2009:1). On the other hand, epidemic diseases that require dense populations to propagate are relatively new additions to human communities (Magner 2009:1). Many pathogens are species-specific and their survival will depend on certain factors. These factors can include the pathogen's virulence, the size and population density of the host group, the immune response of the host, and the pathogen's ability to find new hosts (Magner 2009:1). Some pathogens are only transferred during acute phases of a disease and may disappear after recovery or death of the host (Magner 2009:2). These pathogens will find permanent residence difficult among small groups, as once introduced into a small population all individuals are infected and will either recover or die (Magner 2009:2).

Beginning approximately 10,000 years ago human populations shifted towards agricultural and sedentary lifestyles and provided new opportunities for microbes to survive and reproduce (Grob 2002:10; Inhorn and Brown 1990:94; Magner 2009:2;

Mitchell 2003:174). With this change in subsistence patterns, human populations were changing their environments. Agriculture and sedentism allowed for dependability in food supplies and the domestication of animals (Grob 2002:10-11; Magner 2009:4). This shift created better health care for sick members and permitted host-parasite relationships (Grob 2002:11). On the other hand, it also enabled the emergence of infectious diseases in both endemic and epidemic forms. Permanent housing which allowed for the infestation of insects and rats, poor sanitation practices, irrigation and stagnant water, and viruses that were typically found on animals, were now domesticated and could easily transfer to humans (Grob 2002:11; Mitchell 2003:174).

Once populations in the Americas became sedentary, they began to have shared experiences with the rest of the world. However, differences could be seen in the specific pathogens present, as well as the magnitude of their crises (Grob 2002:17). European populations had endemic and epidemic diseases due to high populations, trade and commerce, and while the Americas did not have the same population numbers, they still experienced serious threats to health and life (Grob 2002:23). Groups in the Americas were becoming increasingly sedentary, establishing host-pathogen relationships, increasing their dependency on maize and thus deficiencies in diet, and were subsequently experiencing increases in chronic and endemic diseases and lowered life expectancies (Grob 2002:23-24).

Europeans began to expand their empires in the 15th century. They introduced their cultures, traditions, plants, animals, people and pathogens into new regions of the world (Grob 2002:27; Inhorn and Brown 1990:95). Spain was initially most active in exploration and colonization attempting to spread Christianity, and in the years following

Columbus' arrival in the New World they were spreading through Central and South America, the southeast and southwest present-day United States, and into California (Grob 2002:28). The Spanish made contact with large groups of Native populations, specifically the Aztecs, Mayans and Incans and introduced new microbes (e.g., smallpox, measles, influenza) into conditions that were ideal for their rapid spread (Magner 2009:16). By the end of the 16th century, England, France and Holland also explored and colonized North America, with the first permanent English settlement appearing in Jamestown in 1607 (Grob 2002:38). By 1640, the English had emigrated approximately 20,000 people (mostly families) into North America, and smallpox epidemics decimated the Native populations since they lacked immunity to this new disease (Grob 2002:39).

Although the introduction of European diseases was catastrophic for the Native American populations, the European settlers were also vulnerable due to the new environment and harsh, unfamiliar conditions, and also initially experienced high morbidity and mortality from infectious diseases (Grob 2002:48). Through the remainder of the 17th century, European settlements increased, and although the population was growing, it was dispersed. Therefore, communication between new immigrants in the ports was slow to reach the interior areas of occupation, and this proved to be advantageous to health in the rural communities (Grob 2002:60).

By early in the 18th century the process of acclimation to the new environment was complete for most people in the American colonies (Grob 2002:69). However, successive generations would have new sets of challenges yet to face. In the 18th century, the population grew at a rapid pace (Grob 2002:71). Acute infectious diseases were still the main threat to health, but there was a shift in the patterns in which they were seen

within populations (Grob 2002:72). Relationships between pathogens and human hosts were changing. These changes were mainly due to increases in size and density of populations, expansions in trade and commerce, new forms of agriculture, landscape transformations, and increases in large towns and urban port areas (Grob 2002:72; Mitchell 2003:173). The large towns and ports played a significant role in the spread of infectious disease and a variety of pathogens that resulted in epidemic outbreaks due to the numbers of people that were now living in close proximity to one another. Ports were entry points for new migrants, and people were in greater contact with those coming from Europe, the Caribbean, and Africa, due to expansion of global populations and increases in trade and commerce (Grob 2002:72; Mitchell 2003:172-173; Smith et al. 2007:1903). The physical environment of these port towns aided in the dispersal of these infectious agents through the crowded living conditions, the poor sewage disposal systems, and water that was stagnant or contaminated (Grob 2002:72). Diseases that began to spread swiftly included smallpox, yellow fever, measles, diphtheria, scarlet fever, pertussis, chicken pox, dysentery, and respiratory illnesses (Grob 2002:72-88).

The 19th century saw increases in both population sizes and the number of cities with the rising rates of economic activity, and as a result, greater risks from infectious diseases (Grob 2002:97). The urban population growth produced local water supplies and public water systems that were inadequate for the community numbers and resulted in contamination and unhygienic conditions (Grob 2002:98-101). With the combined expansion of foreign and domestic commerce, dense populations and unhygienic environments, the introduction of different pathogens and endemic infectious diseases, such as cholera and tuberculosis, were made possible (Grob 2002:90-104).

By the 19th century Americans expanded westward across the United States (Grob 2002:124). Frontier life was not easy and was full of risk factors for disease. Those migrating west were often in close proximity to wild and domestic animals creating opportunities for the spread of zoonotic diseases. At the same time, most travelers were young unmarried males who were less likely to eat nutritiously or have good personal hygiene and frequently succumbed to disease (Grob 2002:137). Infectious diseases that originated on the east coast were also prevalent on the frontier and included malaria, gastrointestinal illnesses, cholera, typhoid fever, tuberculosis, syphilis, and scurvy (Grob 2002:125-137). Many migrants headed for the Midwest and stopped, but many others made their way to the West Coast, especially California, in the search for gold (Grob 2002:124).

Those migrating west into rural environments had advantages over their urban counterparts, but both types of living conditions saw declines in life expectancy (Grob 2002:148-9). Once established in the West, national transportation networks helped increase rates of internal migration, increase interregional trade and contributed to the movement of infectious pathogens that were seen in the eastern urban areas. Specifically, developments in trade and national transportation helped to disperse cholera, out to the more susceptible rural and semi-rural regions of the West (Grob 2002:150; Rosenberg 1962:2). Material advancements and progress also contributed negative health effects onto populations by introducing environmental changes in the forms of factories and workshops, and produced humid, dusty, unhygienic conditions that intensified infectious diseases, specifically, pulmonary disorders and tuberculosis (Grob 2002:151).

Cholera

Cholera is characterized as an acute infection of the small intestine that is caused by the bacterium *Vibrio cholerae* (Grob 2002:104; Kiple 2003:74). It does not normally infect animals, as it prefers the alimentary tract of humans, and although it adheres securely to its host and when displayed its effects are extreme, a person can also be an asymptomatic carrier of the bacterium (Kiple 2003:74). The spread of cholera is not through direct contact with an infected individual, but rather through soiled bedding or clothing, or more commonly via water or food sources that have been contaminated by the excrement of those infected (Grob 2002:105; Kiple 2003:74; Roth 1997:528). The spread and virulence of cholera depends on two things: 1) the appearance of an individual who is infected and expels the bacterium from their intestinal tract, and 2) the overall state of hygiene, specifically the water supply and sewage disposal systems of the community (Kiple 2003:74). The cholera bacterium can survive outside of a human host in any relatively uncontaminated alkaline environment, and can grow in a laboratory setting in an alkalinity greater than most other bacteria can tolerate. This affinity for alkaline environments is significant for its preference of the human small intestine (Kiple 2003:74).

The human small intestine typically has low bacterial populations with a high alkalinity, which allows for *Vibrio cholerae* to survive and replicate in tremendous numbers (Kiple 2003:75). Once in the intestinal tract, cholera does not infect other bodily tissues, but will adhere to the intestinal wall and secrete a toxin that will inhibit water and electrolyte (salt) absorption (Grob 2002:104; Kiple 2003:75). The result is extreme fluid loss in a single day and immobilizing diarrhea (Grob 2002:104). Other symptoms

associated with cholera are linked to the water and electrolyte loss and include weakening with ensuing loss of pulse, thickening of the blood, suppression of urination, loss of fluids in tissues producing a sunken face appearance, cyanosis (a blue or purple discoloration of the skin from low oxygen), muscular spasms and a drop in blood pressure concluding in shock and ultimately death (Grob 2002:104; Kiple 2003:75; Rosenberg 1962:2-3). Today, cholera is curable through intravenous fluids and salt replacement. This treatment was not widely available until the 1900s even though attempts had been conducted as early as the 1830s (Kiple 2003:75, 78).

Early beliefs on the causes of cholera followed the miasma theory, but in 1840 William Budd, an English physician, claimed that cholera was a living organism. In 1849 he and two associates described and published the microscopic bodies that were found in cholera excreta (Kiple 2003:78; Tomes 1998:29). In 1849 John Snow, an English physician, demonstrated that cholera was spread through polluted water by fecal contaminations of the infected, and he published a pamphlet discussing strategies on how best to combat the disease (Grob 2002:106; Rosenberg 1962:6; Tomes 1998:29). Snow laid the groundwork for cholera prevention by instructing people to wash their hands frequently, clean soiled bedding and clothing, close contaminated water pumps, boil their food, isolate those infected, and ensure that water supplies remained clean (Grob 2002:107). Filippo Pacini was the first to see and name the *Vibrio cholerae* bacterium from the excreta and intestinal contents of victims in 1854, but was largely disregarded (Kiple 2003:74, 78). Robert Koch was able to isolate and identify the cholera microbe in 1883 and thus through his efforts, as well as those of John Snow, on the waterborne

nature of the disease, they were able to prove that cholera was a contagion (Kiple 2003:78).

Prior to 1817, there is limited information on cholera except that it was endemic to India (Grob 2002:104; Kiple 2003:75; Rosenberg 1962:1). Europeans continually described seeing cholera in Goa in the 1500s and 1600s, and by the 1700s supplemental reports on the disease were also being supplied by medical practitioners from England documenting the disease (Kiple 2003:75). The modern history of Asiatic or epidemic cholera began in 1817 when it appeared to change its pattern and left India (Kiple 2003:76). Some thoughts as to why this occurred include the belief that a new disease appeared in Bengal at this time; or, more popularly, that a genetic modification arose in the microbe resulting in the production of a toxin that could permit rapid multiplication within the small intestine as well as inhibit the growth of the enteric flora (Grob 2002:104-5; Kiple 2003:76).

In 1817, cholera was first seen in pandemic form in Calcutta, and resulted in 4,000 deaths. By 1818 most of India was contaminated including Delhi and Bombay (Grob 2002:105; Kiple 2003:76; Simpson 1980:177). By 1820 cholera had spread to Singapore, the Philippines, Burma and Siam, and by 1821 it had moved east into Java, Batavia and China and west into Persia and Baghdad. By 1823, cholera had migrated into Egypt, throughout Syria and into the Mediterranean, but by 1824, it had retreated back into India in its endemic form (Grob 2002; 105; Kiple 2003:76; Simpson 1980:177). This wave across the Asian and African continents was considered the first pandemic of cholera.

By 1827, the second pandemic had begun, with the appearance of cholera in Punjab, and the spread of the bacterium to Persia, the Caspian Sea and into Russia by 1829 (Kiple 2003:76). In 1831, the disease was found in Turkey, Constantinople, Alexandria, Germany, and England; and by 1832, it had moved to France and Canada, and by June 23rd of the same year it appeared in the United States in New York and by July 5th it was in Philadelphia (Grob 2002:105; Kiple 2003:76; Rosenberg 1962:4; Simpson 1980:178). By 1834, the disease had receded once again appearing only in India by 1837 (Kiple 2003:77). Five more subsequent pandemics followed similar routes and by December 1848, cholera occurred in the United States once again (Kiple 2003:77; Rosenberg 1962:4).

Cholera appeared in New York and New Orleans in 1848 and quickly spread across North America, ultimately reaching California in 1850 via wagon trains and ships sailing from Panama with the large numbers of people migrating west in search of gold (Grob 2002:105; Kiple 2003:77; Rosenberg 1962:115; Roth 1997:527, 529; Simpson 1980:182-3). Those emigrating across land in 1849 and 1850 were severely ravaged by this disease, and every group or company making this trek seem to have been affected in some way or another by cholera (Rosenberg 1962:115; Simpson 1980:183). Once in California the initial prognosis must have been bleak as the West was an area of pioneers and unsanitary conditions abounded. Between 1863 and 1874, a fourth pandemic made its way into the United States and Latin America. However, by the fifth pandemic which began in 1881, sanitation reforms, studies by Koch identifying the causative microbe of cholera, and the previous research by Snow on the modes of cholera transmission, halted any rampant cholera outbreaks in New York in 1887 (Grob 2002:106; Kiple 2003:77).

Cholera in California

The California cholera epidemic began in 1849 and directly coincided with the rush for gold (Roth 1997:527, 549). Cholera followed both the overland and ocean migration routes of travelers, and parasites and bacteria were easily transported and transferred as these migrants settled along rivers, streams and stagnant water sources (Rosenberg 1962:115; Roth 1997:529, 549). The newly established towns in California contained crowded transient populations, primitive sanitation measures, and since water supplies were shared, individuals were highly susceptible to the spread of the cholera bacterium (Rosenberg 1962:115; Roth 1997:549).

Cholera was first seen in San Francisco in October 1849, and was most likely attributed to two Ohioans who were reported dead from cholera symptoms on October 11th and had recently arrived via a ship from Panama (Roth 1997:535). As many people were migrating to California through sea routes, they were landing in San Francisco, traveling up river to Sacramento, and in due course, up to the more rural areas such as Nevada County and the gold mines. Therefore, once cholera had made an appearance in San Francisco, conditions for its spread to Sacramento were unobstructed. Shortly after the outbreak in San Francisco, cases were being reported in Sacramento by mid October (Roth 1997:535).

As Sacramento was a town attempting to entice people and businesses, the newspapers tried to keep the news of a cholera outbreak concealed. Unfortunately, by the end of October, several fatalities had been reported and the news became public knowledge (Roth 1997:536). Sacramento city officials responded quickly by appointing a city physician, Dr. Volney Spaulding, as well as a committee that would report new cases

of cholera to him for his official reports on the epidemic (Roth 1997:536). Within days, the reports indicated a rise in cholera incidence, and preparations were made for a cleaning of the streets (Roth 1997:536). Owners and occupants of property were to remove rubbish and offensive matter from their premises within 24 hours under penalty of a $500 fine (*Sacramento Transcript* 1850). City council members secured a building for a cholera hospital and the committee met twice a week to tally reports of cholera deaths, which were then entered into city records. New local laws, including rewards for the detection and conviction of those causing or placing rubbish or filth within the city, were aimed at stopping the spread of cholera (Roth 1997:537).

By the end of October there were extreme mortality numbers related to cholera and cholera-like symptoms. However, according to Roth (1997:542) estimates vary on the exact mortality of the 1850 epidemic in Sacramento due to similar symptoms seen with dysentery, typhoid and other enteric disorders. More than likely, there were also many cases and deaths not accounted for or reported (Roth 1997:543). By mid-November the epidemic was in its decline, but Dr. Thomas Logan, who had reported the first official death associated to cholera on October 19th, claimed that the mortality associated with this outbreak was unprecedented and only surpassed by the Black Death and other plagues of the 14th century (Logan 1850:463; Rosenberg 1962:1; Roth 1997:542).

The most immediate need in any cholera-afflicted area was that for hospitals. Not many communities at this time had the initiative or the financial resources prior to the arrival of cholera to have these already established (Rosenberg 1962:119). Although there was high mortality in a short amount of time, the cholera epidemic of 1850 in

Sacramento had an enduring legacy. City council members and physicians reacted quickly to the crisis by passing legislation for more hospitals and sanitation projects, including street and property cleaning (Roth 1997:544). Despite the fact that an official Board of Health was not created at this time, public discussions of health issues came to the forefront of city concerns, and brought a town with no former sense of communal responsibility together to act as a unit (Roth 1997:541). Very few diseases were more dreaded than cholera, and even though it had been subdued at this point in time, other diseases, specifically tuberculosis, were continuing to devastate populations (Roth 1997:527).

Tuberculosis

Tuberculosis is a chronic infection that can last weeks or years before the infected either recovers or dies, and is mainly associated with the lungs but can affect any organ or tissue in the human body (Grob 2002:18; Kiple 2003:336, 338). There are over thirty species of the genera *Mycobacterium* that have been identified, but only one is considered to be the human-type, *Mycobacterium tuberculosis* (Kiple 2003:337; Roberts and Manchester 2007:184). There are also several animal forms of the tubercule bacillus, but only one of these can be transmitted to humans, *Mycobacterium bovis*. This is a disease that affects cattle, and has been linked with sedentism, the advent of agriculture and animal domestication (Roberts and Manchester 2007:184). However, tuberculosis can also be transmitted to humans through wild animals so the domestication hypothesis cannot be fully proven (Roberts and Manchester 2007:185). Also, *Mycobacterium tuberculosis* and *Mycobacterium bovis* may have at one time had a common ancestor, but

M. tuberculosis did not evolve from *M. bovis* as previously believed at the time of animal domestication (Roberts and Manchester 2007:184).

There are three types of the human bacillus form of tuberculosis (Kiple 2003:337). Type I is found in India and is the least virulent, Type A is found in Africa, China, Japan, Europe and North America, and Type B is found only in Europe and North America (Kiple 2003:337). Humans are infected by the tubercle bacillus almost exclusively through aerial transmission between people. Airborne particles, or droplets, are passed as a result of coughing, sneezing, talking, spitting, or any other respiratory actions that may release particles (Kiple 2003:337; Roberts and Buikstra 2003:5; Roberts and Manchester 2007:186). The tuberculosis bacterium is capable of surviving outside of the host body, but once inside it is extremely durable, can remain viable through the host's lifetime, and can stay dormant until the host's resistance fails (Grob 2002:109; Kiple 2003:337). The tubercle bacillus causes an allergic reaction in the host body which causes the immune system to create an attack atmosphere releasing proteins and fatty substances into the person, and triggers inflammation which results in damage to tissues and cells (Kiple 2003:338). Whether or not a person will immediately become infected by tuberculosis depends on several factors: age, sex, host dependent factors and environmental circumstances such as crowding, nutrition or working conditions (Kiple 2003:337).

Tuberculosis can affect meninges, intestines, bones, the lymphatic system, skin, the spine, kidneys, and the genitals (Kiple 2003:338). Due to its varied infection sites, tuberculosis has historically had many names. "Scrofula" pertained to infection in the neck or lymph glands, "phthisis" related to tuberculosis in the lungs, and

"consumption" was used to refer to a generalized wasting of body tissues that is common with tuberculosis (Roberts and Buikstra 2003:9). Pulmonary tuberculosis is the most commonly seen form of the disease, and is characterized by a severe cough with sputum that is sometimes accompanied with blood (Grob 2002:18, 89; Kiple 2003:338). Symptoms of tuberculosis are not universal however, and sometimes individuals can have only mild respiratory issues or be asymptomatic altogether (Kiple 2003:338). According to Roberts and Manchester (2007:187) the human type of tuberculosis can appear in either primary or secondary forms. Those who have never been around tuberculosis before typically contract primary tuberculosis in childhood, and will either survive or die (Roberts and Manchester 2007:187). Those affected by secondary tuberculosis may have incidences in which skeletal changes appear and are either from a latent infection that has been reactivated, or the individual has been infected again (Roberts and Manchester 2007:187).

Skeletal changes mainly occur in the spine but are also commonly found in the hip and knee joints (Roberts and Manchester 2007:187). When tuberculosis affects the skeleton it manifests as osteomyelitis on the ends of long bones and on the joint surfaces, ultimately destroying the joint and developing into ankylosis (Roberts and Manchester 2007:187). Due to these manifestations on joint surfaces, tuberculosis on the skeleton can be confused with degenerative arthritis. However, tuberculosis typically only affects one joint and more bone is generally destroyed than is remodeled and added (Roberts and Manchester 2007:188). Spinal alterations have been documented in 25-60 percent of skeletal cases, usually affecting the lower thoracic and upper lumbar regions of the vertebral column (Roberts and Manchester 2007:188). Usually one to four vertebrae

are affected and severe abscesses that may perforate into the chest or abdomen are present on the vertebral bodies. The affected vertebrae may collapse and ultimately may result in an angular deformity of the spine and a hunchbacked appearance (Roberts and Manchester 2007:188). These spinal features associated with tuberculosis are known as "Pott's disease" as Sir Percival Pott first described them in 1779 (Roberts and Manchester 2007:189).

The history of tuberculosis shows that the disease has affected human populations worldwide throughout prehistory, and that it has conceivably evolved with humans (Kiple 2003:338). This means that tuberculosis is endemic in human populations and as there is a complex interaction between the host, the agent (tubercle bacillus), and the environment, it suggests that epidemics were the result of changes in host populations and their surroundings, rather than an introduction of foreign pathogens into new populations (Kiple 2003:339; Roberts and Buikstra 2003:44). Archaeological evidence demonstrates that tuberculosis dates back to the Neolithic period and has been revealed in Stone Age Europe, third millennium Egyptian mummies, second century mummies from China, Native American individuals dating to 800 BC and mummies from Chile that date to 290 AD (Kiple 2003:338). Historical medical texts have also described tuberculosis through time, specifically in China in 2700 BC, Egypt in 1550 BC, India in 1500 BC, as well as Greek and Roman sources (Kiple 2003:339; Roberts and Manchester 2007:191). There can be some confusion when examining historical texts trying to identify the presence of tuberculosis, as prior to the nineteenth century various types of tuberculosis were considered different diseases (Kiple 2003:339). The terms phthisis and consumption

were used for pulmonary forms of the disease, scrofula typified lymphatic infections, and lupus vulgaris characterized skin infections (Kiple 2003:339).

Ancient cultures that documented tuberculosis were primarily urban in nature, and as population densities rose over time, so did infection rates of tuberculosis (Kiple 2003:339; Roberts and Manchester 2007:192). By the 17th century nations suffered greatly from tuberculosis due to the intense urbanization and industrialization, especially in England, the United States, France and Italy (Kiple 2003:339). However, tuberculosis was found and was considered to be prevalent in rural communities as well (Grob 2002:111). In the 19th century mortality rates from tuberculosis in the United States were approximately 400-500 per 100,000 people, and societies attempted to identify the factors that led to infection of the disease (Kiple 2003:340). Communities believed that dissolute living, alcohol and tobacco consumption, developmental life crises such as puberty or childbirth, damp soil and filth, and even heredity all might contribute to susceptibility in an individual for becoming infected with tuberculosis (Kiple 2003:340). The strongest mechanism for the spread and maintenance of tuberculosis is for infected populations to live in close proximity to one another in settled communities that are overcrowded (Roberts and Buikstra 2003:5). Other environmental factors may predispose populations to tuberculosis. Situations such as war, mass disasters, breakdowns in public health systems, inadequate sanitation, poor hygiene, dirty water, slums and shanty-towns, or movement from rural to urban centers, can all exacerbate incidences and spread of tuberculosis (Roberts and Buikstra 2003:44).

Beginning in the 19th and 20th centuries tuberculosis sufferers were confined to sanatoriums due to the symptoms that were associated with the pulmonary form of the

disease and the sanitation reforms that were adopted during this period (Roberts and Manchester 2007:192). Prior to antibiotics, sanatoriums provided the idea that fresh air, rest, material welfare and segregation were ideal conditions for healing (Roberts and Buikstra 2003:244; Roberts and Manchester 2007:192). Physicians endorsed the idea that elevation increased heart and lung function and used climate as a form of treatment. Therefore, physicians sent infected patients to the American West where populations lived in high altitudes and where there was plenty of fresh, dry air, and sunshine. Popular locations included New Mexico, Arizona, California, and Colorado (Abrams 2010:272, 274; Ott 1996:40; Roberts and Buikstra 2003:244).

Tuberculosis in California

Public health movements were on the rise in California as people were migrating by the thousands and disease was becoming rampant in newly established areas. One attempt at preventing the spread of tuberculosis during the late 19th and early 20th centuries were ordinances against spitting, and the spread of the bacteria through sputum, specifically seen in the cities of Los Angeles and Pasadena in California (Abrams 2010:272; Ott 1996:119). California officials also adopted the idea of the "right to self-defense" as a measure for protecting citizens against consumptives (people afflicted with tuberculosis) from traveling through their state. The "right to self defense" led communities to pass "removal laws" in which health officials were given the right to use force in order to remove affected individuals that were believed to be "recklessly spreading infection" (Ott 1996:120). Furthermore, California regulated travel on railroads and required that tuberculous individuals ride in separate train cars that were fumigated after each trip (Abrams 2010:282). Additionally, California, Colorado, and Texas strived

to request interstate quarantine laws due to their communities being so burdened with tuberculosis patients that basic services were at risk. There was immense support for these laws, but the enforcement for them would have been absurd due to the enormity of the request, and the laws were never passed (Ott 1996:121).

In 1869 the transcontinental railroad was completed and made the cross-country journey safer and easier for those wishing to migrate, and ultimately brought even more "health seekers" to the West (Abrams 2010:275). Although the rush for gold brought massive amounts of people to the West Coast, approximately a third of those that immigrated to this region did so in attempts to recover their health (Abrams 2010:282). Many of those making their way to California, as well as the other regions of the West, ultimately decided to stay and settle here (Abrams 2010:282-283). As many had already settled in California to try their hands at striking it rich in the mining trade, small urban centers sprouted and spread, and with the influx of those seeking respite from tuberculosis it would not be difficult for the bacterium to disseminate and find new hosts. Although there were no major tuberculosis outbreaks in California, the disease has historically been an underlying element to any human population (Kiple 2003:338). Unfortunately, even today, of all the infectious diseases, tuberculosis remains the most common cause of death in adults, and in children it follows only acute respiratory and diarrheal diseases (Roberts and Buikstra 2003:1).

Summary

The period of the California gold rush brought many new immigrants and their diseases to the West Coast. The cholera epidemics and the persistence of

tuberculosis within California communities during this time, forced public health policies to the forefront of political concerns. Public health reforms and proper sanitation measures have not always been important components of city or county policies, but as with most things, the need for something often creates the motive for accomplishment.

CHAPTER IV

PUBLIC HEALTH IN THE UNITED STATES

Antoni van Leeuwenhoek invented a simple microscope in the late 1600s and was able to demonstrate that minute living organisms were present in the world, which he called *contagium vivum* (Tomes 1998:29). In the 18th century those that supported his findings created elaborate identities and family trees, and the microscopic beings turned into fanciful creatures that served to bring ridicule upon this theory (Tomes 1998:29). In the 1820s, advancements in technology were introduced and microscopy became a popular pastime among lay people as well as physicians in both the United States and Europe (Tomes 1998:30). This popularity helped to set the stage for the reintroduction of Leeuwenhoek's *contagium vivum* and the new germ theory of disease (Tomes 1998:30).

Prior to the mid to late 1800s, there was a general lack of awareness for health practices such as having a clean home, boiling of water, sanitary food and water sources and cleaning of soiled linens (Tomes 1998:5). Americans were aware that diseases could spread without any known contact between the infected and the healthy, but the nature of this substance or pathway remained unknown leading many physicians to believe that disease was spread through a generalized atmospheric source known as the miasma theory. The common beliefs at this time were that transmission could occur through an infected person's breath, skin, evacuations, or clothing, but there was little to no concern

for casual forms of contact (Eisenberg et al. 2007:1216; Tomes 1998:3). People in 19th century America were apt to share beds with strangers in hotels, exchange grooming implements, cough, sneeze, or spit without regard, drink unfiltered water from wells or streams using a common cup and to urinate or defecate into chamber pots or outdoor privies without regard to community water supplies (Tomes 1998:3). As people moved into larger cities, lived in closer proximity to one another, and became more dependent upon common water and food supplies, the result was the dramatic increase in death rates from infectious diseases (Tomes 1998:5).

By the mid 1800s, medical literature had shown that affected individuals could initiate outbreaks of a disease in previously unaffected communities (Magner 2009:29). This led Jacob Henle, a German pathologist, to conclude that contagions were animate entities that must multiply within infected individuals, and it was therefore logical to assume that living parasitic agents could be responsible for epidemic infectious diseases (Magner 2009:29). Henle further conjectured that once these contagions had reached a sufficient number they could expel themselves through coughs, sneezes or excrement into new hosts (Magner 2009:29). Henle realized that the infectious agent would need to be isolated from other toxins and diseased tissues, but lacked the appropriate technology to prove his conclusions. Henle did however acknowledge that this proof would be needed in order to establish a causal relationship between germs and disease (Magner 2009:29).

Two individuals helped to create the foundations of microbiology, bacteriology and the germ theory of disease, Louis Pasteur and Robert Koch (Magner 2009:30). Both independently compiled evidence for specific microbes being responsible

for specific diseases that were seen at this time (Magner 2009:31; Tomes 1998:5-6). Louis Pasteur, a chemist, was interested in the process of fermentation, and through microscopic research conveyed that different species of living organisms were responsible for fermentation and putrefaction (Tomes 1998:30). Ultimately, Pasteur was able to distinguish between different species of microbes and realized that his research could have significance in the world of medicine and infectious disease (Tomes 1998:30). Since he had shown that the agents that caused fermentation were living microorganisms, Pasteur claimed that infectious diseases might also be caused by the same microbes that were seen in fermentation processes (Tomes 1998:31).

Robert Koch, a German physician, through his investigations on wound infections and tuberculosis, developed criteria that were needed to provide the proof that specific microbes caused specific diseases (Tomes 1998:31, 43). Koch's Postulates were outlined as follows: 1) specific microorganisms must be found in those infected and not in the healthy 2) the microbe must then be isolated and cultivated 3) the microbe had to be grown as a pure culture and placed into a healthy individual and 4) once the individual displayed all symptoms and properties of the same disease and the microbe could be isolated from them once again then one could reasonably conclude that the microorganism in question was the cause of the disease (Magner 2009:43; Tomes 1998:94).

From these innovations as well as support and research from those in medical and scientific arenas and the public, the germ theory of disease was established. There were two propositions directly related to the germ theory of disease: 1) present in the air and water were distinct species that caused human and animal diseases; and 2) these

germs could not be generated spontaneously, but rather always came from a previous case of the exact same disease (Tomes 1998:33). The introduction and general acceptance of this theory did not immediately change previous explanations for disease processes, but it did begin to alter public health efforts through awareness of hygiene and sanitation practices (Tomes 1998:6, 8, 46). The late 19th and early 20th centuries were considered the "golden era" for the American public health movement, as this is when governmental responsibilities for the health of the public began to occur, and vaccines, antibiotics, pesticides and general barriers to infection were introduced (Eisenberg et al. 2007:1216). Public health reforms centered on a greater understanding for disease transmission through casual contact, food and water contamination, insect vectors and human carriers that were otherwise considered healthy. These reforms motivated changes in public health practices as well, and included the adoption of municipal sewerage systems, water purification, garbage collection and food inspections (Tomes 1998:6).

Individual and familial level purification practices had been in place for centuries during the occurrence of epidemics (Tomes 1998:49). People would avoid those that were infected, would flee areas that were contagious and would clean their homes and yards of filth to attempt to keep the infectious agents at bay (Tomes 1998:50). Those nursing sick family members or loved ones also needed to have practices in place in the home due to the lack of hospitals prior to 1860, and they would typically isolate the sick individual while disinfecting the rooms and personal belongings of the ill (Tomes 1998:50). However, once the crisis or epidemic had passed, communities resorted to previous inclinations that usually did not include good personal or household hygiene (Tomes 1998:50).

With the general acceptance of the germ theory and the public health reforms of the 19th century, these practices began to shift. Reform in households was promoted with the realization that no class or ethnic group was unaffected by disease, that everyone was vulnerable and that people needed to be in charge of their own sanitation (Tomes 1998:51). Poor household plumbing was a starting point for reform, and in the 1840s plumbing moved indoors with eventual advancements for watertight pipes, traps on drains and toilets that flushed thoroughly (Tomes 1998:51, 59). Other household and personal reformation movements included publications on home hygiene, which ranged from simple summaries to full encyclopedic works on disease prevention during epidemics and were distributed prior to 1900 (Tomes 1998:53-54). Despite the intention of education, many families could not afford these publications or did not own their own homes, and therefore could not make the necessary changes towards more sanitary environments (Tomes 1998:54). The result was that these methods and reformations were directed towards the affluent, literate, middle and upper classes of society (Tomes 1998:54).

On the other hand, public health reform could not be completely accomplished within residences alone, and strong public health boards and municipal sanitation efforts would be needed (Tomes 1998:52). Although these systems were functioning on a basic level by the 1870s and 1880s, they were fully functioning in established regions of the United States (Tomes 1998:52). The first areas to be addressed incorporated ideas of prevention and basic hygiene, and included architecture of homes, ventilation and plumbing, dampness prevention, maximizing of natural protectants, adoption of the separation of water systems for drinking and waste, and water safety methods,

specifically through filtration and boiling (Tomes 1998:60). The decades between 1880 and 1920 saw aggressive public health campaigns, and as a result, there was a decline in mortality rates due to infectious disease (Eisenberg et al. 2007:1216; Tomes 1998:6, 12). By the late 1920s, public health interests were shifting once again, and chronic, non-infectious, degenerative diseases became the new focus (Tomes 1998:12-3).

Public Health in California

The path to public health in California essentially followed the same trajectory as other regions of the United States. California was not adopted into the Union until 1850, and because of this, its progression on many issues surrounding public health did not occur until slightly later. However, the massive population influx into California created an environment in which disease, specifically cholera and tuberculosis could flourish, and this forced many public health issues to the forefront of community politics and practices.

The cholera outbreak of 1850 created an ideal environment for public health concerns and policies to begin in the Sacramento area. There were many physicians coming to California, but most, at least initially, were coming to search for gold, not practice medicine (Roth 1997:532). There were physicians with private practices and pharmaceutical supplies that treated (non-charity) patients at home for a fee (Roth 1997:532). Hospitals were in short supply throughout California, but by 1850, there were several hospitals and medical facilities. In Sacramento, the first was Sutter's Fort hospital, and others included the Odd Fellows and Masons Hospital along with other temporary facilities (Roth 1997:533). With the Odd Fellows and Masons Hospital as an

exception, most hospitals and physicians were charging $16 a day, and many individuals ended up going without medical care rather than pay these fees (Roth 1997:535).

For Nevada County, the first public hospital was the Nevada County Hospital, which was founded in 1851. This hospital was built on land owned by Dr. R.M. Hunt, who also served as the "physician and controller of the hospital" (Searls Historical Library, "Nevada County Hospital Transcripts and Newspaper Clippings" 1860-1968). When first opened the Nevada County Hospital served the indigent, was able to accommodate approximately 40 patients at a time, and the fee for services was between $0.80 and $1.00 per day, per patient (Searls Historical Library, "Nevada County Hospital Transcripts and Newspaper Clippings" 1860-1968). Although many diseases were prevalent during this period, particular infectious diseases appear to have been a driving force in the creation of this particular medical facility and in the adoption of public health policies within Nevada County. A map dated August 20, 1887, shows Dr. R.M. Hunt's property, the County Hospital on that property, as well as a "Pest House" nearby the main hospital buildings, adjacent to the graveyard. A "Pest House" was commonly built away from the main medical facility to house those afflicted with contagious diseases, such as tuberculosis or cholera (Merriam-Webster Online 2013).

The inundation of people making their way out west for a better climate to heal from the effects of tuberculosis, further served to create a springboard for public health policies in California. Ideas on city and home cleanliness, segregation and quarantine of those infected with disease, and personal and community preservation as it relates to disease and overall health, provided further impetus for public health strategies in the new state. Cholera and tuberculosis created situations in which individuals,

families, communities and politicians could no longer ignore the need for public health initiatives to be developed and permanently established in California.

Many of the migrants to this new frontier were physicians who brought with them the developing ideas on medicine and public health practices from the east (Halverson 1949:59). However, the institution of public health in California officially began with the arrival of Dr. Thomas M. Logan in Sacramento in August of 1850 (Halverson 1949:59; Jones 1937:251). Logan was a native of South Carolina where he graduated from the medical college, and in 1849, he decided to sail around Cape Horn to California, arriving in San Francisco in January of 1850 during the rush for gold (Halverson 1949:59; Jones 1937:251). After his arrival, Logan began practicing medicine and instituted the foundations for public health in the state through his particular research interests (Jones 1937:251). Logan was concerned with climatic, social and medical conditions in California and attempted to study endemic diseases, and the differences between communicable diseases between California and the eastern and southern states in the United States (Jones 1937:251).

In California at this time, there was no organization within the medical profession, men within the medical fields were not cooperative, and Logan found it difficult to obtain information on his research topics from any of his associates (Jones 1937:251). In 1855 Dr. E.S. Cooper arrived in Sacramento, became friends with Logan and they helped to organize the California State Medical Society in March of 1856 (Jones 1937:251). Although the first meeting, held in Sacramento, had approximately one hundred attendees, activities were subdued for almost ten years (Jones 1937:251). However, in 1863 public health concerns began to shift in California. Dr. Logan was

appointed by the American Medical Association as the chairman for a committee on the medical topography of the Pacific Coast, providing him authorization for pursuing public health pursuits as well as his own research interests (Jones 1937:251). Through this position, Logan was able to send questionnaires to other medical professionals throughout the state on communicable diseases, continue his observations on climatic occurrences, write for medical journals, and perform his own studies on infectious diseases (Jones 1937:251).

The medical profession gained prominence in California, and since Dr. Logan observed events that were taking place in the medical field on the east coast, he knew that Massachusetts had established the first legislation for the institution of a State Board of Health in the fall of 1869 (Jones 1937:251). Logan was extremely excited about this idea, and almost single-handedly put through legislation in California for a State Board of Health. This legislation was approved on March 8, 1870, and held its first session on April 22 of the same year in Sacramento, with Logan as its first secretary of the board (Halverson 1949:59; Jones 1937:251). The legislative act provided for the appointment of seven physicians for terms of four years (Halverson 1949:59). These appointees were to be held responsible for several tasks. They were to communicate with local boards of health, hospitals, asylums and public institutions within California, take notes on the health and lives of citizens, and perform sanitary investigations into the causes of diseases, sources of mortalities, effects of localities, employment, and conditions on public health that could then be translated in such a manner as to disseminate it among the community (Halverson 1949:59). The seven physicians were also to implement a system in which medical and vital statistics of sanitary concern could be gathered, and

were to act as an advisory board to the state on all matters relating to hygiene and medicine specifically in relation to locations, construction, sewerage and administration of prisons, hospitals, asylums and other public institutions (Halverson 1949:59).

At the State Board of Health meeting in 1871 an act was drafted for the provision of a registry for marriages, births and deaths within the state, as well as to establish local boards of health (Halverson 1949:60). Specifically, the Board recommended legislation for registries pertaining to vital statistics, sewerage, scavenging, regulation of slaughterhouses, market inspections, cellar sanitation, ventilation, control of epidemic and contagious diseases, public vaccinations, and interment of the dead (Halverson 1949:60).

Among his accomplishments, Dr. Thomas Logan also held the position of Chair of Hygiene at the University of California, and in 1873 was elected president of the American Medical Association. Sadly, in 1876 Logan passed away after suffering from pneumonia caused by overwork in attempts to strengthen public health laws during this period (Jones 1937:251). Following in his footsteps were Dr. F.W. Hatch and Dr. G.G. Tyrell (Jones 1937:251). The 1880s saw the organization of local health departments throughout California, more reports on infectious diseases being published, monthly reports being received from medical professionals and cases being charted (Jones 1937:251). In the 1890s, more concern was placed on sanitation and quarantine as smallpox was a threat, but the turn of the century saw major changes in public health reform for California (Jones 1937:251).

The new secretary of the California State Board of Health was Dr. N.K. Foster who was appointed in 1901 (Jones 1937:251). With Dr. Foster's appointment, the modern

configurations for this institution appeared and bureaus were created including a Hygienic Laboratory (1905), the Bureau of Vital Statistics (1905), and the Bureau of Foods and Drugs (1907) (Halverson 1949:60; Jones 1937:251). After Foster's resignation in 1909, sanitary inspections began in 1913 and preparations for the control of tuberculosis had commenced. By 1915, the Bureau of Tuberculosis was established (Jones 1937:252).

The second half of the twentieth century saw revisions for the newly named State Board of Public Health and the foundations for how the administration exists today were established (Halverson 1949:61). The department was divided into administration (records and statistics, health education and personnel, accounting and office management), environmental sanitation, preventive medical services (maternal and child health, tuberculosis, venereal disease control), laboratories, and local health services (Halverson 1949:61).

Summary

Although most early medical practitioners migrated to California in attempts to secure their own fortunes, they established and assured the continued service of our public health institutions. In pioneer California, medical diagnoses and advice were based on what was known of contagions and cleanliness. Societies today are not much different; however, the burden of support and relief is placed into the hands of health associations that are in place today rather than on a single practitioner or the individual themselves. These agencies are heavily relied upon to not only keep us safe from hidden dangers such as epidemics, but to heal our everyday maladies such as stomachaches and common

colds. The medical profession in California has come a long way since 1850 and the arrival of Dr. Thomas Logan, but his foresight into the needs of the people and the state as a whole provided the framework for its public health institutions.

CHAPTER V

MATERIALS AND METHODS

This chapter assesses the overall methods used to evaluate cholera and tuberculosis prevalence rates in both Nevada and Sacramento counties. In order to assess prevalence rates of infectious disease within these areas, demographic data was collected and is described first in this chapter. The demographic data is followed by cause of death and cemetery data in which deaths attributed to cholera and tuberculosis were gathered from varying death and cemetery records from each county. All of this information was then compiled and used to present prevalence data for each disease within each county. Finally, there were several limitations for this research, which are outlined and discussed as a conclusion to this chapter.

Demographic Data

In order to evaluate the overall population size, including sex and age information for each county, census records by decade beginning in 1850 and ending in 1900 were examined from the United States Census Bureau (n.d.a). The number of men and women present in each county through each decade during the fifty-year time span under investigation was documented. Where ages were obtained, age ranges were implemented based on similar studies within skeletal research. Some investigations organize age groups by categories such as subadult, young adult, middle adult, and older

adult, while others assign ranges that can encompass five, ten, or even fifteen year increments (Buzon et al. 2005:4; Keenleyside 2003:52; Klaus and Tam 2009:6; Larsen et al. 2001:96). In order to assemble the age groups for this research in a clear manner they were sorted into ten year categories: 0-9 years, 10-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years and 70 and over. This information was used to determine prevalence rates of infectious disease among the sexes and the differing age groups during the California gold rush.

Cause of Death and Cemetery Data

The specific infectious diseases that are considered in this research include cholera and tuberculosis. Records of deaths attributed to cholera and tuberculosis were collected from the Searls Historical Library in Nevada County, the Center for Sacramento History, and the California State Archives. Other names have historically been attributed to these diseases and were included in this research (Table 1). Cause of death information was gathered only on individuals whose cause of death was listed to be cholera, tuberculosis, or a varying name of the same diseases. If an individual was included, all associated demographic data that was available was also documented. Only those who passed away during the fifty-year time span in question (1850-1900) were considered for this research.

For data relating to cholera and tuberculosis from Nevada County, the Searls Historical Library provided cause of death information through the Mortuary Records of Nevada County (1877-1929), Cemetery Records of Nevada County beginning in 1849, and the Nevada County Hospital's Death Records (1859 -1935). Additionally, cause of

Table 1. Alternate names historically used for cholera and tuberculosis.

Alternate Names for Cholera	Alternate Names for Tuberculosis
Cholera infantum	Consumption
Cholera morbis or morbus	Phthisis
Asiatic cholera	Phthisis pulmonalis
	Scrofula
	Acute phthisis or tuberculosis
	Pulmonary tuberculosis or consumption
	Laryngeal tuberculosis or phthisis
	Cerebral tuberculosis
	Tubercular periontitis
	Tubercular disease
	Tubercular meningitis or laryngitis
	Throat tuberculosis
	Miliary tuberculosis
	Intestinal hepatic tuberculosis
	Tubercular ulceration of bowels
	Tubercular pleurisy
	Tuberculosis pulmonalis
	Phthisis peritonitis
	Pulmonary phthisis
	Mesenteric or tubercular consumption
	Tubercular phthisis
	Congenital phthisis
	Phthisis scrophalus
	Fibroid phthisis
	Phthisis tuberculosis or laryngea

death data from Nevada County Vital Statistics (1850-1869), as compiled by Comstock and Comstock (1996) from county records, cemeteries, newspapers, letters, diaries, and family records, were also collected. The Doris Foley Library for Historical Research in Nevada County was also contacted in regards to records that may indicate cause of death during the fifty-year period examined in this study. The Foley Library did not contain any additional documents that could be used for this research.

For data relating to cholera and tuberculosis from Sacramento County, the Center for Sacramento History provided cause of death information through the Sacramento City Cemetery Index (1849-2000), the New Helvetia Cemetery records (1847-1956), and the Sacramento County Coroner's Office Records (1887-1969). The Sacramento City Cemetery and the New Helvetia Cemetery were the most heavily used burial grounds during the time period used for this research because of their locations near the core of the city (Bayless and Mello 1982; Old City Cemetery Committee 2013). The Sacramento City Cemetery was established in 1849 and is still in use today (Old City Cemetery Committee 2013). The New Helvetia Cemetery was also established in 1849 after John A. Sutter donated ten acres of property on Fort Sutter for use as burial grounds (Bayless and Mello 1982). Unfortunately, all individuals within the New Helvetia Cemetery were disinterred and placed into various cemeteries throughout the city due to frequent flooding because of proximity to the American River. Sutter Middle School was eventually built on the property (Bayless and Mello 1982; Old City Cemetery Committee 2013).

There were several other cemeteries in use between 1850 and 1900 in Sacramento County (Table 2). Cemeteries with no known date of establishment or that were located in counties other than Sacramento with Sacramento residents buried in them, were not included in this list. While some cemetery and burial information is available for these locations, cause of death is not listed for any individuals interred at these sites. The California State Archives also provided data on cause of death from Death Reports (1876-1889) for the city of Truckee (Nevada County), as well as the cities of Folsom and Sacramento (Sacramento County). However, due to the general format in

Table 2. Other cemeteries in use in Sacramento County between 1850 and 1900.

Cemetery Name	Establishment Date	Additional Information
Arlington Memorial/ Belleview	Early 1860s	Arlington started as Belleview
Elk Grove Masonic	1877	
Elk Grove Odd Fellows	1878	
Freeport	1800s	Two headstones with burials dated 1860 and 1884
Galt (Odd Fellows)	1878	
Hicksville	1872	
Home of Peace of Sacramento	1850	
Lakeside Memorial Lawn		
Chinese Cemetery #1	1800s	
Chinese Cemetery #2	1800s	
Citizens Cemetery	1850	
I.O.O.F	1870	
Jewish	1870	
Masonic	1860	
Matthew Kilgore	1874	
Miser	1800s	Family cemetery
Point Pleasant	Approx 1892	
Prothero	1858	One burial marker
Saint John the Baptist	1857	
San Joaquin	Prior to 1900	
Sheldon	1900	
St. Joseph's Cemetery	Early 1850s	
Sylvan	1862	
Walltown	No date listed	Pioneer settlement/gold rush era

which this data was compiled, it is not specific enough to be of use for this study, and was not included.

Prevalence Data

All data collected was compiled into Microsoft Excel worksheets to establish a database for archival analysis. Separate tables for population numbers and demographic

information were produced for those with deaths attributed to either cholera or tuberculosis, for both Nevada and Sacramento counties. Tables were created for the different sexes, age groups, ethnicities, place of origin, and alternate disease names for each disease within each county. This data was compiled in the same format as the census record data when applicable.

Sex and age data compiled from above, as well as total population values were used to generate prevalence rates for each county, for each decade, for both cholera and tuberculosis. The resulting prevalence rate was then rounded to the nearest ten thousandth. Prevalence is a simple proportion in which the number of cases is compared to the total population, and no time component is associated (Waldron 2007:59). For the purposes of this research the total population for prevalence was considered to be those that had a cause of death listed from the sources utilized. For Nevada County, these sources included the mortuary records, cemetery records, hospital death records and vital statistics from the Searls Historical Library. For Sacramento County, these sources included the coroner's office records, cemetery records and the Sacramento City cemetery index records from the Center of Sacramento History. Tables were then produced in Microsoft Excel to organize the sex and age prevalence rates of both cholera and tuberculosis for each county.

In order to determine whether the data presented displayed statistical significance, chi-square and Yates adjustment tests were utilized. These tests were run in Microsoft Excel, and tables were created to show the results. Statistical significance was set at alpha = 0.05.

Limitations and Biases

Since this research was based solely on the availability of archival records, there were gaps in information due to what records and resources were procurable. Historic documents are products of their time, and it is typical to have more than one person that contributed to the same set of records. This can create a subjective viewpoint to the details of the time, and create confusion for the researcher. Depending on the archival source, the data within may also have been incomplete or gathered in an unsystematic fashion, also adding to confusion, or a lack of a full picture of the assemblage in question.

The demographic information that was analyzed was not always complete or available for study. Since white, adult men tended to be the dominant population demographic during this period, information on women, children, and other ethnic groups may not have been included in the records examined. Conversely, since many ethnic groups that came to California during this time were ostracized they tended to form their own communities and keep their own records. These records did not commonly make their way into the state or federal databases. Additionally, information on specific medical treatments and hospital records was also not found to be available from this time period as these facilities and records were just being established in the California region.

Since cholera and tuberculosis were specifically examined, the records associated also displayed limitations. In historic periods, it was common for diseases to have multiple names depending on the symptoms seen in the infected individuals. This was the case with these records and all associated names were included when clearly marked. However, there may have been variability in the documentation of actual rates of

cholera or tuberculosis due to ambiguous or vague disease names or record keeping. Additionally, cause of death was not listed or recorded for all individuals in the historic documents for each county and therefore the actual numbers for deaths attributed to these diseases may be higher than indicated in this research.

Summary

This chapter assessed the overall methods used to evaluate cholera and tuberculosis prevalence rates in both Nevada and Sacramento counties. Census records by decade beginning in 1850 and ending in 1900 were examined from the United States Census Bureau, as well as mortality data from each county. All of these details were gathered in worksheets, and statistical tests were run to see if any of the information was of significance. Additionally, the limitations and biases associated with this study were examined and discussed.

CHAPTER VI

RESULTS - CENSUS DATA

(DEMOGRAPHICS)

Census data was collected from both Nevada and Sacramento counties between the years 1850 and 1900 in order to provide an overall picture of the respective populations (United States Census Bureau n.d.a.). Demographic information including total population, sex, age, place of origin, and ethnicity was gathered for each county for each decade. However, since Nevada County did not become a county within California until 1851, there is no data for this region for the census year 1850. Therefore, the California State Census taken in 1852 will be used for the 1850 decade for Nevada County in order to properly compare data. Additionally, in January 1921 a fire occurred in the Commerce Department Building and destroyed most of the 1890 population schedules. A few records managed to be salvaged, but not for California or these counties (United States Census Bureau n.d.b.). Therefore, there is no information for this decade. Additionally, when data was not available this was indicated in the tables with "No data."

Total Population

Both Nevada and Sacramento counties were influenced by population influx and variability during the gold rush (Table 3). At the time of the 1850 census, the California gold rush was in its infancy and this is evident by the population totals seen in

Table 3. Total population values for Nevada and Sacramento counties for each decade.

	Nevada County	Sacramento County
1850	No data	9,087
1852	17,479	12,876
1860	16,446	24,142
1870	19,134	26,830
1880	20,823	34,390
1890	No data	No data
1900	17,789	45,915

Sacramento County at this time. By the 1852 state census, more people were in rural Nevada County than Sacramento due to the inundation of miners and mining camps. By 1860, the population numbers in Sacramento more than doubled from 1850, and continued to increase with each census year. Nevada County population numbers stabilized as the major rush for gold reached its peak, and people either settled in the region or moved elsewhere.

Sex

The number of males and females in each county, for each decade, is outlined in Table 4. These values demonstrate the disparity seen between the sexes over the fifty-year time span in each region. In every decade for each county, more men than women are present. This can directly be ascribed to the draw of California gold. By the 1900 census year, these values become more equalized, but there is still an imbalance seen between the sexes for these counties.

Table 4. Numbers of males and females for Nevada and Sacramento counties for each decade.

	Nevada County		Sacramento County	
	Males	Females	Males	Females
1850	No data	No data	8,472	615
1852	14,690	2,789	10,765	2,111
1860	13,635	2,811	16,759	7,383
1870	13,066	6,068	16,876	9,954
1880	13,380	7,443	21,385	13,005
1890	No data	No data	No data	No data
1900	10,316	7,473	26,937	18,978

Age

The census data for age was not collected in the same manner for each decade. However, the data for each age category presented was collected and separated by sex, as well as the overall totals for each age range. For Nevada County, the 1850 federal census and the 1852 state census had no county age specific data collected (Table 5). In 1860, age data could be placed into the ten-year increments used in this study (Table 6). For the 1870 federal census, the age ranges used were 5-18 years, 18-45 years and 21 and upward by the census committee (Table 7). The 1880 federal census used the age ranges of 5-17 years, 18-44 years and 21 and over (Table 8). There was no data for 1890 due to the fire destruction and no county specific data for the census of 1900 (Table 9).

For Sacramento County (Table 5), the 1850 federal census age data could be placed into the ten-year increments used in this study. The 1852 state census had no county specific age data collected (Table 5). In 1860, age data could be placed into the ten-year increments used in this study (Table 6). For the 1870 federal census, the age ranges used were 5-18 years, 18-45 years and 21 and upward by the census committee

Table 5. Age data for Nevada and Sacramento counties for 1850 and 1852.

Year	Age Ranges	Nevada County			Sacramento County		
		Males	Females	Totals	Males	Females	Totals
1850	0-9 years	No data	No data	No data	176	139	315
	10-19 years	No data	No data	No data	499	123	622
	20-29 years	No data	No data	No data	4,190	178	4,368
	30-39 years	No data	No data	No data	2,405	115	2,520
	40-49 years	No data	No data	No data	918	46	964
	50-59 years	No data	No data	No data	223	11	234
	60-69 years	No data	No data	No data	38	2	40
	70 and over	No data	No data	No data	5	1	6
	Unknown	No data	No data	No data	18	0	18
1852		No data	No data	No data	No data	No data	No data

Table 6. Age data for Nevada and Sacramento counties for 1860.

Age Ranges	Nevada County			Sacramento County		
	Males	Females	Totals	Males	Females	Totals
0-9 years	921	850	1,771	2,181	2,203	4,384
10-19 years	516	416	932	1,425	1,263	2,688
20-29 years	5,451	774	6,225	5,253	1,878	7,131
30-39 years	5,173	537	5,710	5,159	1,316	6,475
40-49 years	1,120	160	1,280	1,893	467	2,360
50-59 years	330	51	381	625	174	799
60-69 years	96	22	118	194	61	255
70 and over	13	1	14	28	19	47
Unknown	15	0	15	1	2	3

(Table 7). The 1880 federal census used the age ranges of 5-17 years, 18-44 years and 21 and over (Table 8). There was no data for 1890 due to the fire destruction and no county specific data for the census of 1900 (Table 9).

Table 7. Age data for Nevada and Sacramento counties for 1870.

	Nevada County			Sacramento County		
Age Ranges	Males	Females	Totals	Males	Females	Totals
5-18 years	2,146	1,978	4,124	3,142	3,038	6,180
18-45 years	7,967	No data	7,967	9,863	No data	9,863
21 and upward	9,338	No data	9,338	11,514	No data	11, 514

Table 8. Age data for Nevada and Sacramento counties for 1880.

	Nevada County			Sacramento County		
Age Ranges	Males	Females	Totals	Males	Females	Totals
5-17 years	2,613	2,579	5,192	4,049	3,848	7,897
18-44 years	6,602	No data	6,602	11,391	No data	11,391
21 and over	9,043	No data	9,043	14,526	No data	14,526

Table 9. Age data for Nevada and Sacramento counties for 1890 and 1900.

		Nevada County			Sacramento County		
	Age Ranges	Males	Females	1880	Age Ranges	Males	Females
1890	N/A	No data	No data	No data	No data	No data	No data
1900	N/A	No data	No data	No data	No data	No data	No data

Place of Origin

Place of origin data was collected from both counties for all decades except for the 1850 federal census and the 1852 state census. This data was organized into two categories: native born and foreign-born (Table 10). For both counties, more native-born individuals were immigrating to California over the fifty-year time period. However, the disparity in numbers was not as great as those seen between the sexes in the same regions, during the same time period.

Table 10. Place of origin data for Nevada and Sacramento counties by decade.

	Nevada County		Sacramento County	
	Native Born	Foreign Born	Native Born	Foreign Born
1850	No data	No data	No data	No data
1852	No data	No data	No data	No data
1860	9,007	7,439	15,450	8,692
1870	10,479	8,655	16,228	10,602
1880	12,360	8,463	21,896	12,494
1890	No data	No data	No data	No data
1900	13,355	4,434	33,179	12,736

Ethnicity

The federal and state censuses used different terms for different ethnicities, depending on the decade that the data was gathered. Every ethnicity was not documented or tabulated for every census year. Therefore, all ethnic categories used by the federal and state censuses have been listed for each decade used in this study, and if information for a particular ethnicity was documented, it was recorded (Tables 11-16).

Table 11. Ethnicity data for Nevada and Sacramento counties for 1850.

	Nevada County			Sacramento County		
	Males	Females	Totals	Males	Females	Totals
White	No data	No data	No data	8,277	598	8,875
"Negro"	No data	No data	No data	195	17	212
Black	No data	No data	No data	No data	No data	No data
"Colored"	No data	No data	No data	No data	No data	No data
Chinese	No data	No data	No data	No data	No data	No data
Indian	No data	No data	No data	1,445	1,781	3,226
Japanese	No data	No data	No data	No data	No data	No data
"Mulatto"	No data	No data	No data	0	1	1
Asiatic	No data	No data	No data	No data	No data	No data

Summary

Census data were collected from Nevada and Sacramento counties between the years 1850 and 1900 (United States Census Bureau n.d.a.). Demographic information including total population, sex, age, place of origin, and ethnicity was gathered for each county for each decade. This information was used in order to provide an overall picture of both counties respective populations during the fifty-year time span if this study.

Table 12. Ethnicity data for Nevada and Sacramento counties for 1852.

	Nevada County			Sacramento County		
	Males	Females	Totals	Males	Females	Totals
White	12,448	920	13,368	9,457	1,739	11,196
"Negro"	76	26	102	195	45	240
Black	No data	No data	No data	No data	No data	No data
"Colored"	No data	No data	No data	No data	No data	No data
Chinese	No data	No data	No data	No data	No data	No data
Indian	1,445	1,781	3,226	62	18	80
Japanese	No data	No data	No data	No data	No data	No data
"Mulatto"	0	1	1	80	18	98
Asiatic	No data	No data	No data	No data	No data	No data

Table 13. Ethnicity data for Nevada and Sacramento counties for 1860.

	Nevada County			Sacramento County		
	Males	Females	Totals	Males	Females	Totals
White	11,457	2,681	14,138	14,738	6,954	21,692
"Negro"	65	17	82	303	157	460
Black	No data	No data	No data	No data	No data	No data
"Colored"	No data	No data	No data	No data	No data	No data
Chinese	No data	No data	No data	No data	No data	No data
Indian	3	2	5	186	65	251
Japanese	No data	No data	No data	No data	No data	No data
"Mulatto"	46	28	74	5	3	8
Asiatic	2,064	83	2,147	1,527	204	1,731

Table 14. Ethnicity data for Nevada and Sacramento counties for 1870.

	Nevada County			Sacramento County		
	Males	Females	Totals	Males	Females	Totals
White	No data	No data	16,334	No data	No data	22,725
"Negro"	No data	No data	165	No data	No data	475
Black	No data	No data	No data	No data	No data	No data
"Colored"	No data	No data	No data	No data	No data	No data
Chinese	No data	No data	2,627	No data	No data	3,595
Indian	No data	No data	8	No data	No data	34
Japanese	No data	No data	No data	No data	No data	No data
"Mulatto"	No data	No data	No data	No data	No data	No data
Asiatic	No data	No data	No data	No data	No data	No data

Table 15. Ethnicity data for Nevada and Sacramento counties for 1880.

	Nevada County			Sacramento County		
	Males	Females	Totals	Males	Females	Totals
White	No data	No data	17,567	No data	No data	28,928
"Negro"	No data	No data	150	No data	No data	560
Black	No data	No data	No data	No data	No data	No data
"Colored"	No data	No data	No data	No data	No data	No data
Chinese	No data	No data	3,003	No data	No data	4,892
Indian	No data	No data	101	No data	No data	14
Japanese	No data	No data	2	No data	No data	1
"Mulatto"	No data	No data	No data	No data	No data	No data
Asiatic	No data	No data	No data	No data	No data	No data

Table 16. Ethnicity data for Nevada and Sacramento counties for 1890 and 1900.

		Nevada County			Sacramento County		
		Males	Females	Totals	Males	Females	Totals
1890		No data	No data	No data	No data	No data	No data
1900	White	9,631	7,393	17,024	22,366	18,551	40,917
	"Negro"	41	29	70	286	225	511
	Black	No data	No data	No data	No data	No data	No data
	"Colored"	No data	No data	No data	No data	No data	No data
	Chinese	No data	No data	632	No data	No data	8,254
	Indian	No data	No data	48	No data	No data	24
	Japanese	No data	No data	15	No data	No data	1,209
	"Mulatto"	No data	No data	No data	No data	No data	No data
	Asiatic	No data	No data	No data	No data	No data	No data

CHAPTER VII

RESULTS - MORTALITY DATA

(DISEASE PREVALENCE)

Disease data were collected from samples of cemetery, mortuary, and hospital populations from both Nevada and Sacramento counties during the years 1850-1900. The information gathered from each source and from each county are not identical and do not furnish a complete representation of each county during this time. However, the data provide a picture of certain segments of the population, specifically, those dying from cholera and tuberculosis. It also supplies a general trend for each of the communities during the time period of this study.

In order to evaluate cholera and tuberculosis prevalence rates for Nevada and Sacramento counties from 1850-1900, the total population values, sex and age information were used. The data for sex and age were used due to their ability to be compared equally between the two counties. The total population value for each county, for each decade, included those individuals who died between the years of 1850 and 1900 with a cause of death listed from the sources utilized for this research.

Nevada County: Cholera

There were 26 people who died from cholera in Nevada County between the years 1850 and 1900 (Figure 1). This total was further broken down by decade, and then

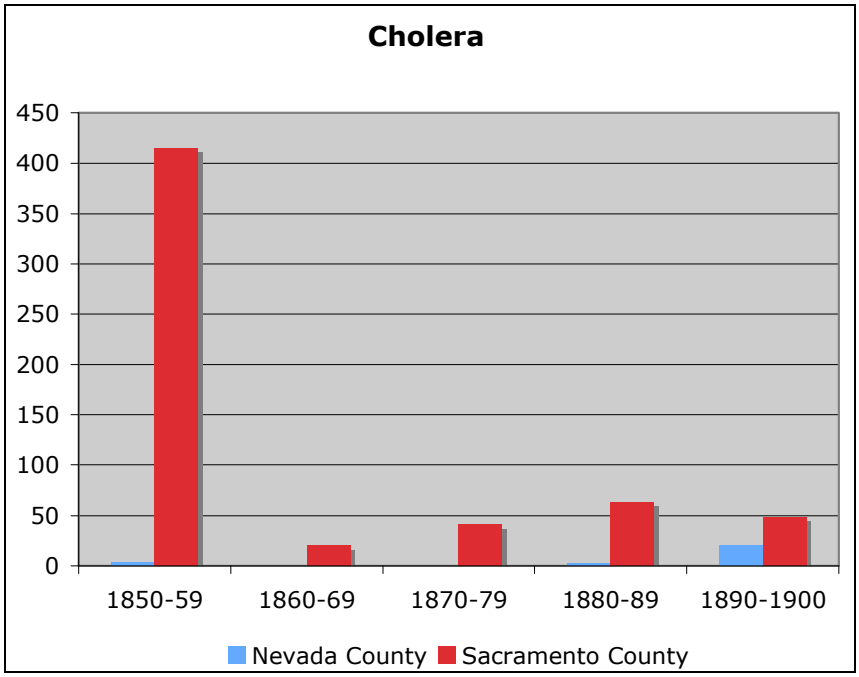

Figure 1. Cholera totals for both Nevada and Sacramento counties by decade.

by population totals, sex and age. The prevalence rates for the total number of people who died from cholera by decade were calculated using the total population values for those who had a cause of death listed from the same years (Table 17). The number of people who died from cholera for each decade was then divided by the total population for the respective decade.

Table 17. Cholera prevalence rates in Nevada County by decade.

	Population Totals	Cholera Totals	Prevalence %
1850-59	481	4	.83
1860-69	723	0	0
1870-79	320	0	0
1880-89	325	2	.62
1890-1900	1,046	20	1.9

The total number of people who died from cholera in Nevada County was further broken down into number of males, females, and individuals of unknown sex (Figure 2). The prevalence rates for males, females, and unknown sex by decade were calculated using the total population values of those who had a cause of death listed from the same years (Table 18). The number of males or females with deaths attributed to cholera was then divided by the total population for that decade.

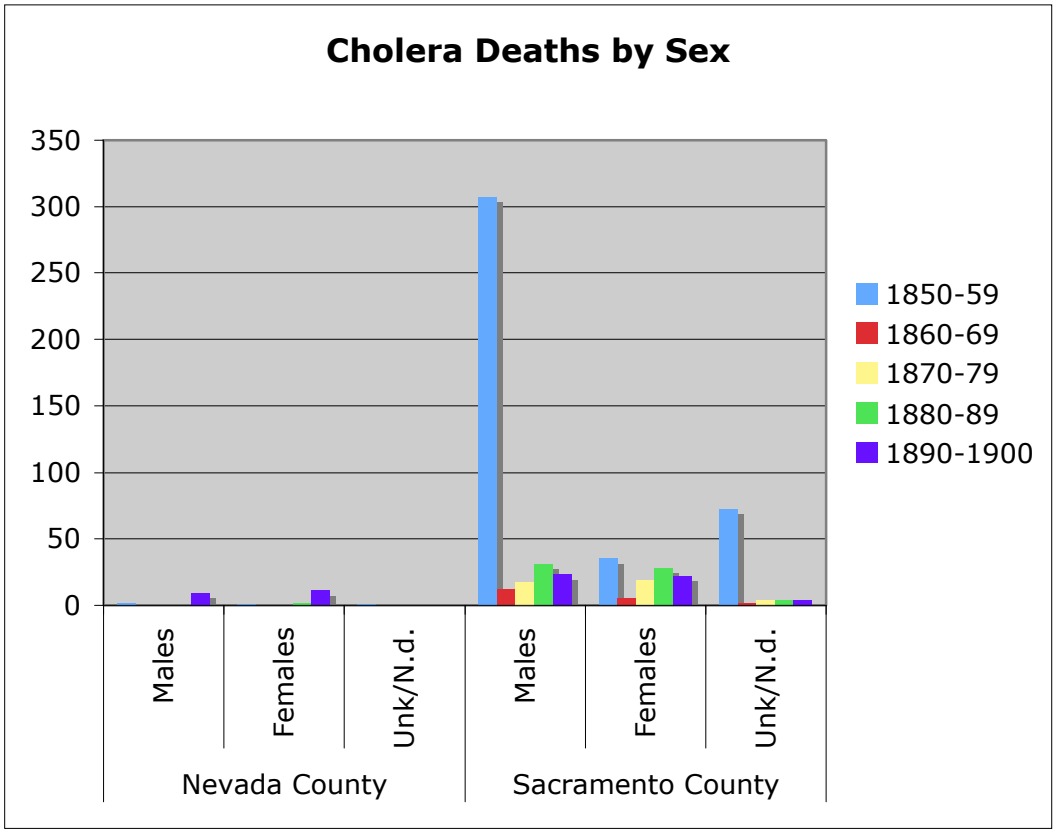

Figure 2. Cholera totals by sex for both Nevada and Sacramento counties by decade.

The total number of people who died from cholera in Nevada County was further broken down by age (Figure 3). The prevalence rates for age were calculated

Table 18. Cholera prevalence rates among males and females in Nevada County by decade.

	Population Totals	Males	Prevalence %	Females	Prevalence %	Unk/ N.d.	Prevalence %
1850-59	481	2	.42	1	.21	1	.21
1860-69	723	0	0	0	0	0	0
1870-79	320	0	0	0	0	0	0
1880-89	325	0	0	2	.62	0	0
1890-1900	1,046	9	.86	11	1.1	0	0

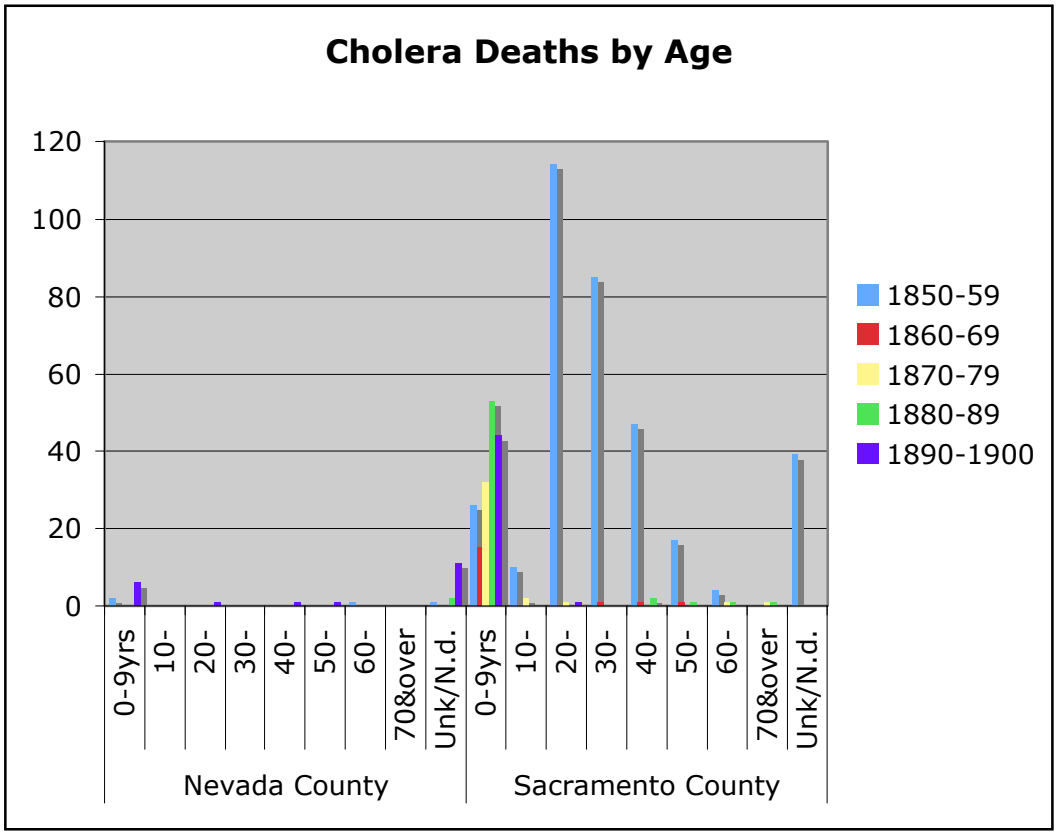

Figure 3. Cholera totals by age for both Nevada and Sacramento counties by decade.

using the total population values of those who had a cause of death listed from the same years (Table 19). The ages were broken down into the ranges previously indicated for this study: 0-9 years, 10-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years and 70 and over. Prevalence rates for individuals with mortality due to cholera with no known age information were also included. The number of people indicated for each age range were then divided by the total population for that decade.

Table 19. Cholera prevalence rates by age in Nevada County by decade.

	Population Totals	0-9yrs	Prevalence %	10-19yrs	Prevalence %	20-29yrs	Prevalence %
1850-59	481	2	.42	0	0	0	0
1860-69	723	0	0	0	0	0	0
1870-79	320	0	0	0	0	0	0
1880-89	325	0	0	0	0	0	0
1890-1900	1,046	6	.57	0	0	1	.10

	Population Totals	30-39yrs	Prevalence %	40-49yrs	Prevalence %	50-59yrs	Prevalence %
1850-59	481	0	0	0	0	0	0
1860-69	723	0	0	0	0	0	0
1870-79	320	0	0	0	0	0	0
1880-89	325	0	0	0	0	0	0
1890-1900	1,046	0	0	1	.10	1	.10

	Population Totals	60-69yrs	Prevalence %	70 and over	Prevalence %	Unk/N.d.	Prevalence %
1850-59	481	1	.21	0	0	1	.21
1860-69	723	0	0	0	0	0	0
1870-79	320	0	0	0	0	0	0
1880-89	325	0	0	0	0	2	.62
1890-1900	1,046	0	0	0	0	11	1.1

Nevada County: Tuberculosis

There were 224 people who died from tuberculosis in Nevada County between the years 1850 and 1900 (Figure 4). This total was further broken down by decade, and then by population totals, sex and age. The prevalence rates for the total

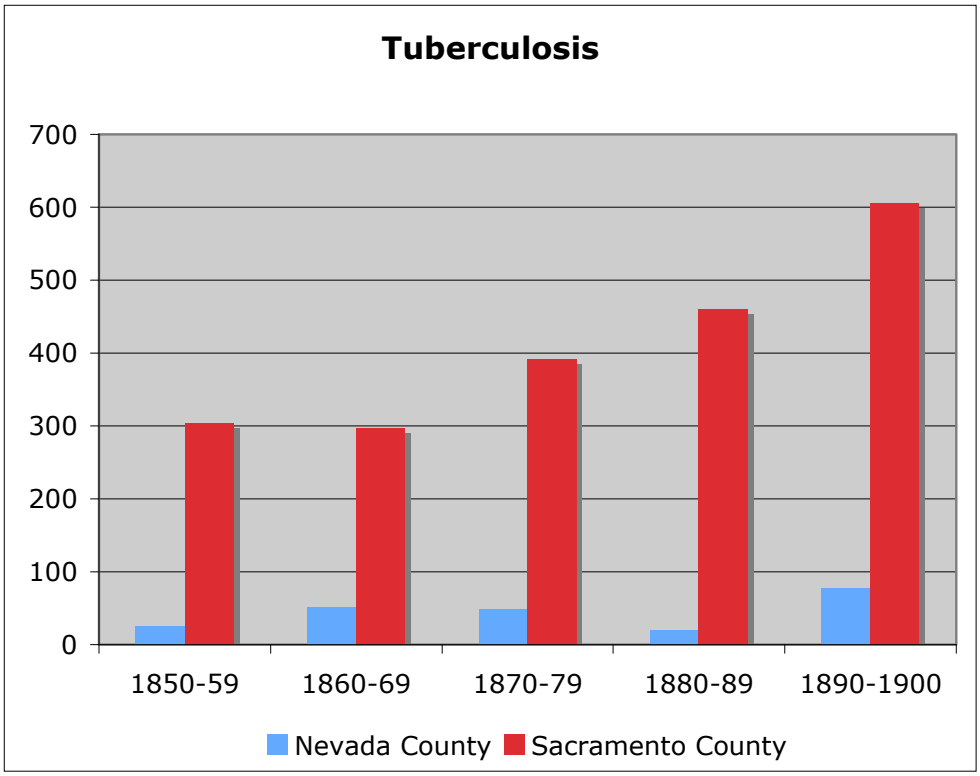

Figure 4. Tuberculosis totals for both Nevada and Sacramento counties by decade.

number of people who died from tuberculosis by decade were calculated using the total population values of those who had a cause of death listed from the same years (Table 20). The number of people who died from tuberculosis for each decade was then divided by the total population for the respective decade.

Table 20. Tuberculosis prevalence rates in Nevada County by decade.

	Population Totals	Tuberculosis Totals	Prevalence %
1850-59	481	26	5.4
1860-69	723	52	7.2
1870-79	320	49	15.3
1880-89	325	20	6.2
1890-1900	1,046	77	7.4

The total number of people who died from tuberculosis in Nevada County was further broken down into number of males, females, and unknown sex (Figure 5). The prevalence rates for males, females, and unknown sex by decade were calculated using the total population values of those who had a cause of death listed from the same years (Table 21). The number of males or females with deaths attributed to tuberculosis was then divided by the total population for that decade.

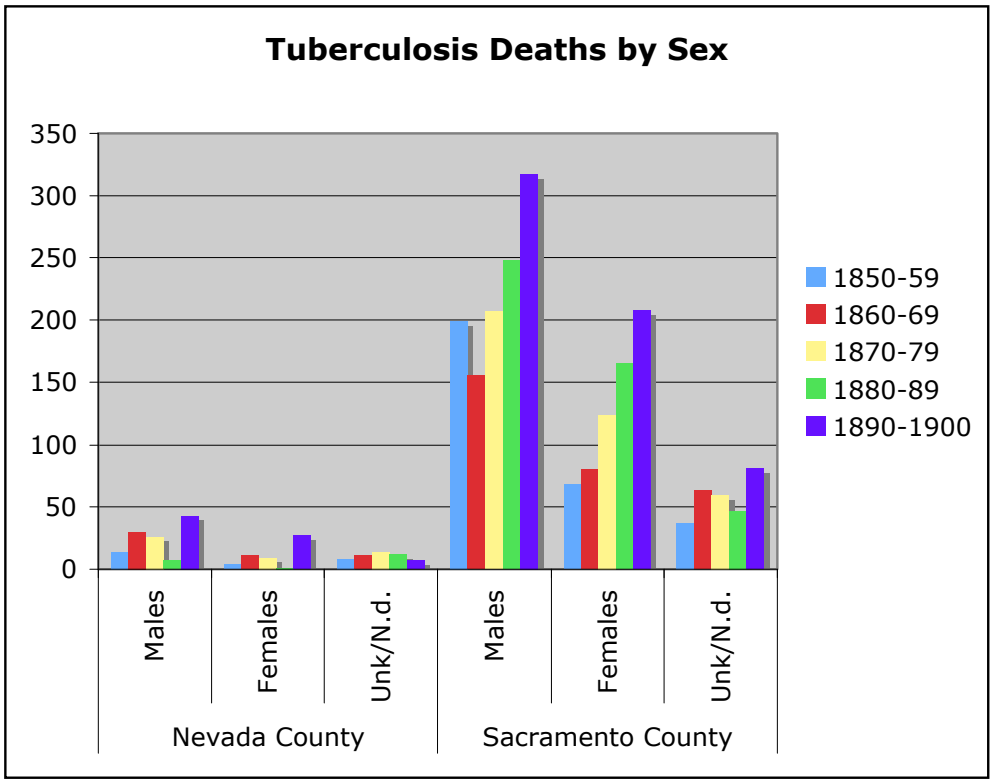

Figure 5. Tuberculosis totals by sex for both Nevada and Sacramento counties by decade.

The total number of people who died from tuberculosis in Nevada County was further broken down by age (Figure 6). The prevalence rates for age were calculated using the total population values for those who had a cause of death listed from the same

Table 21. Tuberculosis prevalence rates among males and females in Nevada County by decade.

	Population Totals	Males	Prevalence %	Females	Prevalence %	Unk/ N.d.	Prevalence %
1850-59	481	14	2.9	4	.83	8	1.7
1860-69	723	30	4.2	11	1.5	11	1.5
1870-79	320	26	8.1	9	2.8	14	4.4
1880-89	325	7	2.2	1	.31	12	3.7
1890-1900	1,046	43	4.11	27	2.6	7	.67

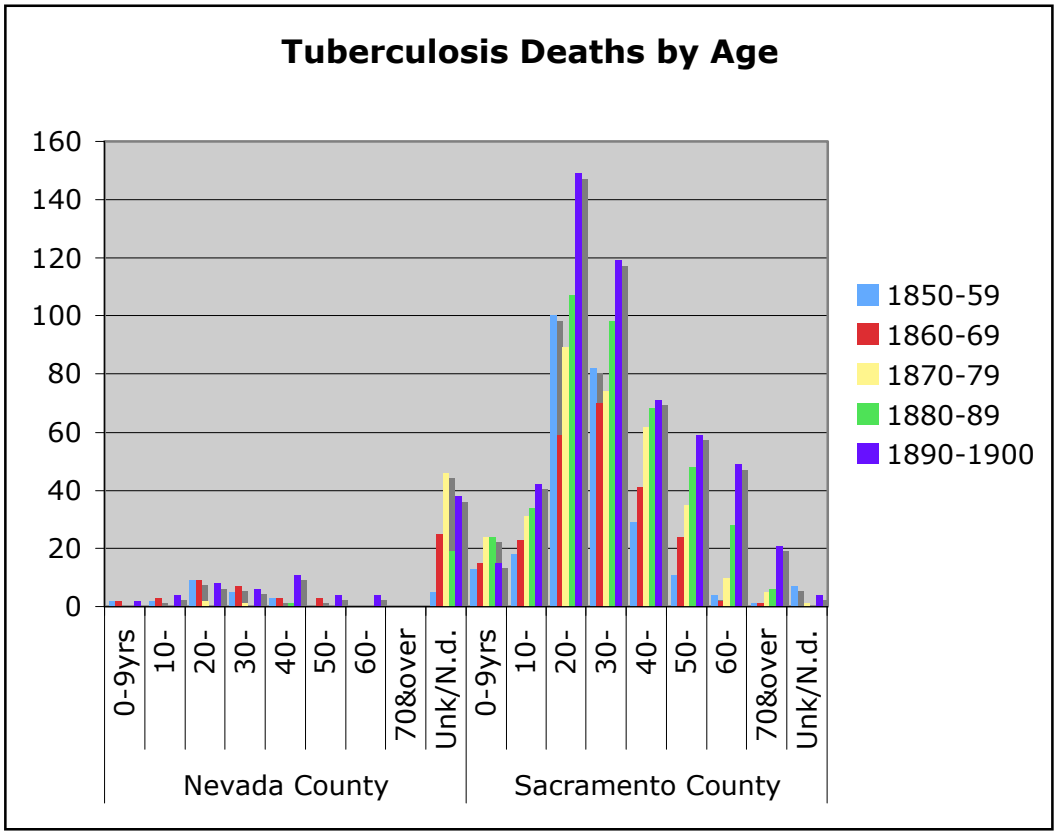

Figure 6. Tuberculosis totals by age for both Nevada and Sacramento counties by decade.

years (Table 22). The ages were broken down into the ranges previously indicated for this study: 0-9 years, 10-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years and 70 and over. Prevalence rates for individuals with mortality due to tuberculosis with no known age information were also included. The number of people indicated for each age range was then divided by the total population for that decade.

Table 22. Tuberculosis prevalence rates by age in Nevada County by decade.

	Population Totals	0-9yrs	Prevalence %	10-19yrs	Prevalence %	20-29yrs	Prevalence %
1850-59	481	2	.42	2	.42	9	1.9
1860-69	723	2	.28	3	.41	9	1.2
1870-79	320	0	0	0	0	2	.63
1880-89	325	0	0	0	0	0	0
1890-1900	1,046	2	.19	4	.38	8	.76

	Population Totals	30-39yrs	Prevalence %	40-49yrs	Prevalence %	50-59yrs	Prevalence %
1850-59	481	5	1.04	3	.62	0	0
1860-69	723	7	.97	3	.41	3	.41
1870-79	320	1	.31	0	0	0	0
1880-89	325	0	0	1	.31	0	0
1890-1900	1,046	6	.57	11	1.05	4	.38

	Population Totals	60-69yrs	Prevalence %	70 and over	Prevalence %	Unk/N.d.	Prevalence %
1850-59	481	0	0	0	0	5	1.04
1860-69	723	0	0	0	0	25	3.5
1870-79	320	0	0	0	0	46	14.4
1880-89	325	0	0	0	0	19	5.9
1890-1900	1,046	4	.38	0	0	38	3.6

Sacramento County: Cholera

There were 588 people who died from cholera in Sacramento County between the years 1850 and 1900 (Figure 1). This total was further broken down by decade, and then by population totals, sex and age. The prevalence rates for the total number of

people who died from cholera by decade were calculated using the total population values of those who had a cause of death listed from the same years (Table 23). The number of people who died from cholera for each decade was then divided by the total population for the respective decade.

Table 23. Cholera prevalence rates in Sacramento County by decade.

	Population Totals	Cholera Totals	Prevalence %
1850-59	3,037	415	13.7
1860-69	2,270	20	.9
1870-79	2,731	41	1.5
1880-89	3,579	63	1.8
1890-1900	5,622	49	.9

The total number of people who died from cholera in Sacramento County was further broken down into number of males, females, and unknown sex (Figure 4). The prevalence rates for males, females, and unknown sex by decade were calculated using the total population values of those who had a cause of death listed from the same years (Table 24). The number of males or females with deaths attributed to cholera was then divided by the total population for that decade.

Table 24. Cholera prevalence rates among males and females in Sacramento County by decade.

	Population Totals	Males	Prevalence %	Females	Prevalence %	Unk/ N.d.	Prevalence %
1850-59	3,037	307	10.1	35	1.2	73	2.4
1860-69	2,270	12	.53	6	.26	2	.09
1870-79	2,731	18	.66	19	.7	4	.15
1880-89	3,579	31	.87	28	.78	4	.11
1890-1900	5,622	23	.41	22	.39	4	.07

The total number of people who died from cholera in Sacramento County was further broken down by age (Figure 3). The prevalence rates for age were calculated using the total population values for those who had a cause of death listed from the same years (Table 25). The ages were broken down into the ranges previously indicated for this study: 0-9 years, 10-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years and 70 and over. Prevalence rates for individuals with mortality due to cholera with no known age information were also included. The number of people indicated for each age range was then divided by the total population for that decade.

Table 25. Cholera prevalence rates by age in Sacramento County by decade.

	Population Totals	0-9yrs	Prevalence %	10-19yrs	Prevalence %	20-29yrs	Prevalence %
1850-59	3,037	26	.86	10	.33	114	3.8
1860-69	2,270	15	.66	0	0	0	0
1870-79	2,731	32	1.2	2	.07	1	.04
1880-89	3,579	53	1.5	0	0	0	0
1890-1900	5,622	44	.78	0	0	1	.02

	Population Totals	30-39yrs	Prevalence %	40-49yrs	Prevalence %	50-59yrs	Prevalence %
1850-59	3,037	85	3	47	1.6	17	.56
1860-69	2,270	1	.04	1	.04	1	.04
1870-79	2,731	0	0	0	0	0	0
1880-89	3,579	0	0	2	.06	1	.03
1890-1900	5,622	0	0	0	0	0	0

	Population Totals	60-69yrs	Prevalence %	70 and over	Prevalence %	Unk/N.d.	Prevalence %
1850-59	3,037	4	.13	0	0	39	1.3
1860-69	2,270	0	0	0	0	0	0
1870-79	2,731	1	.04	1	.04	0	0
1880-89	3,579	1	.03	1	.03	0	0
1890-1900	5,622	0	0	0	0	0	0

Sacramento County: Tuberculosis

There were 2,059 people who died from tuberculosis in Sacramento County between the years 1850 and 1900 (Figure 2). This total was further broken down by decade, and then by population totals, sex and age. The prevalence rates for the total number of people who died from tuberculosis by decade were calculated using the total population values for those who had a cause of death listed from the same years (Table 26). The number of people who died from cholera for each decade was then divided by the total population for the respective decade.

Table 26. Tuberculosis prevalence rates in Sacramento County by decade.

	Population Totals	Tuberculosis Totals	Prevalence %
1850-59	3,037	304	10.01
1860-69	2,270	298	13.1
1870-79	2,731	391	14.3
1880-89	3,579	460	12.9
1890-1900	5,622	606	10.8

The total number of people who died from tuberculosis in Sacramento County was further broken down into number of males, females, and unknown sex (Figure 5). The prevalence rates for males, females, and unknown sex by decade were calculated using the total population values for those who had a cause of death listed from the same years (Table 27). The number of males or females with deaths attributed to tuberculosis was then divided by the total population for that decade

The total number of people who died from tuberculosis in Sacramento County was further broken down by age (Figure 6). The prevalence rates for age were calculated

Table 27. Tuberculosis prevalence rates among males and females in Sacramento County by decade.

	Population Totals	Males	Prevalence %	Females	Prevalence %	Unk/ N.d.	Prevalence %
1850-59	3,037	199	6.6	68	2.2	37	1.2
1860-69	2,270	155	6.8	80	3.5	63	2.8
1870-79	2,731	207	7.6	124	4.5	60	2.2
1880-89	3,579	248	6.9	165	4.6	47	1.3
1890-1900	5,622	317	5.6	208	3.7	81	1.4

using the total population values for those who had a cause of death listed from the same years (Table 28). The ages were broken down into the ranges previously indicated for this study: 0-9 years, 10-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years and 70 and over. Prevalence rates for individuals with mortality due to tuberculosis with no known age information were also included. The number of people indicated for each age range was then divided by the total population for that decade.

Chi-square Test of Independence

The chi-square test of independence was used to test whether or not there were relationships, or statistically significant results, between the population, sex and age disease data for Nevada and Sacramento counties. There are certain assumptions for using a chi-square test: 1) the comparison is between two or more independent samples, 2) nominal data must be used, 3) random sampling must also be utilized, and 4) expected cell frequencies should not be less than five. When there are expected cell frequencies that fall below the value of five, a Yates correction can be applied in order to make the test more conservative. The Yates correction reduces the absolute values in the chi-square test by .5, thus making the difference needed to accept or reject the null hypothesis

Table 28. Tuberculosis prevalence rates by age in Sacramento County by decade.

	Population Totals	0-9yrs	Prevalence %	10-19yrs	Prevalence %	20-29yrs	Prevalence %
1850-59	3,037	13	.43	18	.59	100	3.3
1860-69	2,270	15	.66	23	1.01	59	2.6
1870-79	2,731	24	.88	31	1.1	89	3.3
1880-89	3,579	24	.67	34	.94	107	3
1890-1900	5,622	15	.27	42	.75	149	2.7

	Population Totals	30-39yrs	Prevalence %	40-49yrs	Prevalence %	50-59yrs	Prevalence %
1850-59	3,037	82	2.7	29	1	11	.36
1860-69	2,270	70	3.1	41	1.8	24	1.1
1870-79	2,731	74	2.7	62	2.3	35	1.3
1880-89	3,579	98	2.7	68	1.9	48	1.3
1890-1900	5,622	119	2.1	71	1.3	59	1.05

	Population Totals	60-69yrs	Prevalence %	70 and over	Prevalence %	Unk/N.d.	Prevalence %
1850-59	3,037	4	.13	1	.03	7	.23
1860-69	2,270	2	.09	1	.04	0	0
1870-79	2,731	10	.37	5	.18	1	.04
1880-89	3,579	28	.78	6	.17	0	0
1890-1900	5,622	49	.87	21	.37	4	.07

smaller. Without applying the Yates correction, the small expected frequencies could make the chi-square calculation large due to a few values skewing the data and displaying large gaps between the observed and expected numbers. This in turn creates a skewed result and guarantees a rejection of the null hypothesis (Levin and Fox 2011:234-236). Although there is no specific rule for how many cells below a value of five are needed to apply a Yates correction, for this study a table that had 20 percent of its cells falling below a value of five, and had an overall sample size that was sufficient to run a chi-square test, had the Yates correction applied. Additionally, for the sex and age data, the unknown columns were removed, as these would not generate any meaningful results.

Total Population Results

The chi-square observed and expected values for the total number of people who died from cholera in Nevada and Sacramento counties between the years 1850 and 1900 were calculated. The null hypothesis is that there is no relationship between the county of residence and the likelihood of an individual dying from cholera. The research hypothesis is that there is a relationship between the county of residence and the likelihood of an individual dying from cholera. One of the assumptions for running a chi-square test is that expected cell frequencies are greater than or equal to five. Due to there being four cells with values below five, a Yates correction was also applied in order to get an observed chi-square value and test statistical significance for this data. The chi-square test found a significant relationship between county of residence and cholera prevalence ($\chi 2 = 109.6$; $df = 4$; $p < .001$; Table 13).

The chi-square observed and expected values for the total number of people who died from tuberculosis in Nevada and Sacramento counties between the years 1850 and 1900 were calculated. The null hypothesis was that there is no relationship between the county of residence and the likelihood of an individual dying from tuberculosis. The research hypothesis was that there was a relationship between the county of residence and the likelihood of an individual dying from tuberculosis. The chi-square test found a significant relationship between county of residence and tuberculosis prevalence ($\chi 2 = 31.3$; $df = 4$; $p < .001$; Table 29).

Sex Comparison Results

The chi-square observed and expected values for cholera deaths between males and females in Nevada County between the years 1850 and 1900 were calculated.

Table 29. Chi-square and Yates Correction Test results comparing Nevada and Sacramento counties total populations for both cholera and tuberculosis.

	$\chi 2$	*df*	*p*-value
Cholera	109.6350457	4	<.001
Tuberculosis	31.26999776	4	<.001

The null hypothesis is that there is no relationship between sex and the likelihood of an individual dying from cholera. The research hypothesis is that there is a relationship between sex and the likelihood of an individual dying from cholera.

One of the assumptions for running a chi-square test is that expected cell frequencies are greater than or equal to five. For this data, the majority of the cells were under the value of five and therefore a chi-square test did not yield any significant results. Also, because there were so many cells under the value of five and the sample size was small, a Yates correction would also not yield meaningful results. Therefore, the data will be discussed in a descriptive fashion.

Overall, in Nevada County, 25 males and females died from cholera during the fifty-year time span. In total, there were 11 males (44%) and 14 females (56%) who died from cholera during the study period. Three males and females died from cholera during the 1850-1859 decade (12%); there were zero deaths for both the 1860-1869 and 1870-1879 decades, two during the 1880-1889 decade (8%), and 20 during the 1890-1900 decade (80%). Although statistical significance cannot be accepted or refuted for this data set, the raw numbers indicate that the majority of deaths attributed to cholera were slightly higher in the female group, and that there were more cholera deaths during the 1890-1900 decade.

The chi-square observed and expected values for cholera deaths between males and females in Sacramento County between the years 1850 and 1900 were calculated. The null hypothesis is that there is no relationship between sex and the likelihood of an individual dying from cholera. The research hypothesis is that there is a relationship between sex and the likelihood of an individual dying from cholera. The chi-square test found a significant relationship between sex and cholera prevalence in Sacramento County ($\chi 2 = 9.49$; $df = 4$; $p < .001$; Table 14).

The chi-square observed and expected values for tuberculosis deaths between males and females in Nevada County between the years 1850 and 1900 were calculated and placed into Excel (Table 30). The null hypothesis is that there is no relationship between sex and the likelihood of an individual dying from tuberculosis. The research hypothesis is that there is a relationship between sex and the likelihood of an individual dying from tuberculosis.

The chi-square test found that there was no significant relationship between sex and tuberculosis prevalence in Nevada County ($\chi 2 = 7.83$; $df = 4$; $p < 0.09$; Table 30).

Table 30. Chi-square Test results for males and females for both cholera and tuberculosis in each county.

	χ2	*df*	p-value
Cholera			
Nevada County	9.487729037	4	
Sacramento County	9.487729037	4	<.001
Tuberculosis			
Nevada County	7.825376939	4	0.098188407
Sacramento County	9.487729037	4	<.001

The chi-square observed and expected values for tuberculosis deaths between males and females in Sacramento County between the years 1850 and 1900 were calculated. The null hypothesis is that there is no relationship between sex and the likelihood of an individual dying from tuberculosis. The research hypothesis is that there is a relationship between sex and the likelihood of an individual dying from tuberculosis. The chi-square test found a significant relationship between sex and tuberculosis prevalence in Sacramento County ($\chi 2 = 9.49$; $df = 4$; $p < .001$; Table 30).

Age Results

The chi-square observed and expected values for cholera deaths between the ages for Nevada County between the years 1850 and 1900 were calculated. The null hypothesis is that there is no relationship between age and the likelihood of an individual dying from cholera. The research hypothesis is that there is a relationship between age and the likelihood of an individual dying from cholera.

One of the assumptions for running a chi-square test is that expected cell frequencies are greater than or equal to five. For this data, the majority of the cells were under the value of five and therefore a chi-square test did not yield any significant results. Also, because there were so many cells under the value of five and the sample size was small, a Yates correction would also not yield meaningful results. Therefore, the data will be discussed in a descriptive fashion.

Overall, in Nevada County, 12 people died from cholera with known ages during the fifty-year time span. In total, there were eight people between the ages of 0-9 (66%), zero between the ages of 10-19, one between the ages of 20-29 (8%), zero between the ages of 30-39, one between the ages of 40-49 (8%), one between the ages of

50-59 (8%), one between the ages of 60-69 (8%) and zero between the ages of 70 and over who died from cholera during the study period. Although statistical significance cannot be accepted or refuted for this data set, the raw numbers indicate that the majority of deaths attributed to cholera in Nevada County were for individuals in the age group 0-9 years.

The chi-square observed and expected values for cholera deaths between the ages for Sacramento County between the years 1850 and 1900 were calculated. The null hypothesis is that there is no relationship between age and the likelihood of an individual dying from cholera. The research hypothesis is that there is a relationship between age and the likelihood of an individual dying from cholera.

One of the assumptions for running a chi-square test is that expected cell frequencies are greater than or equal to five. Due to there being several cells with values below five, but a larger sample size being present, a Yates correction test was also applied in order to get an observed chi-square value and test statistical significance for this data. The chi-square test found a significant relationship between age and cholera prevalence in Sacramento County ($\chi 2 = 299.93$; $df = 28$; $p < .001$; Table 31).

The chi-square observed and expected values for tuberculosis deaths between the ages for Nevada County between the years 1850 and 1900 were calculated. The null hypothesis is that there is no relationship between age and the likelihood of an individual dying from tuberculosis. The research hypothesis is that there is a relationship between age and the likelihood of an individual dying from tuberculosis.

One of the assumptions for running a chi-square test is that expected cell frequencies are greater than or equal to five. For this data, the majority of the cells were

under the value of five and therefore a chi-square test did not yield any significant results. Also, because there were so many cells under the value of five and the sample size was small, a Yates correction would also not yield meaningful results. Therefore, the data will be discussed in a descriptive fashion.

Overall, in Nevada County, 91 people died from tuberculosis with known ages during the fifty-year time span. In total, there were six people between the ages of 0-9 (7%), nine between the ages of 10-19 (10%), 28 between the ages of 20-29 (31%), 19 between the ages of 30-39 (21%), 18 between the ages of 40-49 (20%), seven between the ages of 50-59 (8%), four between the ages of 60-69 (4%) and zero between the ages of 70 and over who died from tuberculosis during the study period. Although statistical significance could not be evaluated for this data set, the raw numbers indicate that the majority of deaths attributed to tuberculosis in Nevada County were for individuals between the ages of 10 and 49 years (82%).

The chi-square observed and expected values for tuberculosis deaths between the ages for Sacramento County between the years 1850 and 1900 were calculated. The null hypothesis is that there is no relationship between age and the likelihood of an individual dying from tuberculosis. The research hypothesis is that there is a relationship between age and the likelihood of an individual dying from tuberculosis. The chi-square test found a significant relationship between age and tuberculosis prevalence in Sacramento County ($\chi 2 = 41.34$; $df = 28$; $p < .001$; Table 31).

Table 31. Chi-square and Yates Correction Test results for the different age groups for both cholera and tuberculosis in each county.

	χ2	*df*	p-value
Cholera			
Nevada County	41.33713813	28	
Sacramento County	299.9326655	28	<.001
Tuberculosis			
Nevada County	41.33713813	28	
Sacramento County	41.33713813	28	<.001

Summary

Disease data were collected from samples of cemetery, mortuary, and hospital populations from both Nevada and Sacramento counties during the years 1850-1900. The data provide a picture of certain segments of the population, specifically, those dying from cholera and tuberculosis. It also supplies a general, overall trend for each of the communities during the time period of this study. In order to evaluate cholera and tuberculosis prevalence rates for Nevada and Sacramento counties from 1850-1900, the total population values, sex and age information were used. Additionally, the chi-square test of independence was used to test whether or not there were relationships, or statistically significant results, between the population, sex and age disease data for Nevada and Sacramento counties.

In conclusion, the results indicated that for both cholera and tuberculosis there was a significant relationship between county of residence and disease prevalence. For Nevada County, although statistical significance could not be determined, there were more young adult males succumbing to cholera at the beginning of the study period with an increase in prevalence rates for women over the fifty-year time span. For Sacramento

County, the results displayed that there was a significant relationship between sex and cholera prevalence. For age data in Nevada County, statistical significance could not be determined. The expectation of more children succumbing to cholera over the fifty-year time span was not supported. However, in Sacramento County, the results indicated a significant relationship between age and cholera prevalence.

The sex data showed that there was not a significant relationship between sex and tuberculosis prevalence in Nevada County. Conversely, there was a significant relationship between sex and tuberculosis prevalence in Sacramento County. For age data in Nevada County, statistical significance could not be determined. The expectation of more children succumbing to tuberculosis over the fifty-year time span was not supported. However, in Sacramento County, the results indicated a significant relationship between age and tuberculosis prevalence.

CHAPTER VIII

DISCUSSION

Chapter VII presented descriptive statistics, as well as results of statistical tests on cholera and tuberculosis prevalence in both Nevada and Sacramento counties from 1850-1900. This chapter considers the significance of those results by re-examining the four expectations for this study. Cholera results will be discussed first, followed by tuberculosis for both Nevada and Sacramento counties.

The first expectation was that there would be similarities in cholera and tuberculosis prevalence between Nevada and Sacramento counties at the beginning of the study period (1850), with differences by the end of the study period (1900). The second was that Sacramento County, with a larger population, would show a higher prevalence of disease than the less populated Nevada County over the entire fifty-year time span. The third expectation was that although Sacramento was presumed to have a higher prevalence of disease, it was assumed that there would be an overall increase in both cholera and tuberculosis prevalence rates within each county from 1850 to 1900. Finally, the fourth expectation for this research was that at the beginning of the study period (1850) there would be more young adult males succumbing to cholera and tuberculosis for both counties, with an increase in prevalence rates for both women and children over the fifty-year time span.

Cholera

First and Second Expectations

The overall population and disease totals were analyzed in order to examine whether or not there were similarities in cholera prevalence rates between Nevada and Sacramento counties in 1850, with differences by 1900, as well as whether or not the more populated Sacramento County had a higher prevalence of disease over the more rural Nevada County (Table 17 and Table 23). There were a total of 26 people who died from cholera in Nevada County over the fifty-year period, with 588 individuals dying from the disease in Sacramento County over the same time interval. Additionally, the chi-square test found a significant relationship between county of residence and cholera prevalence.

Based on the numbers alone, few similarities were identified between Nevada County and Sacramento County deaths attributed to cholera during any of the decades examined in this study. During every decade, Sacramento County sustained higher instances of cholera related deaths than the more rural Nevada County. This information suggests that the expectation of similarities during the beginning of the fifty-year study period was not substantiated, while the expectation of differences during the end of the fifty-year study period was supported. Overall, Sacramento seems to have contracted and sustained more cases of cholera than Nevada County over the fifty-year period. The significant chi-square test results further supports these findings. This indicates that the higher population numbers in Sacramento did in fact play a role in the number of deaths attributed to cholera.

These findings make sense due to Sacramento being a river port city, and the landing and starting point for most of the people making their way to the gold fields (Leland 1989:17-18). Cholera disseminated first and quickly in this county with the first waves of migrants, and was able to spread rapidly due to the conditions present in the newly established region (Rosenberg 1962:115; Roth 1997:529, 549). Nevertheless, due to the nature of archival record keeping at this time in the state of California, it is possible that more cases and deaths due to cholera may have been present and not recorded from both Nevada and Sacramento counties. However, the data from the sources utilized for this research seems to present a clear dichotomy between the two counties, as well as a correlation between county of residence, population numbers and the likelihood of dying from cholera. It could therefore be postulated that any additional records on cause of death for these counties would display a similar pattern.

Third Expectation

To review whether or not there was an overall increase in cholera prevalence rates within each county from 1850 to 1900, the overall population and disease totals were surveyed (Table 17 and Table 23). For both counties, the expectation of an overall increase in cholera prevalence over the fifty-year period was not supported. While Nevada County did not have many deaths ascribed to cholera, the pattern showed a decrease in cases after the 1850 decade, with an increase beginning again in 1880 and a further, albeit not substantial, increase in the 1890-1900 decade. Although Sacramento displayed an overall larger number of deaths due to cholera, the majority of deaths were in the 1850 decade, which fits with the influx of people into the region for gold and the progression of the disease into the United States at that time (Chidsey 1968:43; Grob

2002:105; Ketchum 1996:6; Kiple 2003:77; Leland 1989:17; Rohrbough 1997:24; Rosen 2005:105; Rosenberg 1962:115; Roth 1997:527, 529; Simpson 1980:182-3). However, each subsequent decade showed less than 100 deaths, a steady decrease over the fifty-year study period.

This pattern of decrease in cholera deaths seen in both counties during the fifty-year span can be directly linked to the initiation of public health practices that began to take shape by the mid-to-late 1850s (Halverson 1949:59; Jones 1937:251; Roth 1997:532-533). When people first began migrating to California, they were focused on the search for gold, there were little to no city ordinances related to public health, and diseases were rampant due to high population numbers and poor sanitation conditions (Rosenberg 1962:115; Roth 1997:529,549). As cholera began to devastate the gold rush populations, mainly the port city of Sacramento, the medical professionals in the area also began to organize and spread the word on how to combat the problem with new sanitary measures (Roth 1997:536-537; *Sacramento Transcript* 1850). As further cases were documented between 1860-1900, this did not eradicate the disease, but as evidenced by the data, it severely reduced the number of people that would otherwise have succumbed to cholera.

Fourth Expectation

To investigate whether or not more young adult males succumbed to cholera at the beginning of the study period (1850), with an increase in prevalence rates for both females and children over the fifty-year time span, the sex and age data was reviewed (Tables 18 and 24; Tables 19 and 25). Sex data will be discussed first. Due to the small sample size, statistical tests could not be run to either substantiate or disprove the

expectation for Nevada County. However, the sample sizes for Sacramento County were of sufficient size and were run for this data. The chi-square test found a significant relationship between sex and cholera prevalence in Sacramento County.

For Nevada County, although statistical significance cannot be accepted or refuted for this data set, the expectation of more young adult males succumbing to cholera at the beginning of the study period (1850), with an increase in prevalence rates for women over the fifty-year time span was supported. The raw numbers indicate that the majority of deaths attributed to cholera were slightly higher in the female group. Both the 1880 and 1890-1900 decades, as well as the total death count overall, displayed more females dying from cholera than males.

There are five possible suggestions for this outcome. The first is that Nevada County did not display high population numbers when compared to larger metropolitan areas such as Sacramento (Table 3). This would create a situation in which the overall death counts for diseases such as cholera would also be lower than other regions. Second, in the Nevada County gold mining camps, although cholera was present, people were more spread out and were not as likely to share contaminated water sources (Thompson and West 1970:53). Third, men were the main demographic found searching for gold in the rural foothills, and the women that were present in Nevada County at this time, were mainly at home in the cities (Holliday 1998:6, 10, 12-13; Limerick 1998:32-33; Rohrbough 1997:91-94, 97, 174, 180; 1998:28; 2000:27-28). The cities and townships in Nevada County would have been more populated and polluted compared to the more spread out camps of the gold mining areas, and diseases such as cholera would have spread more easily. Therefore, if the women were maintaining residence in these areas

while the men were mining, they would have been more susceptible to contracting cholera. Another possibility is that there may have been more cases of males with deaths attributed to cholera, but due to the rural nature of their mining camps and wanting to maintain discretion with their gold finds, some may have died in the foothills and never been recovered or recorded as dying from the disease. Lastly, a lack of record keeping, or systematic record keeping, may be once again contributing to the lack of data seen in this county at this time.

For Sacramento County, the expectation that more young adult males succumbed to cholera at the beginning of the study period (1850), as well as in overall numbers was supported. However, there was not an increase in prevalence rates for women over the fifty-year time span. The raw numbers indicate that the majority of deaths attributed to cholera were higher in the male group, specifically during the 1850 decade. The subsequent decades all had more males dying from cholera than females with the exception of 1870, and the statistical information confirms that there was in fact a significant relationship between sex and the likelihood of an individual dying from cholera in Sacramento County.

The high numbers of male deaths due to cholera in the 1850 decade was anticipated, as they were migrating to California, specifically Sacramento County, to begin their search for gold in the foothills (Leland 1989:17; Thompson and West 1960:47). Young adult males were the first main group to arrive and settle, and diseases such as cholera spread fiercely and quickly (Ketchum 1996:6-7, 28, 66; Rohrbough 1997:1, 31; Rosenberg 1962:115; Roth 1997:549). As public health reforms made their mark, diseases became less rampant and those dying became fewer in number. Although

there were not many women in Sacramento County in 1850, there were more female deaths attributed to cholera in this decade over any other as well. However, the pattern of decline is not as marked as that in the male group, most likely due to the larger population numbers of men at this time.

The fourth expectation of this study also included age data. Specifically, an increase in prevalence rates for children over the fifty-year time span was also expected. For this discussion, "children" are considered to be those in the age group of 0-9 years. As indicated by the occupation section of the federal census records, those aged 10 and over were often found old enough to work at this time, and thus are considered "adults" for this period (United States Census Bureau n.d.a). For Nevada County, there were two children in the 1850 decade (25%), zero in the 1860 decade, zero in the 1870 decade, zero in the 1880 decade, and six in the 1890-1900 decade (75%) that died from cholera during the study period. For Sacramento County, there were 26 children in the 1850 decade (15%), 15 in the 1860 decade (9%), 32 in the 1870 decade (19%), 53 in the 1880 decade (31%), and 44 in the 1890-1900 decade (26%) that died from cholera during the study period.

Due to small sample size, statistical tests could not be run to either substantiate or disprove the expectation for Nevada County. However, the sample sizes for Sacramento County were of sufficient size to run for this data. The chi-square test found a significant relationship between age and cholera prevalence in Sacramento County.

For Nevada County, although statistical significance cannot be accepted or refuted for this data set, the expectation of more children migrating to, or being born in

California and thus succumbing to cholera over the fifty-year time span was not supported. There were a higher number of deaths due to cholera in the 0-9 year age range over any other age category. There were two deaths in the 1850 decade and six in the 1890-1900 decade for the 0-9 year age group. Although this demonstrates an increase over time, the increase is slight and the decades in between displayed no deaths for this age classification. The slight increase in the 1890-1900 decade may be due to more children being present in the region, however the small sample size overall and the likelihood of poor record keeping may be the larger contributors to these values.

For Sacramento County, the expectation of more children migrating to, or being born in California and thus succumbing to cholera over the fifty-year time span was supported. There were more total deaths attributed to cholera for this age category than any other during the study period. Since the population was larger in Sacramento County compared to Nevada County, the pattern indicated here suggests that the children that were present during this interval were dying from cholera more frequently than the other age groups. There was a statistically significant relationship between the age and the likelihood of an individual dying from cholera in Sacramento County, and there was an increase seen in the 0-9 year age range, based on the raw data, over the fifty-year period for this study. There was, however, a slight decline in the values during the 1860 and 1890-1900 decades. As population numbers were rising, according to the census data presented earlier, these declines may be due to better public health practices being implemented, specifically in the 1860 decade (Jones 1937:251). However, since the declines are slight and the values seem to remain relatively steady over the time span, it

seems as though children were just more susceptible to contracting diseases such as cholera when compared to their older counterparts.

Tuberculosis

First and Second Expectations

The overall population and disease totals were analyzed in order to examine whether or not there were similarities in tuberculosis prevalence rates between Nevada and Sacramento counties in 1850, with differences by 1900, as well as whether or not the more populated Sacramento County had more instances of disease over the more rural Nevada County (Table 20 and Table 26). There were 224 people who died from cholera in Nevada County over the fifty-year period, with 2,059 individuals dying from the disease in Sacramento County over the same time interval. Additionally, the chi-square test found a significant relationship between county of residence and tuberculosis prevalence.

Based on the raw data it appears that the patterns were very different between Nevada County and Sacramento County deaths attributed to tuberculosis during all decades examined in this study. During every decade, Sacramento County sustained a higher prevalence of tuberculosis-related deaths than the more rural Nevada County. This information suggests that the expectation of similarities during the beginning of the fifty-year study period was not supported, while the expectation of differences during the end of the fifty-year study period was supported.

Overall, Sacramento residents contracted and sustained a high prevalence of tuberculosis cases than Nevada County residents over the fifty-year period. This was

supported by the statistical analysis that found a significantly higher prevalence of tuberculosis in the Sacramento County sample compared to the Nevada County sample. This suggests that the higher population numbers in Sacramento did in fact play a role in the number of deaths attributed to tuberculosis (Table 3). Higher population numbers with close proximity, dirty streets and buildings, poor hygiene and sanitation practices would have all contributed to the proliferation of tuberculosis through Sacramento County (Roberts and Buikstra 2003:5, 44).

Third Expectation

To review whether or not there was an overall increase in tuberculosis prevalence rates within each county from 1850 to 1900, the overall population and disease totals were surveyed (Table 20 and Table 26). For both counties, the expectation of an overall increase in tuberculosis prevalence over the fifty-year period was not supported. Both Nevada and Sacramento counties had steady numbers of tuberculosis related deaths over the research period.

Contrary to the fast moving, high mortality of cholera, this pattern seems to follow the evolution of the tubercular disease itself (Kiple 2003:338). Tuberculosis can remain dormant within individuals, may or may not infect certain people, and humans can survive with the disease for weeks or years before recovery or death ensues (Grob 2002:109; Kiple 2003:337). Therefore, this steady pattern of tuberculosis deaths in each county over the fifty years seems to fit with the steady flow of the tubercular bacterium through human populations. The higher number of deaths attributed to the Sacramento region is most likely directly due to the larger numbers of people in closer proximity to one another, and thus the easier spread of the bacterium from one individual to another.

Fourth Expectation

To investigate whether or not more young adult males succumbed to tuberculosis at the beginning of the study period (1850), with an increase in prevalence rates for both women and children over the fifty-year time span, the sex and age data was reviewed (Tables 21 and 27; Tables 22 and 28). Sex data will be discussed first. Statistical tests were also run to either substantiate or disprove the expectation. For Nevada County, the chi-square test found that there was no significant relationship between sex and tuberculosis prevalence in Nevada County. For Sacramento County, the chi-square test found a significant relationship between sex and tuberculosis prevalence in Sacramento County.

For Nevada County, based on the statistical data, there was no difference between the sexes in who died from tuberculosis in this region. Although the raw numbers indicate that there were more males than females dying from tuberculosis in each decade, there were in fact fewer male deaths linked to tuberculosis at the beginning of the fifty-year period, and there was not a significant increase in prevalence rates for women over the fifty-year time span. Thus, the expectation of more young adult males succumbing to tuberculosis at the beginning of the study period (1850), with an increase in prevalence rates for women over the fifty-year time span was not supported.

Tuberculosis is an equal opportunity disease. For the most part it can infect anyone and has a high transmission potential (Grob 2002:109; Kiple 2003:337; Roberts and Buikstra 2003:5; Roberts and Manchester 2007:186-187). This is apparent in the Nevada County data as males and females seem to have been infected in a similar fashion. Since Nevada County was a less populated, more rural region in comparison to

Sacramento, the disease most likely hit who it could, when it could (Table 3). Therefore, although there were less women than men during this period, since tuberculosis is spread via air and can survive for long periods within human hosts, it had the time and ability to hit the population that was present equally (Holliday 1998:6, 12-13; Limerick 1998:32-33; Rohrbough 1997:91-94).

In Sacramento County, there was a statistically significant relationship between sex and the likelihood of an individual dying from tuberculosis. The raw numbers show that in every decade there were more males than females dying from tuberculosis in this area. For Sacramento County, there were also fewer male deaths linked to tuberculosis at the beginning of the fifty-year period, but there also seems to be a steady increase in the prevalence rates for women over the fifty-year time span. This illustrates that part of the expectation was supported.

Similar to Nevada County, tuberculosis in Sacramento County could afflict anyone. The difference is due to the population differences seen between these counties and the environmental factors that were found in the river city area of Sacramento. Sacramento was the first stop for almost all new travelers to the California gold mines, and was the center for all new business and industry related to the growing region (Leland 1989:17-18; Thompson and West 1960:47). Since most of those making their way into California at this time were male, and many made their home base in Sacramento, tuberculosis had ample opportunity to spread among this population (Ketchum 1996:6-7, 28, 66; Rohrbough 1997:1, 31). Females were also affected, and as more made their way into California, their numbers also steadily increase over the fifty-year period in this county (Rohrbough 1997:97; 1998:28; 2000:27-28).

The fourth expectation of this study also included age data. Specifically, an increase in prevalence rates for children over the fifty-year time span was expected. As previously stated, for this discussion "children" are considered to be those in the age group of 0-9 years, as those aged 10 and over were often found old enough to work, and thus considered "adults" for this period. For Nevada County, there were two children in the 1850 decade (33%), two in the 1860 decade (33%), zero in the 1870 decade, zero in the 1880 decade, and two in the 1890-1900 decade (33%) that died from tuberculosis during the study period. For Sacramento County, there were 13 children in the 1850 decade (14%), 15 in the 1860 decade (16%), 24 in the 1870 decade (26%), 24 in the 1880 decade (26%), and 15 in the 1890-1900 decade (16%) that died from tuberculosis during the study period.

Due to the sample size, statistical tests could not be run to either support or refute the expectation for Nevada County. However, the sample sizes for Sacramento County were of sufficient size and were run for this data. The chi-square test found a significant relationship between age and tuberculosis prevalence in Sacramento County.

For Nevada County, although statistical significance cannot be accepted or refuted for this data set, the expectation of more children migrating to, or being born in California and thus succumbing to tuberculosis over the fifty-year time span was not supported. There were the same number of deaths in the 1850, 1860, and 1890-1900 decades, with the decades in between displaying no deaths for this age group. Unless additional data surfaces for this county in future research, nothing notable can be discussed regarding this information at this time. However, the small sample size and the likelihood of poor record keeping may be the most likely explanation for these results.

For Sacramento County, the expectation of more children migrating to, or being born in California and thus succumbing to tuberculosis over the fifty-year time span was supported. There was a statistically significant relationship between the age and the likelihood of an individual dying from tuberculosis in Sacramento County. There was also an increase seen in the 0-9 year age range, based on the raw data, over the fifty-year period for this study. There was, however, a minimal decrease in the number of deaths during the 1890-1900 decade. Since the decrease is seen at the end of the fifty-year study period, it may be due in part to the gold rush coming to a close and many families leaving or settling in other regions (Ketchum 1996:102; Rosen 2005:223-224). It may also be due to public health reforms and cities such as Sacramento becoming more settled, gaining greater access to medical supplies and personnel and ultimately becoming more sanitary (Halverson 1949:59-60; Jones 1937:251).

Summary

The results for the disease totals for both counties indicated that Sacramento displayed higher prevalence rates than Nevada County for both cholera and tuberculosis. The variable that affected these results most was that of population size. For both cholera and tuberculosis, the higher population numbers seen in Sacramento County allowed for easier transmission of the diseases and thus higher mortality numbers. Additionally, the sex comparison data demonstrated that more males than females succumbed to both diseases in each county. As there were more males than females in each county during this period, both cholera and tuberculosis had the ability to travel through the male population in elevated quantities. Furthermore, the age comparison data revealed that

more young people (0-29 years) succumbed to both cholera and tuberculosis in each county. As this was the main demographic during the fifty-year period, they were the main group affected by these diseases.

There were several limitations for this research. There were many gaps in the historical documents utilized, and the records were often incomplete or originally gathered in an unsystematic fashion. It was common to have more than one person contributing to the same set of documents, which led to subjective record keeping and confusion for readers. Additionally, some minority groups, such as Chinese populations, kept their own records, which did not become part of the state or federal databases. Historically, there were multiple names for both cholera and tuberculosis and some listings of mortality due to these diseases may have been missed due to ambiguous documentation or unclear handwriting. Lastly, a cause of death was not listed or recorded for all individuals that died in each county during the fifty-year period. Therefore, actual mortality rates may be higher than indicated in this research.

Future research should center on the strategies for the building of businesses, homes, streets, water systems, and other municipal efforts within each county, and how these systems would have played a role in the transmission or termination of these diseases. Supplementary studies could also focus on locating any California State Board of Health documents that are dated for the years included in this study. Since California did not have a Board of Health until 1870, the official records do not begin until after 1900, after the fifty-year period examined for this research. However, there may be some documentation from these Board meetings within other state or federal records that were chronicled between 1870 and 1900.

CHAPTER IX

SUMMARY AND CONCLUSION

Summary

The purpose of this research was to examine the presence and spread of infectious disease during the California gold rush, a period in which studies of public health are few. The aim of this research was to address this issue by studying the presence, dispersal, and death rates of infectious disease through the large cultural event that was the California gold rush. In order to present a before and after picture of disease patterns surrounding the California Gold Rush, the research questions focused on a longer time period, and data from 1850 to 1900 was presented. Both Nevada and Sacramento counties began as small mining camps, but within a fifty-year period they differed in their population growth patterns and incidence of infectious disease. Sacramento County became a major metropolitan area with a large population, while Nevada County became a thriving community with many smaller populations. As such, this research examined differences in rates and types of infectious diseases between these two counties based on: 1) differences in population size and 2) biological demographics. For the purposes of this study, examinations of infectious disease, particularly cholera and tuberculosis, were evaluated based on prevalence within the growing populations of Sacramento and Nevada counties.

A literature review on the California gold rush was necessary to understand California as it was prior to its inundation. Therefore, a brief history of California, as well as an introduction to the California gold rush and the major figures that had roles in its beginnings were discussed. Additionally, as this research focuses on two counties that had large roles in the search for gold, brief histories of Nevada and Sacramento counties were presented.

New immigrants and the establishment of new communities introduce old and well-established diseases from their place of origin to their newly settled regions. Additionally, new habitats expose people to the threat of new diseases. The study of the progression of diseases helps us understand how they proliferate within the human body, how they spread between organisms, and how people have learned to treat and cope with them. As such, several aspects of infectious disease progression were examined: the biology of infectious disease; paleopathology and paleoepidemiology; the history of infectious disease in America; and in depth discussions on the two prominent infectious diseases examined for this research, cholera and tuberculosis.

As people migrated to and settled in the newly established regions of California, diseases became a prominent part of daily life. It became apparent that public health and medical practices would need to be instituted. The literature review further details a concise history of public health in the United States as well as California, and the prominent people that established public health policies in the new state.

Census records from 1850, 1852, 1860, 1870, 1880, and 1900 were reviewed in order to provide an overall picture of demographic information for each county. Additionally, archival records of death found from the Searls Historical Library in

Nevada County and the Center for Sacramento History were assessed for those that were attributed to cholera and tuberculosis. All of this information was analyzed and compiled into Microsoft Excel worksheets. The results of the mortality information were refined into prevalence data, and the chi-square test was used on all aspects of the data analyzed, to determine statistical significance. Finally, this thesis concludes with a discussion of these results and a comprehensive conclusion to the research.

Conclusion

Not just those who migrated west experienced changes due to the California gold rush. The native peoples, plants, animals and the landscape itself were forever altered because of this cultural event. America, and specifically California at this time, was seen as a place of escape and as a promise for a better future. New communities were exploding, and most saw California as a place of paradise to start fresh, raise families, and become both healthier and wealthier. What these migrants failed to realize, was that diseases would follow them west, and new ones would be introduced from the new environments.

Disease is rarely more rampant than in newly established areas, unsanitary conditions, and large numbers of people. Newly settled gold mining regions in California offered this exact environment, and diseases such as cholera and tuberculosis initially proliferated with barriers or obstacles. California's early towns were slums with unsanitary living conditions, and little to no medical expertise, supplies, or resources. However, with the large influx of people many medical professionals made their way west and set up practices and facilities to help combat these growing health concerns.

This research attempted to address a lack of awareness on the actual hardships that many faced due to cholera and tuberculosis in their search for gold. Many historical works have been presented regarding the California gold rush, its people, and their experiences. This composition strived to cover the misfortune of suffering from cholera and tuberculosis from a physical anthropological standpoint, one that typically entails the examination of human remains. As historical sites and assemblages are often not available for study due to their sensitive and recent contextual nature, archival records were utilized as the source for this research. As there are currently gaps in historical demographic studies that could help to supplement the historical skeletal remains that have been studied, archival documents can offer knowledge that otherwise may not be available to researchers in this field. Although records from 19th century California were not always reliable or gathered in a systematic fashion, they provided a wealth of information about those who lived and died in this area at this time. As more historical records are uncovered every year, there are possibilities of re-visiting this research and adding to its findings in the future. These records and texts are currently an unrecognized or un-tapped resource for many in the field of anthropology. Future researchers should be cognizant of these sources and would find many research opportunities in the dark and dingy spaces where these materials are found.

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