LIFE AND DEATH IN THE VALLEY OF HEART'S DELIGHT: UNDERSTANDING HEALTH AND NUTRITION AT THE SANTA CLARA VALLEY MEDICAL CENTER HISTORICAL CEMETERY

By

Lisa Nicole Bright

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Anthropology—Doctor of Philosophy

2019

ABSTRACT

LIFE AND DEATH IN THE VALLEY OF HEART'S DELIGHT: UNDERSTANDING HEALTH AND NUTRITION AT THE SANTA CLARA VALLEY MEDICAL CENTER HISTORICAL CEMETERY

By

Lisa Nicole Bright

There are many interconnected variables that directly impact an individual's health, including but not limited to economic status, gender, ethnicity, environment, and access to care. Between 2012-2014, a portion of the Santa Clara Valley Medical Center Historical Cemetery, located in San Jose, California, was excavated. The cemetery was in use from approximately 1875-1935 and served as one of the county's indigent burial grounds. This dissertation explores the impact of immigration, public health, and structural violence on the biological health of individuals interred at the Santa Clara Valley Medical Center Historical Cemetery (VMC).

The primary goal of this study is to examine specific and non-specific indicators of health, while contextualizing the archaeological and osteological data with the socio-political context in which the pathological conditions occurred. Multiple theoretical paradigms including structural violence and epidemiological transitions are used to provide possible explanations for the observed health patterns. The VMC skeletal sample is also compared to archival data sets and other historic skeletal samples to examine similarities and differences in expected and observed health indicators.

The individuals interred at VMC had higher rates of infectious communicable disease and higher infant and neonate mortality rates than comparative samples. The results of this research suggest that the social and health inequalities seen in the VMC skeletal sample can be understood by examining the county's efforts towards public health initiatives, public policy

towards the destitute, and the components of structural violence and institutionalization that intertwine these factors.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

State Board of Charities and Corrections 1916:60.

Chapter 1: Introduction

This research seeks to examine the complex processes that led to potential social and health inequalities by examining a large-scale historical cemetery from California; the Santa Clara Valley Medical Center (VMC) Historical Cemetery. Most large-scale historical cemeteries that have been analyzed (Collins 2009; Dougherty 2011; Grauer et al. 1998; Grauer and McNamara 1995; Higgins and Sirianni 1995; Lanphear 1988; Leavitt-Reynolds 2001; McGloin 2012;Milligan 2010;Phillips 2001A, 2001B; Richards 1997; Wesolowsky and Eila 1991) are located in the East and Midwest, and are thus based on the demographics of the area. The examination of a historical cemetery from the Western United States would address a regional research gap. This research will have implications for both bioarchaeology and mortuary archaeology, as it will address a portion of the mortuary and bioarchaeological record that has been addressed thus far only in a limited fashion.

Bioarchaeological Approaches to "Health" and Paleopathology

Bioarchaeologists are limited in the ways health and stress can be documented from skeletal remains. This interpretation requires evaluating an individual's resistance to stressors by examining the presence and severity of skeletal lesions such as linear enamel hypoplasias, porotic hyperostosis, cribra orbitalia, periosteal reactions, and other systemic infections such as osteomyelitis, syphilis, or tuberculosis (Goodman et al. 1984;Lawler 2016; Martin et al. 2013; Ortner 2003,2008; Pinhasi and Mays 2008). These skeletal indicators of health can be used to evaluate stress incurred during an individual's lifetime. However, many stress events do not leave evidence skeletally, as only long-term or chronic health events impact bone growth and response. Pathognomonic diseases are unfortunately the exception as skeletal tissue most often responds in nonspecific and generalized ways, making the diagnosis of specific causes/pathogens difficult (Bush 1991; Lawler 2016; Ortner 2009; Wright and Yoder 2003). However, these biological responses can still be used to examine the interactions between biology and culture in disease processes.

Most current bioarchaeological studies examine health within the framework of Selyean stress, where stress is a bio-behavioral response to external environmental conditions (Klaus 2014; Goodman et al. 1988; Schell 1997). In general, the biological responses to stress should be the same for everyone (with of course minor differences due to genetic background and host resistance factors), so it is the cultural interference that will result in the variation seen in skeletal populations. "This approach also views evidence of stress and disease as products of environmental inadequacies, whether socially, economically, politically, or ecologically generated" (Zuckerman et al. 2012:35).

There are many factors that will impact host-pathogen-environment interactions (Zuckerman et al. 2012), and an integrated biocultural approach using historical documents can answer some of these factors. It is also important to consider the impact of age, sex, and the overall health of the individual being stressed and their specific host resistance factors (Martin et al. 2013:11, Reitsema and McIlvaine 2014). Although Selyean stress models acknowledge that it is difficult to determine the sole mechanism by which "sociocultural events translate to disease" (Goodman et al. 1988:176), as a framework for understanding health it is heuristically useful.

In historical cemetery populations, it is possible to reconstruct some of the cultural buffering systems and culturally induced stressors the individuals would have encountered during life. This part of the stress model, however, is too often overlooked by bioarchaeologists. Even if the all other components of the stress model are employed, without a nuanced incorporation of the historic scenarios that impacted the biological responses of the people being studied, we are destined to create interpretations that are “wanting in relevance and significance” (Martin 1998:177). Historical cemeteries provide an opportunity to interweave the cultural and biological variables that result in skeletal indicators of stress.

Research Goals

The VMC historical cemetery (~1875-1935) was used by Santa Clara County to bury indigent patients from the county hospital, unknown individuals from the coroner’s office, and members of the community that could not afford private burial elsewhere (Rehor and 2015). Between 2012 and 2014, a portion of the VMC cemetery was excavated resulting in the exhumation of 998 burials, consisting of 1,004 individuals (Rehor and Beck 2015). This skeletal collection provides a unique opportunity to examine rural, western, frontier health amongst recent immigrants, migrants, and lower socioeconomic individuals at a crucial time in U.S. history.

This study seeks to examine the health of the most at-risk and least documented segment of the historical Santa Clara Valley population; indigents. The primary objective of this research is to understand the health patterns present within the VMC burials while incorporating both the mortuary archaeological and historical context of the burial ground. Furthermore, this research will study the health of the excavated individuals while specifically examining the biological impact of the county’s efforts towards public health initiatives, public policy toward the poor, and prevailing medical practices of the time. Paleopathological observations of specific and nonspecific indicators of stress will be used to establish prevalence rates within the sample and will be compared to available historical records. This research also seeks to focus on the comparison of the VMC sample with similar samples from indigent and non-indigent historical cemeteries. These comparisons will serve to establish the relative health of the VMC sample.

Significance of Research

This research will have implications for both bioarchaeology and mortuary archaeology, as it will address a portion of the mortuary and bioarchaeological record that has been addressed only in a limited fashion. Investigating VMC also presents a unique opportunity to examine historical immigrant groups that are not Western European in nature. Because VMC is located in San Jose, California, the ethnic makeup of the area in the late 19th and early 20th century is drastically different from both the East Coast and Midwest. California underwent many significant demographic, economic, and social changes during the mid 19th and early 20th centuries. The discovery of gold at Sutter's Mill in 1848, and California's admittance to statehood in 1850, created a precedent for a dramatic influx of domestic and international immigrants (Hall 1871; Foote 1888). Asian and Pacific Islander immigrants accounted for 6-9% of the total population of California between 1860 and 1900, but this group accounted for only 0.11-0.21% of the total U.S. population (Campbell and Jung 2002). By 1870 the percentage of foreign-born residents had risen from an initial 24% in 1850, to 37% (Wright 1940:332), and Chinese migrants were the second largest ethnic population in Santa Clara County (Tsu 2013). By 1870 the top five countries of origin for foreign-born residents in California were Great Britain (37%), China (23%), Germany (14%), Mexico (4.5%), and France (4%) (Wright 1940:340). In striking contrast to the eastern U.S., California displayed a heavily Hispanic population (Wright 1940, Pitti 2003), and in 1860 Santa Clara County likely boasted the largest Hispanic immigrant population in the United States (Pitti 2003:41). By the time VMC opened in

1871 (Foote 1888) the demography in California, and specifically Santa Clara County, was unique both in terms of the number of foreign-born residents, and their countries of origin.

By assessing the health of the individuals at VMC, while incorporating and interpreting both their mortuary and social contexts, this research will give a broader and more holistic understanding of rural, western, migrant, immigrant, and indigent health during the late 19th and early 20th century. Additionally, this research will demonstrate the implications of structural violence, social inequality, and institutional caregiving on both individual and population levels of health, thus also examining the potential timing of the second epidemiologic transition within this population. Historical records pertaining to the cemetery use are sparse. Therefore, the biological analysis of the skeletal remains offer an opportunity to fill in gaps in our knowledge regarding this period of Santa Clara County history.

Outline of the Dissertation

This dissertation addresses a number of important research questions: specifically, what is the impact of structural violence, public health, and institutionalization on the low socioeconomic individuals of Santa Clara County in the late 19th and early 20th century. Chapter two outlines the theoretical foundation of this dissertation.

Chapter Three discusses the historic era context of the California, with a specific focus on the Santa Clara Valley and immigration trends. Following the discussion of the larger historic context, a history of the development of the Santa Clara county hospital and the counties use and formation of potter's fields is outlined.

Chapter Four outlines the research questions and goals for this project. Chapter Five presents the materials including VMC, details regarding the excavations, and the comparative and historical records used. Chapter Six presents the results of the VMC skeletal analysis.

Chapter Seven presents the comparative sample results. Chapter Eight synthesizes the results of this study and presents interpretations of the skeletal pathology and mortuary analysis within larger theoretical frameworks

Chapter 2: Theoretical Background

Introduction

Historical mortuary sites are uniquely positioned to explore complex biological and social situations because of the cross-cultural, empirical, and diachronic perspectives that the skeletons and historic context can provide. The integration of empirical studies using skeletal remains with social theory to interpret the skeletal data provides an interpretive framework to better understand how social and political relations create specific health patterns (Klaus 2014a, 2014b; Nguyen and Peschard 2003). However, to date, few systematic studies of health have been conducted on large-scale historical cemeteries in the United States. Some bioarchaeological researchers have worked to broadly contextualize historic health patterns (Collins 2009; Dougherty 2011; Grauer and McNamara 1995; Grauer et al. 1998; Heilen 2012; Higgins and Sirianni 1995; Higgins et al. 2002; Lanphear 1988, 1990; Leavitt-Reynolds 2011; McGloin 2012; Milligan 2010; Phillips 2001A, 2001B; Richards 1997; Wesolowsky and Eila 1991), but the salvage nature of many of the archaeological projects, along with time and budgetary constraints, have limited the scope of past bioarchaeological research.

The studies of health, disease, and stress have been key components of bioarchaeological research since the beginning of the field (Cohen and Armelagos 1984; Buikstra 1977; Temple and Goodman 2014). Although bioarchaeology has attempted to move beyond the descriptive approach and embrace larger theoretical frameworks, the reality of integrating and examining the intricate biosocial processes that shape health and illness has remained an issue. Just as archaeological data is viewed as messy and thus often avoided by the bioarchaeologist (Goldstein 2006), so too is social data and theory.

Health and disease cannot be disassociated from the larger socio-political context and must be considered within the global (and regional) political-economic structure that shapes the local context of people's lives and becomes embodied biologically (Temple and Goodman 2014). It is not debated that skeletal morbidity correlates with lower social and economic status (Klaus et al. 2017; Danforth 1999; Larsen 1997), but it is often difficult to consider the interconnections of the full array of variables. The ability to consider the interconnections among these parts, including the ways they promote and reinforce each other, creates a "complex and burdensome web of intertwined health and social problems" (Singer 2009:xiv).

Health disparities examined in modern times are increasingly understood to be caused by social and economic inequality; "i.e., social bias and institutional racism, limited education, poverty, and related environmental conditions that either directly produce ill health or promote unhealthy behaviors that lead to poor health" (Mikkelsen et al. 2002:3). Historical cemeteries are uniquely positioned to allow bioarchaeologists to examine the biological impact of health disparities. Archival sources have the potential to provide abundant contextual information regarding both the individuals buried in the cemetery, and the social systems and policies operating during their lives. The physical remains of the people themselves can provide direct evidence of the biological impact of long-term and episodic health stressors.

To contextualize the methodological and theoretical frameworks employed in this dissertation, an overview of mortuary archaeology, bioarchaeology, paleopathology, and public health theory is discussed. Additional focus on class and race-based issues in public health, structural violence, and the epidemiological transition are also discussed as it relates to this research.

Mortuary Archaeology Theory

The study of mortuary rites and their archaeological correlates has been an integral part of archaeology since the beginning of the discipline. In the early twentieth century anthropological approaches to mortuary behavior focused on the assumption that funerary rituals hold social meaning (Rakita and Buikstra 2005). The concept of the "rite of passage" was developed by Van Gennep (1908) and is frequently used by anthropologists as a means to interpret mortuary behavior. Van Gennep (1908) proposed a three-part transitional period that involved rituals divided into stages of separation, transition, and reincorporation. It is through these specific processes that death is transformed from a threat into a normal part of life. By the mid twentieth century mortuary archaeological work began to critique Kroeber's idea that funeral rituals were unrelated to other social customs (Rakita and Buikstra 2005).

Hertz's (1960) publication marked a shift in mortuary studies. This work focused on expanding the meaning and context of mortuary rituals with a particular focus on secondary burials. Binford (1971) argued that mortuary studies should be used as a method to interpret social organization and complexity. He also suggests that as the number of social roles an individual held during life increases, so too does the symbolic representations of those roles in mortuary treatment. O'Shea (1981) expands on past work by comparing ethnographic status against the archaeological record to highlight both vertical and horizontal status differentiation. Morris (1992) addresses the need for mortuary archaeology to be integrated and well contextualized, specifically when it comes to incorporating other lines of evidence such as text, art, ethnography, and other types of archaeology/anthropology. He argues that in rituals people use symbols to make explicit the cultures' social structure. Parker-Pearson (1999) emphasizes that in mortuary archaeology we analyze the life of the individual, not their death. He cautions that we must be wary of how we separate the material culture on the body from the material culture of the body, from the material culture off the body.

Cemeteries and the Historical Era

Historic mortuary sites are uniquely positioned to answer questions surrounding the effects of large-scale political, social, ecological, and economic processes and their effects on the biology of members of those communities. The textual evidence available at historic period sites allows for anthropologists to provided more nuanced interpretations of historical narratives. Perry (2007) points out that both textual evidence and archaeological evidence must be examined for inherent biases. Perry (2007) demonstrates this with a case study from the Classical Near East where the bioarchaeological data contrasts with some forms of historic textual data.

Mortuary behavior in the United States and Great Britain underwent significant changes during the nineteenth and twentieth centuries. The rise of urbanism, industrial capitalism, and increased consumerism profoundly changes attitudes towards death, culminating in a trend of mortuary behavior commonly referred to as the Beautification of Death movement (Lee Decker 2009). Funerals and graveyards are important parts of rituals and are employed as communicative symbolic actions for the construction of ethnic and cultural identity (Reimers 1999). Cannon (1989) demonstrated that during the 19th and 20th centuries western mortuary displays went through cycles of elaboration and simplification due to funerals and mortuary monuments being used as opportunities for social advancement and social display. However, as noted by Aries (1974) there has been an increasing disconnection in the West of death, and the feelings and processes associated with it, from everyday thought.

As mortuary traditions shifted towards large ostentatious displays associated with the Beautification of Death movement, the funeral rituals of the poor were also impacted. This shift caused a major change in the final determination of one's social status from the time of death to the time of burial. Thus, being relegated to a simple, anonymous paupers burial became a source of great shame, highlighting a perceived failure on the part of the deceased (Laqueur 1983). Additionally, the anonymity of a pauper's burial impacted the use of these burial spaces as mourning and commemoration locations. Denied the ability to privatize burial space, the working class adopted a mutable language of loss, allowing for the veneration of the dead without definitive burial spaces (Strange 2003).

Identity

Mortuary practices represent the complex interplay of ritual, material culture, and social memory as seen through the material remains created by ceremonies. Archaeologists attempt to reconstruct social structure through the interpretation of grave goods, skeletal remains, and funerary structures. The translation of material culture and the material remains of mortuary rites into social identity is one of the most fundamental aspects of mortuary archaeology. However, in order to make these inferences, archaeologists must first consider the social, religious, political, and environmental dimensions of mortuary behavior in order to examine and reconstruct the social relationships between them (Carr 1995). We infer that material cultural patterning relates to social patterning (Shanks and Tilley 1987).

Many of these frameworks hinge on the belief that the embodied value of commodities is the connection between cultural material and existing social frameworks (Appadurai 1986). According to Budja (2010) the living use death rituals to negotiate the agency of both the living and the dead's relatedness; thus, these social structures should be reflected in mortuary contexts. It follows that mortuary ceremonies including grave goods deposited with the remains, the physical location of the burial, and relationship of the burial to the larger landscape all signal both social (vertical) and kin based (horizontal) levels of social configuration (O'Shea 1981). Tainter (1978) argues that social personae are determined by the larger group's social organization, which in turn is reflected in the mortuary ritual. He argues that in order to correlate mortuary data with identity the use of spatially distinctive groups of evidence to correlate burial type with social persona is necessary.

Peebles and Kus (1977) developed a model to describe some archaeological correlates of social hierarchy, with burial distinctions being one category of potential. They concluded that mortuary practices are the most effective way to demonstrate ascribed ranking of persons based on the symbols, energy expenditure, age, and sex of the individual. Cannon (2005) was able to demonstrate the role of age and gender in historic burial trends and patterns of mortuary treatment. However, Conkey and Spector (1984) argue that archaeology tends to reinforce modern culture-specific beliefs of gender when interpreting past societies. They suggest the reevaluation of many prior gender-based identity assumptions.

Interpreting Identity in Historic Cemeteries

Given the diverse demographic makeup of the historic United States, one of the central questions of any examination of a historic U.S. cemetery revolves around the concept of the identity of the individuals interred there. Bioarchaeologists and mortuary archaeologists are being asked to move beyond the basic biological profile, and to assess cultural affinity, identity, and relatedness. Unfortunately, when it comes to burial practices there is no simple correspondence between one's biological ancestry and one's culture. The assessment of individual identity requires a close examination of archaeological, osteological, and historical evidence. Belonging to a specific religious group could supersede the burial traditions of belonging to a specific ethnicity, just as being socioeconomically disadvantaged can impact a range of burial traditions. The intersection of religion, biology, culture, and ethnicity necessitates a nuanced approach where context means everything (Goldstein et al. 2012). Never the less, some cultural affinity trends have been established by examining the historic mortuary practices of different groups.

The transnational identity of Chinese migrants in the United States created a unique mortuary tradition. In Mainland China the prevailing death ritual was a combination of multiple religious denominations including Confucianism, Taoism, and Buddhism. Chinese belief holds that the dead can directly influence the lives of the living, thus many customs have remained relatively unchanged for centuries for fear of retribution. Graveside services include ritual wailing, fasting, burning of symbolic sacrifices, and offerings of food. Burial location and orientation is determined through geomancy in accordance with feng shui principles. Shrines to specific ancestors are maintained both in private homes, and ancestral worship halls. After a predetermined amount of time, individuals are disinterred, the bones are washed and the remains are re-deposited in an urn for a secondary burial (Rouse 2005). For the Chinese sojourners that died in America, an additional layer was added to the ritual; the transportation of their bones back to China for final burial in their home provenance. Chinese individuals that permanently resettled in the United States typically did not undergo the secondary burial, but maintained the other graveside and mourning components of the traditional mortuary ritual (Rouse 2005; Smits 20008).

African American burial characteristics were influenced first by slavery, and later by racial segregation. Within mortuary contexts enslaved Africans were given more cultural leeway than in other facets of their lives. Cultural transmission of traditional burial practices was also hindered by the age and gender distribution of individuals taken by the slave trade. There is also a lack of comparative ethnohistorical and archaeological data from Africa, which further limits the creation of burial typologies. However grave goods placed with the body, such as copper jewelry and cowrie shells, may offer the most obvious and abundant evidence (outside of the physical remains themselves) for identifying antebellum African burials. By the late 19th century African American burials, like many others, were homogenized by religious and cultural trends towards mass-produced coffins and coffin hardware (Jamieson 1995). In the late 19th and early 20th centuries American cemeteries reflected larger race, class, age, gender and religious distinctions. Thus, African Americans were often segregated into separate cemeteries, or in biracial burial grounds they were relegated to the outer periphery along with paupers and criminals (Kruger-Kahloula 1994).

Hispanic and Mexican American burial characteristics are heavily influenced by the wide scale adoption of Catholicism. The Catholic funerary model emphasized the need to put the soul to rest is consecrated ground. Funeral arrangements are made quickly, cremation is taboo, and the extended family is often included in burial decisions (Kalish and Reynolds 1981; Younoszai 1990). The corpse typically undergoes minimal treatment, and children are often dressed in white (Marino 1997).

The Beautification of Death movement significantly impacted Euro American burial characteristics in the historic United States. By the end of the eighteenth-century dramatic changes in both death rites and burial grounds had occurred. Rural areas continued more traditional mortuary rites with the body being washed and prepared by family or close friends, covered in a burial shroud, and then transported to the cemetery (Laderman 1996). By the second half of the 19th century, death was further segregated from the living. Industrialization and urbanization lead to the rise of undertakers, and the increased popularity of embalming removed the dying process from private homes and transferred the body preparation and disposal processes to professionals (Steiner 2003). The emergence of a low socioeconomic working class facilitated changes to a subsection of American mortuary rites. In opposition with the Beautification of Death movement, the poor were left with anonymous burials in potter's fields. This necessitated a more flexible mourning tradition within these groups, as the traditionally marked grave location was denied to them. These potter's field graves were also regulated by the government entity overseeing the process, limiting potential individual expression in burial characteristics (Rosenow 2015).

Ritual and Identity

To understand mortuary rituals and their accompanying behaviors, it is necessary to examine the symbolic roles these rites encompass. Death is a transition, both of the biological and social components of an individual's place in a community. However, it is important to keep in mind that death is inherently related to life (Metcalf and Huntington 1991). Bloch and Perry (1982) discuss death as a form of regeneration, and thus specifically focus on symbols of fertility and rebirth in funerary rituals. The key to the archaeological inference of ritual and performance from mortuary remains is the connection between social behaviors and the mortuary remains. The physical traces of rituals are used to interpret issues of power relations, identity, social transformation, and cultural constructions of ecology, community, and personhood (Swensen 2015). Swensen (2015) cautions that in understanding ritual, archaeologists need to recognize that rituals are not immediate proxies of other sociopolitical realities but are often vehicles of social change. Rituals related to death are of particular interest to archaeologists, as the treatment of human remains, and the accompanying processes often leave visible archaeological traces.

The connection between material culture and ritual hinges on the meaning conveyed by funerary objects and the placement of the dead. These are believed to reflect the social structure of the living population in that the social persona of the deceased is expressed in the mortuary ritual. According to Kuijt (1996) ritual behavior can also be employed as a framework for modifying social relationships, either by reinforcing social cohesion and community identity, or as a means to symbolize social change. Kopytoff (1986) argues that commodities are a universal cultural phenomenon, and that the exchange of commodities is a universal feature of human social life. Because commodities have value, and can be exchanged, they are of particular interest to archaeologists. Weiner (1983) explores the concept of inalienable wealth in which value is created in objects not because of their material value, but because of their cultural value. Thus commodities, or material culture, can be imbued with levels of both ritual and social significance. Weiner (1983) examines the implications of such types of wealth in the Maori, and arguing that in ranked societies social capital is often defined not only by relationship networks among the living, but the demonstrated connection to ancestors, thus specific types of objects display levels of cultural wealth. Goldstein (2000) demonstrates the connection between material cultural and inalienable wealth by examining secondary burial practices at Cahokia's Mound 72. She argues that the secondary burials could represent a form of inalienable wealth, as the individuals within the mound became a demonstration of group, rather than individual identity.

Placement and Spatial Analysis

Spatial analysis of burial locations is used to examine many dimensions of funerary ritual and social complexity. Saxe (1970) was one of the first to acknowledge and apply a spatial analysis to mortuary studies. Saxe sought to create a model of sociocultural systems based on mortuary practices through the formulation of eight specific hypotheses. With regards to spatial analysis, Saxe's hypothesis 8 argued that formal disposal areas of the dead are maintained by corporate groups with ancestral claims to that specific area (Saxe 1970). Goldstein (1981) challenges this hypothesis and noted that although bounded space is typically associated with corporate groups, not all corporate groups create and utilize bounded mortuary spaces. Brown (1995) supports the hypothesis but argues that there are some problems stemming from a misconception that hypothesis 8 defined a relationship between boundary rights and settlements. Brown argues that the patterns visible archaeologically are not the only part of the funerary ritual occurring. Brown suggests that the focus of funerary ritual related research should shift towards attempting to understanding the funerary process and how it benefits the living population.

Goldstein (1995) also proposes a multidimensional approach that considers both inter and intra site spatial dimensions, including their placement on the larger landscape. The benefits of this multiscalar approach is well-illustrated by Ashmore and Geller (2005), who examine the mortuary landscape of the formative Maya. They argue that placement within the larger landscape is just as important as individual burial placement within a defined mortuary burial boundary. Charles and Buikstra (2002) examine how the dead and the living interact by examining how the dead are placed, seen, and referenced by the living. They demonstrate this by examining changes in cemetery locations throughout the woodland period in the Illinois Valley. They argue that as group identity became more important for the living population, centrally constructed, easily sighted burial mounds were used to promote active engagement with the ancestors as a means to negotiate social and political spheres.

Bioarchaeology Theory

The field of bioarchaeology has its origins in the combination of human osteology and archaeological techniques to investigate the human condition and the role of the environment on human biology (Larsen 2006). Although the term bioarchaeology had been used previously, Jane Buikstra popularized its current usage in 1977 (Buikstra 1977). The development of bioarchaeology is often framed alongside the rise of the "New Archaeology" of the 1960s and the processual archaeology of the 1970s (Armelagos 2003; Buikstra 1977). Prior to this time, archaeological and osteological studies were strongly descriptive, rather than interpretive (Buikstra 2006). Buikstra advocated the need for an interdisciplinary research strategy that incorporated mortuary archaeology and osteology in order to investigate broad research problems including: burial program and social organization, daily activities and division of labor, estimates of population size and density, population movement and genetic relationship, and diet/disease (Buikstra 1977:71). The interdisciplinary nature of bioarchaeology allows for cross-cultural perspectives and larger evolutionary frameworks to be applied to studies examining the biological impact of cultural practices (Armelagos 2003).

The study of human remains and their integration into broader investigations of culture began, in the United States, prior to 1900 with Thomas Jefferson's burial mound excavations (Buikstra 2006). Jefferson combined osteological observations with archaeological contexts to answer larger questions about pre-contact North America. His studies influenced additional nineteenth century works of scholars including Samuel George Morton, Joseph Jones, Washington Matthews, Frank Hamilton Cushing, and George A. Otis (Buikstra 2006). Aleš Hrdlička and Earnest A. Hooton dominated early 20th-century physical anthropology, and their drastically different orientations to archaeological contexts and anthropological problem solving greatly influenced a generation of physical anthropologists (Buikstra 2006). Bioarchaeology's problem-oriented approach and hard science based analysis has proven especially suited for examining past human behavior and lifestyle including: quality of life, behavior and lifestyle, population history and biological relatedness (Larsen 2006). The procedures outlined in Standards sought to standardize recording methodology in human skeletal analysis (Buikstra and Ubelaker 1994). However, there are several theoretical and methodological issues that complicate the use of human skeletal remains for the reconstruction of past populations.

The seminal Osteological Paradox publication by Wood et al. (1992) presented three large issues that bioarchaeology and paleopathology needed to overcome; demographic non-stationary, selective mortality, and hidden heterogeneity. Demographic non-stationary refers to the issue of age-at-death distribution sensitivity to changes in fertility, but not mortality. This means that the often-used life expectancy or mean age at death are actually measures of fertility and not mortality. The second issue of selective mortality grapples with the fact that bioarchaeologists never have a sample of all the individuals at risk of death or at a specific age. The skeletal samples we use are only individuals that died and happen to end up in any given burial context. Hidden heterogeneity is the unknown variation present in underlying frailty or susceptibility to disease and death. Frailty can be impacted by biological factors such as genetic predisposition, or cultural factors like socioeconomic differentials. These major issues make it impossible for bioarchaeologists to obtain direct estimates of demographic and epidemiological rates from archeological samples (Wood et al. 1992). Wood et al. (1992) suggest four specific areas of research that may help solve the Osteological Paradox: (1) research on the underlying causes of heterogeneity in individual frailty; (2) research on the relationship between frailty and the risk of death; (3) research on pathological lesion formation processes and the interaction between frailty and the risk of death at different stages in the disease process; and (4) the role of culture in heterogeneity and culture's interaction with selective mortality.

Dewitte and Stojanowski (2015) summarize and analyze research on Wood et al.'s Osteological Paradox in the approximately 20 years since publication. They argue that although Wood et al. is a seminal document in the history of the field there are many misperceptions, and few authors have actually attempted to directly tackle answering the issues of the osteological paradox. Dewitte and Stojanowski note that particularly in the last five years (preceding the 2015 publication) paleopathology and bioarchaeology have developed new techniques (such a genomic, phonemics, epigenetics, parasitology, and stable isotope analysis) and perspectives that have allowed more researchers to tackle the osteological paradox in direct and meaningful ways. They call for a multidisciplinary bioarchaeology with an emphasis on cultural context with research that examines heterogeneity of frailty as an important component of the research design itself.

Paleopathology Theory

The definition of paleopathology has changed over time, today paleopathology is the study of the evolution of human diseases, human adaptation to the environment, and the interactions between human culture and infectious/noninfectious diseases (Grauer 2012; Zuckerman et al. 2012). Before the 20th century the discipline was focused on descriptive and typological approaches examining the origins and antiquity of specific diseases with little incorporation of theory. During the early 20th century (1900-1960), following trends in wider anthropology, paleopathology began to consider diseases in broader biological and social contexts. This was pushed forward greatly by Hooton's 1930 Pecos Pueblo study, and the development of Washburn's "new physical anthropology" in the 1950s (Zuckerman et al. 2012).

In the 1960s the focus shifted to ecological, epidemiological, and evolutionary considerations. The development of processual archaeology, and the emergence of ecological and biocultural approaches in conjunction with the recognition of skeletal indicators of stress allowed for the investigation of adaptation in past populations (Grauer 2010; Zuckerman et al. 2012). The 1970s and 1980s were greatly impacted by improved dating techniques, larger sample sizes, and the recognition of the issues with specific diagnoses. This allowed for research projects to examine large scale epidemiological and culturally/ecologically relevant interpretations of diachronic trends in health (Zuckerman et al. 2012). Since the 1980s methodological advances in biomolecular and biochemical techniques such as; stable isotopes, parasitology, and ancient DNA have largely affected paleopathology.

Population level analysis has allowed the theoretical investigation of paleopathology with larger issues such as social roles, social status, living environments, activity patterns, disease and diet, disease lesion relationships, and injuries/treatment (Boldsen and Milner 2012; Buzon 2012). Though it is stressed that solid archaeological techniques and context are necessary to integrate paleopathology with larger evolutionarily based lines of inquiry. Researchers caution that it is necessary to consider the specific place, time, sex, age, socioeconomic position, and residential location when putting disease into a population context. Although there has been progress in the methodological approach to paleopathology, there are still many diagnostic and theoretical issues that must be overcome. These include the adequacy of archaeological samples, sample size, accuracy of diagnosis, research design issues, and contextualizing the meaning and importance of research questions (Ortner 2003a; Ortner 2009). Paleopathological research should strive to contribute to understanding the significance of disease in human societies or the evolutionary processes that shape present day and the future (Ortner 2009).

Stress/Non-specific Infections

Bioarchaeologists are limited in the ways health and stress can be documented from skeletal remains. This interpretation requires evaluating an individual's response to stressors by examining the presence and severity of skeletal lesions such as enamel hypoplasia's, porotic hyperostosis, cribra orbitalia, periosteal reactions, and other systemic infections (Lewis and Roberts 1997). However, skeletal tissue most often responds in nonspecific and generalized ways to stress and disease, making the diagnosis of specific causes/pathogens difficult. Most current bioarchaeological studies examine health within the framework of Selyean stress, where stress is a biobehavorial response to external environmental conditions (Goodman et al. 1988, Klaus 2014). Although Selyean stress models acknowledge that it is difficult to determine the sole mechanism by which "sociocultural events translate to disease" (Goodman et al. 1988:176), as a framework for understanding health it is heuristically useful. Schell (1997) made the important point that although many researchers treat culture as a buffer to stress, it can also be the causal agent.

There have been some critiques of the application of "stress" and "health" in bioarchaeological research. Temple and Goodman (2014) argue that bioarchaeologists are not actually measuring health outcomes when they talk about stress response. Klaus (2014) is a bit more optimistic, but stresses that bioarchaeology needs to be more interdisciplinary in order to better understand biological stress and disease outcomes. These issues are highlighted in works by Weston (2012) and Walker et al. (2009). Weston (2012) argues that bioarchaeologists don't really understand the physiological response bone takes to stress events, and that the interpretation of periosteal reactions as generalized nonspecific reactions ignores biology. In a similar vein Walker et al. (2009) suggests that long standing assumptions regarding the relationship between cribra orbitalia and porotic hyperostosis with iron-based anemia are wrong based on the physiological way hematopoietic marrow expansion occurs.

Measuring Indicators of Health: Infections and Degenerative Changes

Although the skeleton generally responds to stress and infection in nonspecific ways, there are several instances in which a specific disease can be pinpointed. This includes leprosy, treponemal infection, tuberculosis, and most metabolic disorders. Due to their pathognomonic natures these diseases have received ample attention in paleopathological research.

Leprosy, also known as Hansen's disease, is caused by the bacteria *Mycobacteria leprae* (Lynnerup and Boldsen 2012). Although this disease has been documented since 2,500 BC and studied intensively, the exact path of contagion is still unknown. Disease manifestation is extremely variable and can range from mild to very severe, therefore only a small portion of the total infected population will progress to skeletal involvement. The paleopathological diagnosis is further aided by a strong historical documentation of the disease. Because leprosy is severely debilitating and causes overt physical symptoms, sufferers were often segregated into leper colonies and buried in segregated cemeteries (Lynnerup and Boldsen 2012). Skeletally leprosy is characterized by resorption of the anterior nasal spine, alveolar resorption (with loss of the maxillary incisors), periostitis of the maxillary palate, and contraction of the hands and feet. The accumulation of bacteria in nerve sheaths of the peripheral ulnar and fibular nerves leads to a loss of motor function and causes high rates of secondary infections in the damaged tissue that results from the loss of sensation (Lynnerup and Boldsen 2012).

Tuberculosis (TB) is an infectious disease caused most commonly by the bacteria *Mycobacterium tuberculosis* (in humans) and rarely by *Mycobacterium bovis* (in humans and cows). Prior to the genomic sequencing of TB in 2002, it was believed that *M. tuberculosis* developed from *M. bovis* as a byproduct of animal domestication. However, the DNA analysis concluded that *M. tuberculosis* predates the domestication of animals by thousands of years. TB causes skeletal changes in the post-primary stage of infection, 3-5 years following initial infection. Skeletally TB is recognized primarily through destructive lesions of the lumbar and thoracic vertebral bodies (Pott's disease), periosteal pitting and new bone formation on the visceral rib surface, calcified pleura, hypertrophic pulmonary osteoarthropathy, and septic arthritis (although some of these responses are nonspecific and can be caused by other pathological conditions). TB has been documented as far back as the 3rd millennium B.C. in specific parts of the world but is absent from parts of North and most of South America, Africa, and most of eastern Europe and Asia. However, this absence may be due to preservation, culture, and lack of bioarchaeological work in many of those locations, rather than a historical lack of the disease itself. TB is still a major concern globally today, with millions of cases and the emergence of antibiotic resistant strains (Roberts 2012).

There are four distinct types of treponemal diseases: pinta, yaws, bejel (endemic syphilis) and syphilis (venereal syphilis). Yaws, bejel, and venereal syphilis all have the potential to manifest skeletally, while pinta only impacts the skin. There is considerable overlap in lesion type, distribution, and frequency between treponemal variants. Treponemal disease manifests in three stages: primary, secondary, and tertiary. Primary infection rarely involves the skeleton, producing only mild, non-diagnostic lesions. Secondary stage infection also produces periosteal reactions, though they are very mild and often completely remodel. Tissue is damaged by localized and systemic inflammation however distinctive skeletal lesions appear only in the tertiary stage. Tertiary infection involves periosteal reactions, osteitis, osteomyelitis, and gummata necrotizing lesions. Tertiary lesions are characteristically bilateral and systemic.

Excessive periosteal deposition results in pseudo-bowing of the tibia, commonly referred to as saber shins. Cranially, tertiary infection can cause palatal perforation, rhinomaxillary destruction, periosteal reactions on the maxilla, and *caries sicca* on the vault (Harper et al 2011).

There are three competing theories regarding the evolution and spread of treponemal diseases: Columbian, Pre-Columbian, and Unitarian. The Columbian hypothesis suggests that venereal syphilis originated in the New World and was introduced into the Old-World following Columbus's return from the Americas in the 15^{th} century. The Pre-Columbian hypothesis argues that treponemal disease existed in the Old World prior to 1492. The Unitarian hypothesis argues that treponematoses are environmentally determined variants of a single flexible disease and are thus a reflection of cultural changes. The Unitarian hypothesis has been discredited by recent genetic evidence that shows three distinct treponemal subspecies with different evolutionary trajectories (Harper et al. 2011). Both the Columbian and Pre-Columbian theories hinge on proper diagnosis of treponemal disease skeletally. Proponents of the Columbian hypothesis, such as Rothschild (2005), point to data suggesting that syphilis is absent from pre-Columbian Europe, Africa, and Asia, while it has been identified in North America as far back as 8,0000 years ago. However, Harper et al. (2011) assessed 54 published reports of supposed pre-Columbian, Old World treponemal disease. They found no solid evidence for a single case of Old World treponemal disease with a certain diagnosis and secure pre-Columbian date. They conclude that the diagnosis of syphilis is complicated by the continued use of specific and non-specific indicators by paleopathologists.

The final category of specific diseases is metabolic disorders. Metabolic disorders are all based in nutritional issues, be it the result of too much or too little of some food component. Vitamin C deficiency, known as scurvy, is characterized in subadults by subperiosteal hemorrhages, hypertrophic lesions, abnormal flaring of ribs, and cortical thinning of long bones. Healed scurvy presents as coarsely structured transverse bands. There is sparse evidence of adult scurvy. Rickets and osteomalacia are associated with a lack of vitamin D. Too little vitamin D prevents mineralization of bone protein. Rickets is a systemic disease of early childhood that extensively impacts the growth and shape of the skeleton, causing bending deformities of the long bones and brittle stress fractures. Osteomalacia is connected with intestinal mal-absorption of calcium and vitamin D in adults. Because the skeleton is no longer growing, osteomalacia impacts the remodeling of trabecular and compact bone, causing diffuse diminished density (Ortner 2003c).

Paleodemography

Paleodemography is the study of past population dynamics including age and sex. The interpretation of skeletal age distribution has been the focus of paleodemography since the 1920s. Critiques of paleodemography, responded to in turn by equally strong defense of the subject, have focused on measurement and analytical concerns (Bocquet-Appel and Masset 1982). Bocquet-Appel and Masset (1982) argue that osteological methods for estimating age and sex from skeletal remains are flawed. They contend that age structures of skeletal samples reflect the age structure of the reference population that was used to create the aging standard, and thus not a true reflection of that population. Second, they feel that age estimates on adult individuals lack sufficient accuracy (they argue that only an accuracy rate of .9 or better would work) to produce legitimate demographic profiles. Van Gerven and Armelagos (1983) present research to contradict Bocquet-Appel and Masset's assertions. Their data fails to support Bocquet-Appel and Masset's conclusions, and the authors argue that paleodemography does have an important future and application. Supporters of the field (Konigsberg and Frankenberg

1994; Frankenberg and Konigsberg 2006; Milner et al. 2008; Meindel and Russell 1998) argue that the critiques have spurred much needed constructive debate and timely reexaminations of models and assumptions.

Beginning in the 1960s and 1970s demographic data began to be presented using life tables derived from the age profiles of skeletal samples. Life tables are used to measure mortality, survivorship, and the life expectancy of a population at varying ages. However, this approach treats skeletal samples as stable populations, with all skeletons deriving from a single population. Beginning in the 1980s demographic analysis transitioned to the use of hazard models (Frankenberg and Konigsberg 2006; Meindel and Russell 1998). Hazard models are nonlinear mathematical functions that represent age related changes in the risk of dying, i.e. the hazard function (Gage 1991). Hazard models, including Siler and Gompertz functions, allow for the use of age ranges and counter some of the limitations of life tables. Hazard models provide a more accurate method of statistically controlling for age related biases and relative risk (Gage 1994).

Public Health Theory

The modern public health movement began as a response to the negative impacts of industrialization and urbanization (Numbers and Leavitt 1997). The spread of epidemic disease drew attention to the poor living and working conditions of the lower classes. American public health was greatly impacted by the work of Edwin Chadwick, whose work in England reshaped thinking about pure water delivery, the removal of sewage, and the collection and disposal of trash. Chadwick pushed forth the notion that publicly run works, and new technology, would improve the unhealthy living conditions of society. This challenged the prevailing notion that poverty itself was the main cause of illness by refocusing attention on the environmental and social factors that impact health. In both England, and the U.S., statistical studies of health and disease became an important component of public health reform arguments (Melosi 2000a). By the mid 1800s many cities has established city health boards that worked with government institutions such as the almshouse and local hospital (Duffy 1990b; Leavitt 1982; Melosi 2000b). However rapid urban growth soon necessitated major improvements (or the creation) of public works. Additionally the advent of bacteriology had major impacts on the priorities of public health, as greater attention was thus paid to biological pollutants in water supplies, food, sewage, and refuse (Melosi 2000b).

The miasmic theory of disease was the dominant theory prior to the development of the bacteriological theory of disease transmission, (Duffy 1990a). This theory held that bad vapors emanating from sewage and wastewater were the cause of disease. The transition to bacteriological theory in the later part of the nineteenth century was slow amongst the public. This is highlighted by the case of "Typhoid Mary" and the personal and public backlash to her imprisonment (Leavitt 1997). Public health campaigns worked to change popular attitudes and beliefs about infectious diseases. At a time when public health services were still new in many parts of the country (Bernstein 1972), the public was urged to take charge of the health and cleanliness within their own homes (Tomes 1997). The public health movement had a direct impact on morbidity and mortality trends in the United States. As cities worked with public health officials to clean up waste, provide clean drinking water, and to monitor the spread of food born illness (such as with milk) infant mortality rates declined, average life expectancy increased, and many types of epidemic diseases were controlled (Duffy 1990a; Halverson 1949; Melosi 2000a).

Social welfare has been a contentious issue throughout American history. Prior to the formation of centralized institutional care in the mid nineteenth century, the primary form of social welfare was outdoor relief. Outdoor relief was usually cash or goods given directly to destitute individuals, typically widows, children, the elderly, and the sick. Outdoor relief was routinely challenged because proponents argued that those on relief did not actually need help, and that providing cash and food removed any incentive to work. At this time destitution was believed to be caused by failure of moral character (Katz 1986b). Weakened by social animosity and overburdened by the increase in individuals seeking aid, by 1850 outdoor relief was generally replaced by centralized government run institutions. These poor farms, almshouses, insane asylums, juvenile detention facilities, jails, and hospitals because the dominant form of social welfare. Distinctions were made between the able bodied poor and the infirm. If an individual was deemed able bodied, they typically were placed in a poor farm where they were required to work for their room and board (Katz 1986a; Wagner 2005). The infirm were funneled into hospitals.

Hospitals were not always viewed as accepted places to receive medical care. When centralized non-private hospitals began to develop in the mid nineteenth century, they were highly stigmatized and viewed as dumping grounds for the urban poor (Waller 2014). The Civil War marked a turning point for popular understanding and acceptance of medical institutions. Because of the Civil War a large cross section of the American male population experienced the reality of “modern” institutional medical care (Rosenberg 1987). As both the quality of hospital care, and the quality of medical training improved, social attitudes towards institutional medical care changed (Christianson 1997). Between 1850 and the early 1870s hospital growth increased dramatically, spurred by social welfare reform and public health activism (Rosenberg 1987;

Waller 2014). Though major medical improvements had occurred, and the hospital was seen as part of good public stewardship, it wasn't until the turn of the twentieth century that middle- and upper-class individuals began regularly using public hospitals (Waller 2014). However, a major function of public hospitals remained the medical aid of the dependent poor. Lovell (1943) highlights how the larger numbers of sick and impoverished immigrants arriving in California, both during the Gold Rush and the Dust Bowl, necessitated the early creation, and long-term continuance of public health policies and state-run institutions to care for the destitute.

More often than not indigent individuals under state medical care died. The institutional management of indigent bodies is the final segment of state-run social welfare (Hoffman 1919). As the cost of funeral expenses outpaced the economic means of many working-class families, internment in a government run county potter's field was not uncommon, even if the individual had not been treated in medical institutions (Kleinberg 1977). Changes in both public health policy, the large numbers of individuals living outside of their close kin networks, and the increase in the number of poverty-stricken individuals all served to make pauper burials a reality of American life.

In order to address the consequences of institutionalization it is necessary to first examine the historical record and develop a cultural context of institutional life. Institutional burials and their cemetery records are often poorly maintained while the burial ground is in use, and records of who is buried there or where the cemetery physical is after it falls out of use is typical. Anthropologists are faced with the task of re-associating these remains with difficult to construct contexts. The bioarchaeology of institutes is truly the bioarchaeology of poverty.

The Industrial Revolution ushered in the emergence of a heterogeneous poor lower working class (Phillips 2001b). Just as it is today, historically poverty was highly stigmatized.

The rise of wage labor resulted in increasing scrutiny of able-bodied individuals seeking alms. This negative attitude toward the dependent poor is reflected in institutional cemeteries. Nawrocki (1990) suggests that poverty is one factor that can explain the invisible nature of institutional burial grounds. The minimalist mortuary treatment, and lack of hesitation in removing these individuals, may also represent a gap in social memory.

The nineteenth century is significant because it was during this time that social policies and medical science were first applied to social issues in North America (Phillips 2001A). These cultural developments transformed the social and environmental landscape via prisons, workhouses, and asylums. "The universal response in Europe and the United States was aggressive action to preserve the social order by re-creating "normalcy" within the institutional environment" (De Cunzo 2006:168). Prisons and asylums served as long term custodial homes, while almshouses and hospitals were short-term residences (Katz 1986c). Institutions were (and still are) places of othering, places of discipline, and places of monotony that served to institute moral management.

Additionally, during the nineteenth century the burgeoning public health movement was viewed as a solution to the increasing impact of disease in America's urban cities (Bernstein 1972; Duffy 1990; Melosi 2000). These new public health movements worked in tandem with the rise of institutions to mediate the impact of the near epidemic proportions of infectious disease in urban areas. The biological consequences of institutions and public health policies are tangible.

Race and Class Issues in Public Health

Not everyone benefited equally from public health initiatives as issues related to social class, race, and ethnicity impacted public health access. Immigrants, and migrants, were consistently associated with germs and contagions. They were stigmatized as the cause of a wide variety of social and physical ailments (Markel and Stern 1999,2002). This issue has been well documented in many time periods and places in the United States.

Shah (2001a, 2001b) chronicles the production of the Chinese as different and a threat to white norms within public health knowledge in San Francisco. She argues that for over sixty years the Chinese were characterized as a health menace based on ideas surrounding their citizenship, conduct, and health. Public health officials portrayed the Chinese as vectors of contagious disease, and as willfully defying public health code. Through scientific observation, manipulated statistics, and mapping of public and private living spaces, public health officials portrayed the Chinese as threats to middle-class white ideals, and as deviant, inhuman creators of ill health (Shah 2001a, 2001b). Wallace (2017) argues that similar to Shah's study of the Chinese in San Francisco, south Asian immigrants on the west coast were also the victim of discriminatory public health and immigration policies.

The concept of disease is a powerful trope in the racialization of Mexicans and Mexican Americans. Invoking them as a diseased "other" worked to construct social and cultural strife and internal borders against Mexicans and Mexican Americans in the United States. Mexicans are historically (and currently) characterized as a socially under privileged population that creates public health problems (Molina 2016). Public health trends emphasized the prevalence of disease amongst Mexican immigrants, depicting them as willful agents, rather than victims of the disease. This was often used as evidence to support deportation and stricter immigration policy. In historic Los Angeles when Mexican migrants applied for financial assistance or medical care, they were given train fare to get them out of the area, rather than being supplied with proper aid (Abel 2007). As health and hygiene norms increasingly became associated with standards of “Americanness”, public health officials were able to determine who and what was considered an “American” habit, thus branding any deviation as a defiance of acculturation (Molina 2006).

Ethnic affiliation was not the only precursor for unfair public health access as social and economic class also impacted access to health care. Although many public health programs and policies were aimed at areas of low economic means, the urban poor were often targeted as the cause of contagions and epidemics. Often the correlation between social categories and deviance made by public health officials were spurious and caused by the way the public health agency measured deviancy and disease (Kadushin 1964). An excellent example of the impact of unbiased data is found in the handling of tuberculosis mitigation and reporting in New York City at the close of the nineteenth century. When compulsory notification of contagious or communicable diseases was instituted, the city was able to recognize patterns of contagion by creating an early form of epidemiological statistics. This allowed the proper focus of general social welfare to all social and ethnic groups, rather than unnecessarily targeting a specific group for medical discrimination (Fox 1978).

Prior to the mid 19th century, the local dispensary was the primary means of providing care for the urban poor. Dispensary’s provided medication, vaccinations, diagnoses, and played an important role in public health management. By the 1920s the dispensary had been pushed to the wayside, replaced by institutional hospitals. Because the urban dispensary no longer fit the public’s perception of health care, the urban poor lost this crucial health amenity (Rosenberg 1997). As the bacteriological theory of germ disease became more accepted, it caused an indirect impact on social and political reform. The middle and upper classes sought to insulate themselves from the potentially hazardous conditions surrounding the working class. As urban slums worsened, and "diseases of the poor" spread, public health became a concern for all of the class (Duffy 1978:423).

Structural Violence

The biological impact of social inequality has been extensively documented across multiple cultures and time periods. Anthropologists have attempted to incorporate the theoretical social framework of structural violence into this work. Sociologist Johan Galtung (1969) developed the term "structural violence" to describe the social structures that suppress agency and impair the social, economic, and biological potential of an individual or group. It is structural because it is embedded in the political and economic forces that constitute social structures and organizations. It is violent because it results in direct injury or death (Farmer et al. 2006, Nystrom 2014; Nystrom et al. 2016). Gender, ethnicity, and socioeconomic status play a role in creating the time and place specific vulnerability responsible for health-related inequality. Both social and biological distinguishing characteristics can serve as a pretext for discrimination, however no single axis can fully define or predict an increased risk for suffering (Farmer 2004, 2006). Poverty can also diminish the protective status conferred by specific genders, ethnicities, and religions as it can crosscut all of these categories. Although cultural and medical anthropology has repeatedly made the link between structural violence and disease (Bourgas 1995, 2010; Scheper-Hughs 1992; Farmer 1996; Farmer et al. 2006, Singer and Clair 2003; Quesada et al. 2011), this concept has not been widely applied by bioarchaeology. Disease has a documented relationship with social inequity and the unjust exercise of power; issues that have played an important role in human disease history and thus human history in a wider sense. They also have a significant impact on modern populations, and are likely to have a significant influence on the emergent health profile of the twenty-first century (Singer 2009:xv).

Bioarchaeologists that have incorporated structural violence frameworks in their research have focused on direct physical violence as sanctioned forms of control and power (de la Cova 2008, 2011; Geber 2015; Klaus 2014a, 2014b; Martin et al. 2010; Perez 2014; Robbins et al. 2012; Schug et al. 2013). Although several studies have incorporated health and pathological data (de la Cova 2011, 2012, 2014; Robbins et al. 2012; Schug et al 2013), only Klaus (2014a, 2014b) includes a broad range of health-related data to evaluate the long-term biological impact of structural violence. This pattern of social violence leaves observable and quantifiable biological impacts on the body. Social inequality is embodied via risk and is visible in the different prevalence's of disease, as well as the outcomes between different social groups. The risk, be it actual or perceived, can itself be a measure of social violence (Nguyen and Peschard 2003). The relationship between inequality and health disparities and disease processes is a form of structural violence enacted through cultural and governmental policies and rationalities. Historically the reformation of social welfare policies led to an increase in structural inequality (Nystrom et al. 2016).

Klaus (2014a) suggests that structural violence, as an interpretive framework in bioarchaeology is relatively simple. "Socially constructed restriction of resources can and does cause harm and death, evidence of which can manifest in skeletal and dental tissue. Under such conditions, disparities in health reflect a form of violence" (Klaus 2014a:35). Bioarchaeologically structural violence could be the driving social force behind the morbidity associated with conditions such as enamel hypoplasias, anemia, stunted growth, and infection (Klaus 2014a:34). However, there are specific contextual circumstances in which it is appropriate to apply structural violence as a theoretical model. Additionally, to apply structural violence it is important to remember that a thoroughly and deeply embedded engagement with archaeological and historic contexts is necessary (Buikstra 2006; Goldstein 2006; Klaus 2014a; Palkovich 1996), thus limiting the type of sites it can potentially be applied to.

Because structural violence hinges on how social inequality is produced and exercised in a rigidly hierarchical society, it is historically contingent on specific social trajectories. Klaus (2014a:35) argues that it is most applicable to Western contexts with capitalist-style political economies and cautions against applying it elsewhere. Structural violence can also build upon a Foucaultian inspired thesis that in modernity violence is sublimated and transformed in historic (and modern times) into a more "insidious and pervasive ordering of bodies through institutional practices" (Nguyen and Peschard 2003:457). Thus, institutions become the perfect microcosm within which to examine the biological consequences of structural violence. The conditions experienced by inmates reinforce both social and health inequalities (Nystrom et al. 2016).

Epidemiological Transition

Another theoretical conceptual framework for discussing how disease patterns change overtime is epidemiologic transition theory. It focuses on the complex changes in patterns of health and disease overtime and the interactions between these patterns and their demographic, economic, and sociologic determinants and consequences (Orman 1971). The original model introduced by Orman (1971) sought to capture the changes in cause-specific mortality following the industrial revolution in the United States and Western Europe. It has since been integrated within a wider evolutionary framework (Barrett et al. 1998; Armelagos et al. 1996, 2005; Zuckerman 2014). Although the demographic transition is an important theoretical component of many physical anthropological studies, within paleopathology the epidemiological transition is focused on more frequently.

The classic model is now referred to as the second epidemiologic transition, bounded by the first transition coincident with the rise and intensification of agriculture (Cohen & Armelagos 1984), and a third transition of emerging and reemerging infectious diseases in the modern era (Barrett et al. 1998). Although many studies have addressed the characteristics and impact of the second epidemiologic transition (Omran 1971, 1983; Preston 1976; Higgs 1979; Preston and Haines 1991; Schofield and Reher 1991; Gage 1993, 1994, 2005; Barrett et al. 1998), critics have suggested that the model fails to recognize and incorporate the impact of culture, socio-economic forces, political forces, and health policy in understanding epidemiological profiles (Defo 2014; Harper and Armelagos 2010).

Armelegos (2014) argues that high levels of social stratification means that not all citizens benefited from the improved nutrition, improved sanitation, and medical advances often correlated with the decline in mortality seen during the second transition. However, very few papers have examined socio-economic status as a condition of transition timing. The few that have (de la Cova 2012, 2014; Kitson 2014; Sattenspiel and Lander 2014) support the notion that changing socioeconomic structures directly challenge the fallacy of a universal epidemiologic transition (Zuckerman 2014). Nineteenth century America saw rapid increases in population, increases in the amount of urban residents, and virulent epidemics. Additionally, because this framework emphasizes both socioeconomic and ecological factors as primary determinants for disease mortality risk during the epidemiological transition (Barrett et al. 1998), the widening socioeconomic gap during this time is an important factor to consider. Not every group or population reached the second epidemiological transition at the same time (Barrett et al. 1998, Omran 1971, 1983). But what has not been examined yet in depth is to what degree socioeconomic or cultural disparities viewed archaeologically and skeletally can be used to examine epidemiological transition timing.

The typical generalization of rural v. urban differences in mortality during the second transition follows that mortality was higher in urban than rural areas historically, but has shifted in more recent times. However, the generality of this description is in question (Gage 2014:386). Simplifying geographic contexts to a rural v. urban dichotomy oversimplifies the demographic, educational, socioeconomic, and public health related differences between two locations. Additionally, this view fails to take into account any community-level variables affecting mortality differentials. “Perhaps community characteristics do make a difference” (Gage 2014:387).

Summary

This dissertation seeks to address the health of individuals interred at the Santa Clara Valley Medical Center historic cemetery by utilizing specific theoretical approaches. To understand why pathological and demographic prevalence’s occurring at the cemetery theories regarding structural violence, paleopathology, epidemiological transitions, and public health will be used. A contextual approach will be used to interpret the skeletal and mortuary data within time and place specific historic contexts.

Chapter 3: Historical Background

"*Most of the western states have been peopled by a steady influx of settlers from two or three older states. Minnesota, for instance, and Iowa have grown by the overflow of Illinois and Ohio, as well as by immigration direct from Europe. But California was settled by a sudden rush of adventurers from all parts of the world… This mixed multitude, bringing with it a variety of manners, customs, and ideas, formed a society more mobile and unstable, less governed by fixed beliefs and principles than one finds in such Northwestern communities…" James Bryce* 1891:887-888

Introduction

Although there is a robust pre-historic record in the greater San Francisco Bay area, this historical background chapter focuses on the historic-era context of Santa Clara Valley, California. To understand the framework within which the Santa Clara County Infirmary and its burial ground were established and operated, it is necessary to focus on the areas more recent history. The Santa Clara Valley Medical Center (VMC), and its predecessor the County Infirmary/Hospital, developed in response to a multitude of regional and global historic events. This historical context provides a summary of the pertinent events surrounding the European exploration and settlement of the Santa Clara Valley, focusing on San Jose, a brief framework of medical care in early California, and a historical overview of the establishment of the Santa Clara Valley Medical Center and the historic era cemetery associated with the Infirmary.

Historic Era Context

Spanish Period: 1777-1810

In January 1777, Father de la Peńa and several Spanish soldiers set out with their families from Mission San Francisco de Asis to establish a mission on the banks of the Guadalupe River (Garcia 1997). This settlement would become the Mission de Santa Clara de Asis (Mission Santa Clara), and served to solidify Spain's claim to the area. Spain's method of colonization consisted of three complimentary institutions: the pueblo, the mission, and the presidio (Garcia 1997:8). Jose Joaquin Moraga founded the Pueblo de San Jose de Guadalupe in the general area of modern downtown San Jose by November 1777 (Rehor and Beck 2015). This was the first pueblo in Alta California[1], and the Spanish government hoped this could entice further settlement of the area (Pitti 2003). The presence of the Mission and Pueblo made the valley a place of central importance to the Spanish empire.

The mission prospered, due in part to the rich agriculture soil in the surrounding territory. This agriculture was fueled by the manual labor provided by Ohlone neophytes (Pitti 2003). The pueblo grew in size rapidly, roughly doubling every twenty-five years (from 1790-1846, Source: Pitti 2003:12). Following the Mexican Revolution in 1810, Spain lost control of Alta California. The lack of Spanish supply ships resulted in the pueblo, and the San Francisco presidio, becoming increasingly dependent on the mission for sustenance (Garcia 1997:8).

Mexican Period: 1810-1848

The shift to Mexican rule had dramatic impacts on the mission and surrounding community. The 1834 Act of Secularization resulted in the redistribution of land previously held by the mission/pueblo (Garcia 1997). This act gave residents enough land to establish large herd of cattle, and also gave residents a ready source of cheap labor to work in the fields by taking this land away from the surviving Ohlone. Between 1834 and 1836 over eight million acres of land were opened to private ownership (Garcia 1997:14).

During this time period, inhabitants of Alta California were dealing with not only major changes imposed by the Mexican government, but with the influx of American settlers. Tensions

[1] A historic geographic region that roughly corresponds to present day California, Nevada, Utah, and Arizona.

were high, and by 1844 a small civil war had begun. The 1844 Revolution was short lived, but it created uncertainty amongst the foreign-born population with regards to the province's power base (Garcia 1997:21). By 1845 several nations had challenged Mexico's claim on Alta California. In 1846 immigrants were arriving in larger numbers, including the Bear-Flaggers[2] under the command of U.S. Army officer John C. Frémont (Pitti 2003: 29). Many *Californios*[3] did not oppose the impending American takeover and laid down their arms or joined them. The Mexican American War, begun in 1846, was relatively short lived, and on February 2nd, 1848 Mexico signed the Treaty of Guadalupe Hidalgo and ceded Alta California to the United States (Pfaelzer 2007).

American Period: Post 1848

Although the influx of immigrants to date seemed daunting, it was nothing compared to what was to come. On January 24th, 1848, just nine days prior to the signing of the Treaty of Guadalupe Hidalgo, gold was discovered in the Sierra foothills (Garcia 1997, Pitti 2003). The gold strike not only brought waves of foreigners into California, but also caused a mass exodus from the Santa Clara Valley, so much so the area was nearly depopulated. So much food went unharvested that it rotted in place, causing near catastrophic shortages of food and inflated prices (Garcia 1997). Perhaps it was then, that the value of the agricultural potential of the valley was truly recognized. The population of Alta California in 1848 was estimated to be around 150,000 (Pfaelzer 2007). By mid-1849 the population doubled and had become so large and diverse that managing the new growth under existing governance was impossible. In 1850 California was granted statehood.

---

[2] American immigrants that formed the Bear Flag Revolt
[3] Spanish speaking individuals living in Alta California

Many individuals that did not strike it rich in the gold mines did not return home, choosing rather to say in the Santa Clara Valley and turn to agriculture. The rich growing soil and intensive cultivations earned the area the title "Valley of Heart's Delight". Santa Clara Valley quickly became one of the largest producers of fruit in the world, propelled by the completion of the trans-continental railroad in 1869. A robust fruit canning, drying and packing industry soon sprung up alongside the orchards (Munro-Fraser 1881:528).

Early 20th Century: 1900-1940

By 1914, Santa Clara County produced half of all the prunes grown in the United States (Irvine 1914). There were fifteen large fruit and vegetable canneries, twenty packing houses, and several fruit preserving plants which produced an estimated $10,000,000 in manufactured goods, and employed seven thousand people (Irvine 1914). The Santa Clara Valley lagged behind other nearby cities, such as San Francisco and Oakland, with the speed of urbanization and industrial growth (Pitti 2003:80). However drastic changes to area politics and industry began in the late 1930s and early 1940s. This period, sometimes referred to as the "second Gold Rush", ushered in an era of increased federal spending, U.S. military presence, and the early foothold for the technological industry (Pitti 2003).

Immigration Trends

Immigration is an important component of the peopling of the historic United States. Gerber (2011) notes three waves of voluntary international migration that had a substantial impact on the demographics: (1) 1840-1850; (2) late 1890s-WWI; and (3) post 1965. Debates over immigration, specifically who should be allowed to immigrate, have been ongoing for much (if not all) of American history. Between 1820-1920 over 35 million Europeans entered the

United States, with only 1% being denied entry. During that time frame roughly one million immigrants from Asia, Mexico, Canada, and other parts of the western hemisphere entered the country (Gerber 2011). Although European immigrants faced discrimination, individuals from non "white" countries (the definition of what was considered "white" varied drastically by time period) were confronted with severe discrimination, both cultural and political in nature. For example between 1820 and 1920, 25% of Chinese immigrants were denied entry into the country. This was exacerbated by exclusionary legislation (the Chinese Exclusion Act and the Page Act) that further limited immigration from China (Pfaelzer 2007).

California's immigration patterns are unique both in terms of the rapid influx of individuals and their regions of origin. Prior to European contact California was home to a robust Native American population. It is estimated that prior to 1850 between 150,000 and 300,000 Native Americans lived in California. By 1860 it is estimated that only 32,000 Native Americans survived (Pfaelzer 2007). The rapid population decline was due to tensions caused by the Spanish mission system, epidemic disease, and later the influx of American settlers into the area (Pitti 2003a). Following the Mexican American War, and ceding of California to the United States, individuals of Spanish and Mexican decent living in Alta California were forced to renegotiate their ethnic identity. These Spanish-speaking individuals became known as Californios (Pitt 1966; Pitti 2003a).

Though many Californios were born in Alta California, they were treated as foreigners, many of the American migrants lumping the Californios together with recent immigrants from Mexico (Pitt 1966). Following the systematic loss of their land, many of the disenfranchised Californios in Santa Clara County found employment at the New Almaden quicksilver mine (Pitti 2003b). The discovery of gold in the Sierra foothills in 1849 set the stage for an unpredicted wave of immigration into California. California transformed practically overnight from a Mexican territory with approximately 150,000 residents (including native people, Mexicans, and Californios) to a formally recognized state with the population nearly doubling in size in less than a year (Commonwealth Club of California 1946; Pfaelzer 2007). Although Africans first entered Alta California in 1769 in connection with a Spanish expedition (Ruffin 2014a), African and African American populations in California and specifically Santa Clara County remained low (Ruffin 2014b).

California's geographic position made it the prime gateway for Asian immigration and the logical terminus of the westward Manifest Destiny migration. California had a larger Asian population than the rest of the United States combined (Commonwealth Club of California 1946; Coolidge 1909; Pfaelzer 2007), although European immigrants still comprised a majority of the population (Commonwealth Club of California 1946). Chinese migration was substantially halted by the passage of anti-Chinese legislation (Coolidge 1909; Pfaelzer 2007). Between 1880 and 1940 Asian immigrants still comprised between 2-7 percent of the total population of Santa Clara County. Asian immigrants situated themselves as an integral part of the California agricultural industry. Overlapping waves of first Chinese, then Japanese, and Filipino immigrants ensured a large Asian population, even after the Chinese Exclusion Act (Tsu 2013). In the early 20th century, attention turned to the Japanese population as a potential "threat" to the white population. The Japanese were viewed as threats because of their high birth rates, low infant death rates, and landownership (State Board of Control of California 1978). American migrants, however, were not immune from hostility. The Great Depression and Dust Bowl created a population of American migrants and refugees that headed west in search of better living and working conditions. However, the "Okies" were seen as anti-California acculturation, and a burden on state housing, healthcare, and benevolence (California State Chamber of Commerce 1940; Jamieson 1942).

County Hospital

"…everything conductive to the welfare of the waifs of humanity has been done, so that their sufferings may be assuaged and their pillows smoothed as they fall into the grave". – Munro-Fraiser, J.P. 1881:148

On March 31, 1855 Santa Clara County Supervisors, in accordance with an act to provide for the counties indigent sick, formed the "Board of Directors of the Infirmary of the County of Santa Clara" (Shortridge 1896:143). In this organized effort to care for the indigent sick, the county was to bear two thirds of the expense, and the city of San Jose the remaining third (Foote 1888). At the same time, a county physician was appointed, and paid $50 a month towards the maintenance and medical attention paid for the indigent sick (Foote 1888). It soon became apparent that a centralized location for treatment was required, and the Old Levy property was rented at a cost of $40 a month (Foote 1888). Rapid city expansion soon rendered the Old Levy property inadequate, and arrangements were made to purchase the Sutter house from the Merritt Brothers for $5,500. The Sutter house was located northeast of the city limits and included twenty-five acres. The city occupied the premises until February 1856, when the property owners failed to provide a proper deed (Foote 1888).

While waiting to find appropriate accommodations, Dr. G.B. Crane was contracted to care for the sick in their homes for a cost of $4,600 a year. Dr. Crane demanded strict stipulations in his contract, where he was not to care for more than seven patients a day without additional pay. This continued for several years until in 1860 the need for a larger hospital became apparent. An act of state legislature authorized counties to acquire land not to exceed 160 acres to establish an infirmary and associated buildings to care for the indigent (tenBroek

1957:288) The city purchased the property of Hiram Cahill, which contained twelve acres situated on the south side of South Street just west of Los Gatos Creek. The existing buildings were repaired and enlarged, and a pest house[4] was built near the creek. There were objections to having the infirmary, specifically the pest house, so close to the city limits. In 1868 the board purchased one hundred fourteen acres from John S. Conner (See Figure 1), at a cost of $12,400. The buildings were moved from the Cahill property, and the old lot was divided and sold. In 1875 a contract to build a new infirmary was awarded to W.O. Breyfogle for $14,633.70. Messers, Lazen and Gash were contracted as the architects (See Figure 2). To defray some of the costs of the expansion and new build, 81 acres of the Conner property were sold to different parties (Foote 1888).

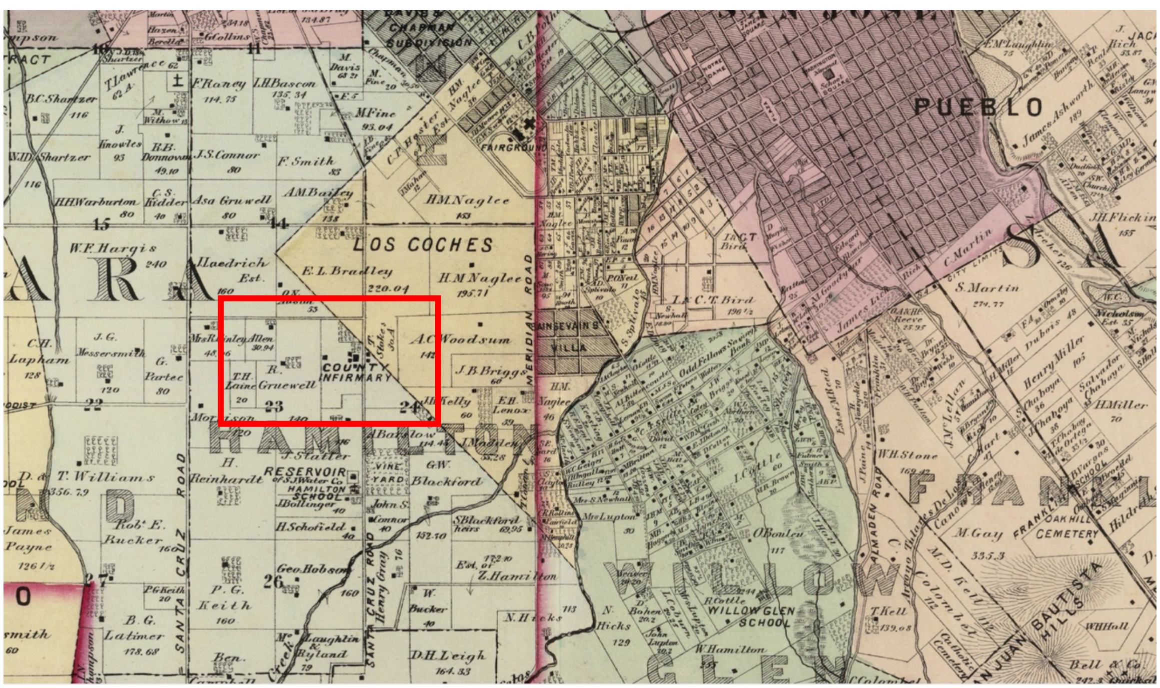


Figure 1. 1876 Map of Santa Clara County Showing County Infirmary and John S. Connor Property - Source: Thompson & West 1876, David Rumsey Map Collection.

[4] A quarantine building for infectious diseases

Figure 2. Infirmary, Santa Clara Co. 1876. Lithograph. Source: Thompson & West 1876, David Rumsey Map Collection.

The Infirmary was a Gothic style building with six wards that could accommodate 65 patients. It included all of the modern amenities with gas, water, and modern medical equipment (Munro-Fraser 1881:148). The institution was said to be "dedicated to Sickness, Poverty and Charity – a temple which is an honor to Santa Clara County, and is considered a model of its kind throughout the state" (Munro-Fraser 1881:148).

Until 1883 the County Infirmary also served as an almshouse, where invalids in destitute circumstances were cared for. In 1883, in an attempt to alleviate the costs of indigent relief, a county almshouse (also referred to as the county farm) was established in Milpitas (Foote 1888). Thus in Santa Clara County the medical care of dependents was entirely separated from custodial or almshouse care. The hospital provided care for the indigents with severe medical conditions, while the slightly more able bodied destitute men occupied the almshouse (California, 1921).

The 1871 relocation was the last major move for the county hospital, as the Santa Clara Valley Medical Center still occupies that location today. The remaining property was used as a ranch, which supplied the infirmary and almshouse with "fruits, vegetables, eggs, butter, and a sum of money that is added to the funds by the sale of the superfluous products" (Mars 1901:75). The farm remained an important part of the daily operations of the hospital, and the acres used for production, as well as the numbers of cows, horses, hogs, and poultry were routinely listed as assets in official state level reports (State of California, 1902-1922). The presence of farm animals on the property is apparent in maps as late as 1929 (See Figure 3). A barn was also noted on the property, a farmer is listed on the payroll (Rehor and Beck 2015:2-8), and Jacob Albert lists his occupation as hospital gardener on the 1910 census (U.S. Census 1910, ED 67, page 6A).

Later additional buildings including a tuberculosis hospital, Old Ladies' Home, Old Men's home, isolation hospital and pest house, and residences for nurses and superintendents were added (See Figure 4). The Old Ladies' Home cared for aging indigent women because the almshouse in Milpitas did not have proper accommodations for females (State Board of Charities and Corrections 1905). The Infirmary was routinely noted as being "one of the best county hospitals in the state" (State Board of Charities and Corrections 1915:156). In addition to structural expansion, the County Infirmary developed its service, treatments, and the population that it served (See Figure 5). The 1906 San Francisco earthquake temporarily halted new development plans.

The earthquake demolished the Tuberculosis Sanatorium, and severely damaged the main hospital building. Three patients died during the earthquake, while seven others were seriously injured (Rehor and Beck 2015:2-10). However, the hospital itself incurred only minor damages.

The second story of the main building was partially salvaged by lowering it to the ground floor and using it as a women's ward until 1961. The nearby Agnews State Hospital (asylum) lost 101 patients and 11 employees when nearly every structure on the property was destroyed (State Board of Charities and Corrections 1906:54). A county bond election was held to allocate money to repair damage to county buildings, including the infirmary. In 1907, a new E-shaped wood frame building was constructed to serve as the new main infirmary building (Rehor and Beck 2015:2-10). The new building (see Figure 6) is reported to have cost over $100,000 (State Board of Charities and Corrections 1908:125).

The 1918 influenza epidemic spurred further hospital development, and in 1920 a new isolation unit was built. In 1925, a 20-bed addition was added to the isolation unit. Expansion continued throughout the late 1920's, including the addition of a pediatric ward and preventorium[5] building (Roehr and Beck 2015:2-10). By the early 1930's the County Hospital was providing care for approximately 400 indigent individuals a day. In 1946 the hospital provided a new tuberculosis sanatorium, blood bank, dentist, and physiotherapy. It was also accredited as a nursing school, and provided graduate training in medicine, surgery, and obstetrics (Roehr and Beck 2015:2-11).

The nursing school was initially established in 1905, and construction of a dedicated Nurses Hall began in 1906. When it was completed in 1920, it accommodated up to thirty nursing students. In 1913, the Infirmary became a well-respected teaching hospital. (Rehor and Beck 2015:2-12). In addition to the physical changes of the campus, the infirmary underwent several name changes. Records indicate that around 1912 it changed from County Infirmary to

[5] A preventorium is a space for individuals infected with tuberculosis that did not yet have the active form of the disease. Its purpose was to prevent further spread of disease.

the Santa Clara County Hospital, and finally to the Santa Clara Valley Medical Center in 1966 (Rehor and Beck 2015:2-12).

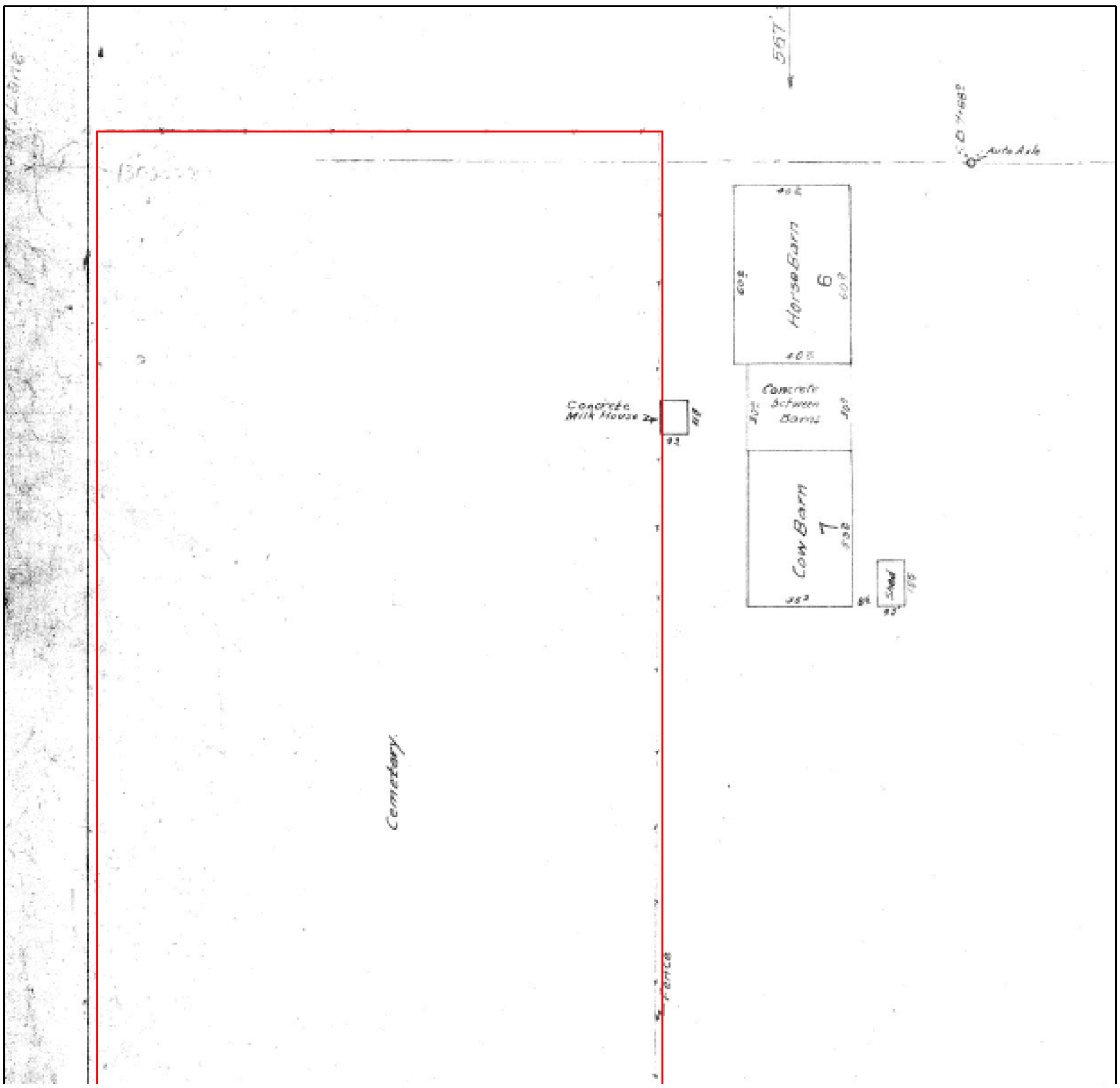


Figure 3. 1929 County Surveyor Map Close-up - Showing Encroachment of Milk house, Horse barn and Cow Barn. Image Source Roher and Beck 2015.

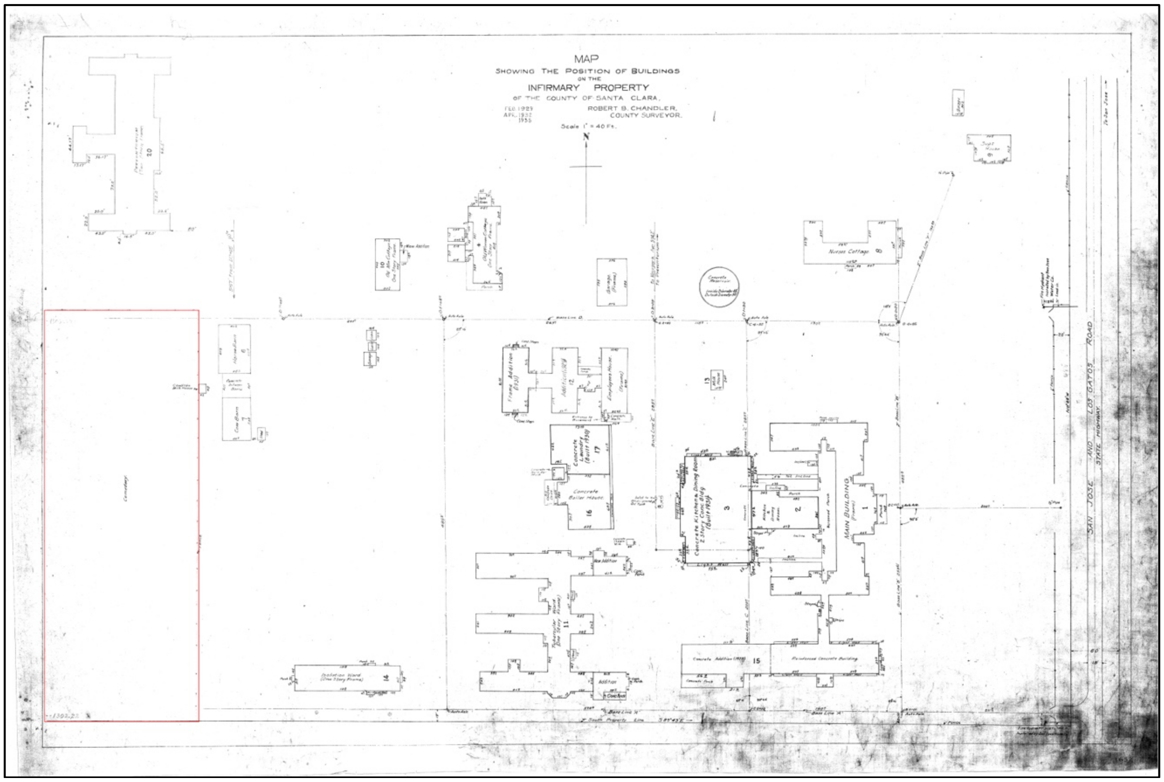


Figure 4. 1929 Campus Map - Cemetery Boundary Highlighted in Red. Image Source Roher and Beck 2015.

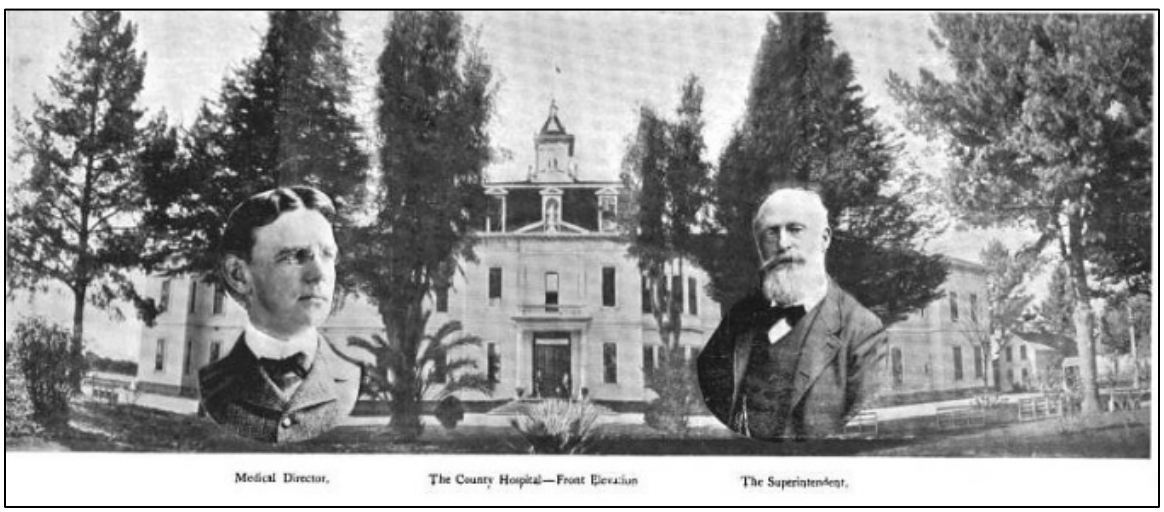


Figure 5. The County Hospital - Front Entrance Source: Mars 1901:77.

NEW COUNTY HOSPITAL—SANTA CLARA COUNTY.

Figure 6. County Hospital Approximately 1907-08. Source California 1908.

The Infirmary Cemetery

As previously mentioned, scant historical references have been located regarding the historic-era cemetery associated with the County Infirmary. To date, no burial records have been located and the earliest map documenting the cemetery is a 1915 Sanborn Insurance Map, which unfortunately only gives a partial depiction (See Figure 7). The clearest picture of the cemetery boundary is from the 1929 campus map (See Figure 4).

The cemetery was most likely established after 1871, following the Infirmary's relocation to the Connor property. It is unknown if a cemetery was established at the Infirmary's prior location at the Cahill property. An exact end date is also currently unknown. The latest map the cemetery appears on is a 1935 county surveyor record. On the November 1937 insurance map, the cemetery no longer appears and three buildings are depicted in what was the northern extent of the cemetery (Rehor and Beck 2015:2-13).

Because of the cemetery's association with the County Infirmary, it most likely also acted as a charitable institution. Thus, the cemetery contained individuals buried at the counties expense, direct hospital/almshouse internments, and individuals from the greater community that could not afford burial elsewhere. Specific burial records for this cemetery have not been located, gleaning information from other sources, such as Coroner Inquest reports is further complicated by the presence of additional potter's field[6] locations in the county. Nineteenth and early twentieth century inquest records and death certificates are also vague and inconsistent. Often the place of burial is not always indicated, and although some individuals are listed as buried at the expense of the County, the inability to determine which potter's field an individual went to complicates the matter. To date only two Coroner's Inquest reports have been located that identifies the County Infirmary Cemetery as the place of burial.

Because the infirmary was operated at the expense of the county, they were required to be transparent with their costs and operations. For example, in an 1899 semi-annual report the County lists expenses of $715.30 incurred by "digging graves," "burying indigents", and "burying ex-Union soldiers" (The Evening News July 27 1899). Although some soldiers received indigent burials, their status as veterans required specific burial treatments and they were not allowed to be buried in a potter's field (State of California 1901:596).

Services, such as burial of the indigent dead, were put out to bid by the County. The County then published the name of the individual, or firm, that won that bid as well as the cost of the

[6] Burial ground where indigent and unknown individuals are buried.

contract. For instance, in 1886 Trueman & Woodrow won the contract for $10 per burial, with $2 extra for coloring the coffins (The Daily News February 2 1886:3). By 1899, multiple

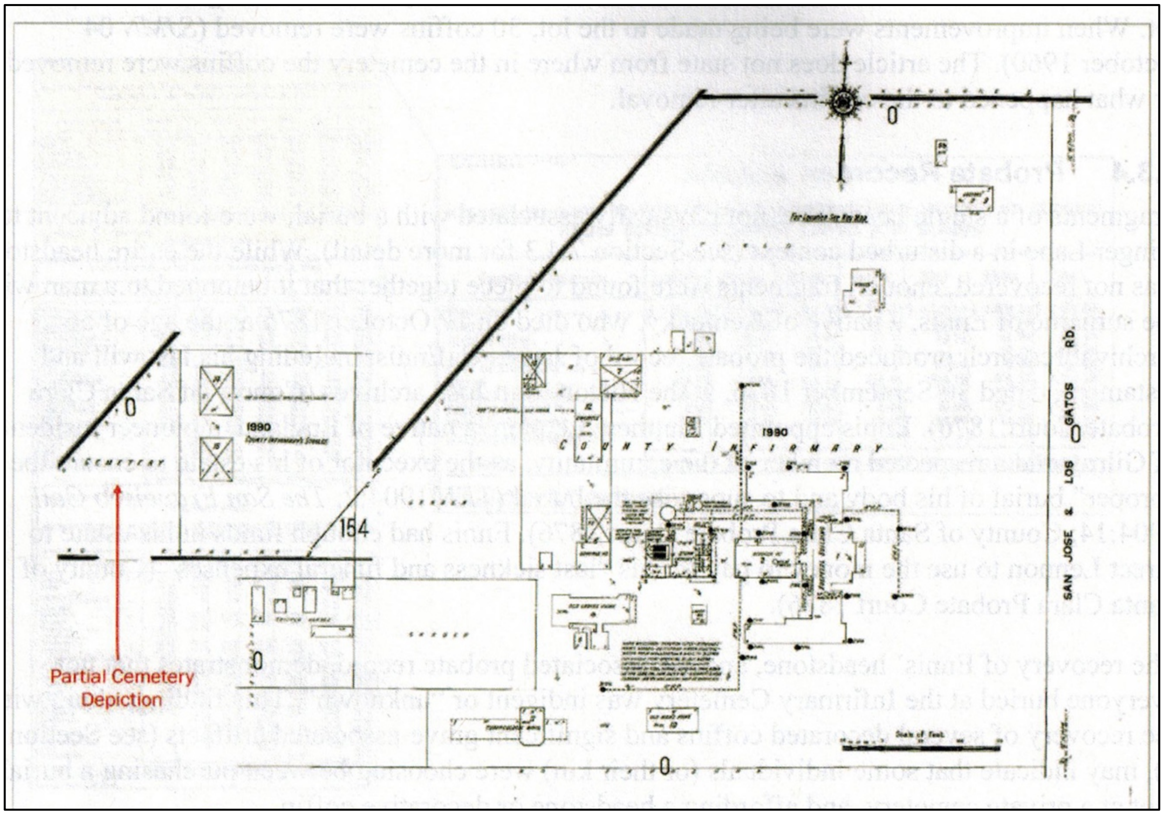


Figure 7. 1915 Sanborn Insurance Map - reformatted along match lines to show partial cemetery. Image Source Roher and Beck 2015.

companies were vying for the contract, with the San Jose Undertaking Company submitting a bid for $3.50 per burial, but W.B. Ward won the contract by underbidding at $2.93 per plain redwood coffin, $5.00 per black painted coffin, and $10 for redwood coffins with handles, varnish, and an inner lining (The Evening News August 8th 1899:4). The county routinely paid multiple entities every month for different components of the indigent burial process. In February 1902, the Infirmary fund receipts (Figure 8) note separate payments for digging graves ($18), burying indigents ($20) and burying ex-Union soldiers ($50). The February 1902 list of claimants owed money by the county (Figure 9) note that Peter Sex was owed $18 for opening graves, A.B. Tyron was owed $20 for coffins, and W.B. Ward Undertakers were owed $50 for burial (likely the charge for the ex-Union solider burial).

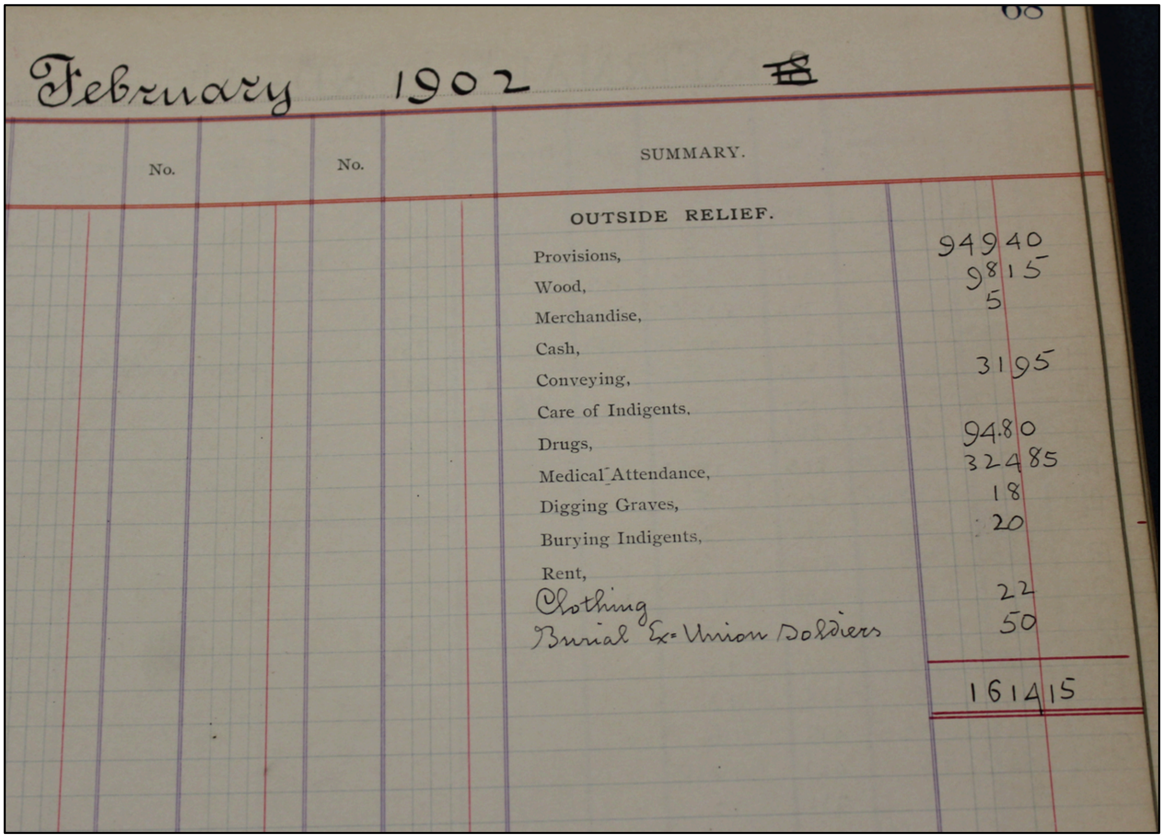
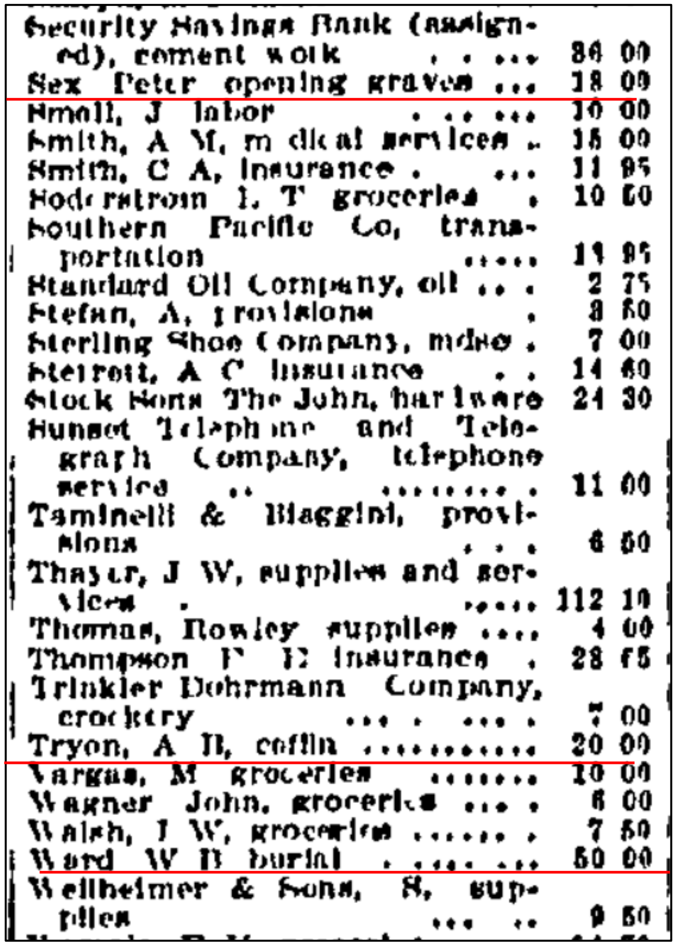


Figure 8. Infirmary Fund record book – Image from February 1902 account. Image taken by author. Archival source Santa Clara County Archives Clerk-Recorder Records Collection number 2009-009 through 2009-164 Series XII Miscellaneous 1840-1985 Sub-series 5: Classified Allowances Infirmary fund 1896-1904.



Security Savings Bank (assigned), cement work	84 00
Sex Peter opening graves	18 00
Small, J labor	10 00
Smith, A M, medical services	15 00
Smith, C A, insurance	11 95
Soderstrom L T groceries	10 60
Southern Pacific Co, transportation	11 95
Standard Oil Company, oil	2 75
Stefan, A, provisions	3 50
Sterling Shoe Company, mdse	7 00
Steirott, A C insurance	14 40
Stock Sons The John, hardware	24 30
Sunset Telephone and Telegraph Company, telephone service	11 00
Taminelli & Biaggini, provisions	6 50
Thayer, J W, supplies and services	112 10
Thomas, Rowley supplies	4 00
Thompson F E insurance	28 75
Trinkler Dohrmann Company, crockery	7 00
Tryon, A B, coffin	20 00
Vargas, M groceries	10 00
Wagner John, groceries	6 00
Walsh, J W, groceries	7 50
Ward W B burial	50 00
Wellheimer & Sons, S, supplies	9 50

Figure 9. For County Needs Supplies and Labor Required During January Name of Claimants San Jose Mercury News February 16 1902 Volume LXI Page 7.

Other Local Cemeteries

The infirmary cemetery was not the only location the county buried indigent individuals. Potter's field sections at Oak Hill Cemetery and Mission City Memorial Park were also used (Roher and Beck 2014:7-43).

Oak Hill Cemetery (seen in the lower right corner of Figure 1) was the only municipal cemetery operating in San Jose from 1849-1870. Originally designed as a joint Protestant and Catholic cemetery, it also sectioned off a portion for a potter's field. Although burial records were kept from the beginning, in June 1862 Marshal Jasper D. Gunn, the cemetery superintendent, absconded with the cemetery funds and all records. They were unfortunately, never retrieved so the earliest death certificate on file for the cemetery is 1862. The cemetery underwent significant expansion in the 1870s. At this time, the first burials of individuals of Chinese ancestry occurred in the western portion of the cemetery. By 1900, several Chinese organizations had worked together to deed land for their own cemetery. In 1878, a new potter's field was allotted between the Chinese section and the Catholic section. By 1888 it contained nearly 400 interments. The original potter's field had been near the center of the cemetery, and at that time, it was estimated to have held nearly one thousand individuals. In 1913, the City of San Jose sold the cemetery to a private management group, the Oak Hill Cemetery Association (Maggi et al. 2002). It is still in use today.

The burial ground now known as Mission City Memorial Park was founded by the Santa Clara's board of trustees in 1850-1851. It has been called simply "the graveyard", Town of Santa Clara Cemetery, Santa Clara City Cemetery, Santa Clara Protestant Cemetery, and since 1972 Mission City Memorial Park (Lichtenstein 2005:9). Mission City Memorial Park has multiple potter's field sections within the boundary of its cemetery, the earliest mention being a July 1862 ordinance for the operation of the cemetery that notes that persons not owning burial lots could only be buried in the public potter's field portion of the cemetery (Lichtenstein 2005:9). One potter's section was in use from 1913-1937, and the other from 1937-1954. Individuals that received indigent burials at Mission City Memorial Park have "County Hospital" or "Santa Clara County Hospital" listed as their place of death (Dejanvier 2014).

Conclusion

The Santa Clara Valley underwent significant demographic, political, and cultural changes during the late 19th and early 20th century. The rapid influx of immigrants following the Gold Rush, the west-ward migration associated with Manifest Destiny, and the agricultural potential of the area made it a hub of commerce and trade. Migration to California, and specifically Santa Clara County, was unique not only in its tremendous volume, but in its region of origin. Even as late as 1940, two out of every three Californians had been born outside of the state (Commonwealth Club of California 1946:230). From the standpoint of nativity, the majority of Santa Clara County was comprised of individuals of European (both foreign and native born), Chinese, Japanese, Filipino, Californio, Native American, African American, and Mexican ancestry. The demographic makeup of the state and county, at this time, is skewed heavily male: there was a 12:1 male to female ratio in California in 1850, which did not equal out until roughly 1940 (Commonwealth Club of California 1946). In the 1890s the average age in Santa Clara County was 46, 20 years older than cities of similar sizes like Chicago (The Evening News 1896). A lack of children is also noted in population data, with individuals under the age of 20 accounting for roughly 30% of the population from 1900-1940 (Commonwealth Club of California 1946).

The Santa Clara County Hospital cemetery, and the skeletal sample exhumed from it, represents a unique time and place in United States history. Those governing Santa Clara County quickly realized that larger institutional structures were necessary to manage the fast-paced growth of the low socioeconomic portions of the population. The individuals migrating to the Santa Clara Valley in the 19th and early 20th century were far from the more traditional caregiving structures of family and community. “This growth of county hospitals [in California] was caused primarily by the acute need for a substitute for home life” (Cahn 1936:144). There is a lack of rigorous investigation into the health trends amongst 19th and 20th century immigrants and poor in an area central to Americas economic, territorial, and populational expansion: California. The skeletal sample used in this dissertation provides an opportunity to better understand the health of immigrants and low socio-economic status individuals in the late 19th and early 20th century Western United States.

Chapter 4: Research Questions & Expectations

Introduction

This dissertation research seeks to examine the complex processes that led to potential social and health inequalities by examining a large-scale historical cemetery from California; the Santa Clara Valley Medical Center (VMC) Historical Cemetery. The primary objective of this research is to understand the health patterns present within the VMC burials while incorporating both the mortuary archaeological and historical context of the burial ground. Furthermore, this research will study the health of the excavated individuals while specifically examining the biological impact of the county's efforts towards public health initiatives, public policy toward the poor, and prevailing medical practices of the time. This research also seeks to focus on the comparison of the VMC sample with similar samples from indigent and non-indigent historical cemeteries. These comparisons will serve to establish the relative health of the VMC sample.

Research Questions and Expectations

With this research, I propose to address the following broadly defined research questions pertaining to the VMC collection:

Question 1: Does institutionalization and or structural violence lead to identifiable biological impacts?

Santa Clara County was an early adopter of public health policies, creating a means to care for the indigent sick as early as 1855 (Shortridge 1896). The presence and impact of communicable diseases was a major health concern during the 19th and early 20th centuries (Duffy 1990a, 1990b). Santa Clara County was forced to contend with epidemic and endemic diseases in both the urban city center and rural countryside. The rapid population growth, and burgeoning migrant population, soon overwhelmed the initial public health systems put in place during the mid-1800s, forcing new policy implementation that focused on broadly improving sanitation, food purity, and infectious disease.

Historical records indicate that hospital patients, or inmates as they were called, were treated at the hospital for periods ranging from several days, weeks, months, or even periods longer than ten years. Thus, the institutional policies of the hospital should potentially have visible biological impacts. Personal effects will be used to separate hospital patient internments from burials of individuals from the wider community. It is expected that hospital burials will show signs of increased biological stressors, and more individuals with multiple stressor events than other burials at VMC. The increased variability and quantity of pathological reactions in the hospital burials are expected due to institutional policies and issues accessing timely medical care.

Immigrants and lower socioeconomic migrants entering the Santa Clara Valley at this time faced structured risk, referred to as structural violence, which was created by the prevalent social forces of the time. Time and place specific vulnerability, caused by embedded political and economic forces, has specific biological consequences. Even though the hospital was created to serve indigent community members, were all indigents given equal access? If structural violence was present in the area, it should be discernable within the pathological biological reactions present across VMC sample. If structural violence impacted the patterns of health and stress present at VMC, it is expected that higher rates of infectious disease and untreated conditions would be present in the non-hospital burials.

Question 2. At this time, we know that major issues such as the second epidemiological transition, public health reform, immigration, and socioeconomic status impact the health and nutrition of people. Given the nature and historical context of VMC how did these events effect people at VMC?

Previous bioarchaeology studies of health (Grauer and McNamara 1995; Higgins and Sirianni 1995; Higgins et al. 2002; Lanphear 1988, 1990; Leher et al. 2010; Milligan 2010; Ubelaker and Jones 2003) have used selective criteria for examining the health of past populations. These studies focus on prevalence rates of pathogenic and activity-based stressors (dental hypoplasias, porotic hyperostosis, periosteal lesions, pathognomonic lesions) that are used to examine the comparative health of the sample. This sample is expected to exhibit high levels of biological stress both from activity-based stressors and pathogenic stressors. This study expands upon the on-site collected data and subsequent report by incorporating more detailed comparison of the prevalence, location, and co-occurrence of pathological and degenerative changes. Specifically, I test whether incidence of the biological stressors is statistically different between age, sex, and ancestry groups. In addition, I test for statistical differences in different combinations of pathological conditions and age, sex, and ancestry groups. It is anticipated that the number and variability of pathological conditions will be greater for adult males in the sample than female or subadults.

There is a general consensus that the second epidemiological transition at the end of the Industrial Revolution ushered in widespread trends of decreased infant mortality, increased life span, decreased infectious disease mortality, and an increase in degenerative diseases (Barrett et al. 1998; Gage 2005). However, it has been argued that not all populations would have reached this transition at the same rate (de la Cova 2008). Populations that were disadvantaged with regards to equal access to resources would still be facing higher rates of infectious disease and increased mortality rates that are typically associated with the first epidemiological transition

(Gage 2005; Orman 1977). Therefore, the impact of public health initiatives, immigration, and socioeconomic status will be considered when evaluating the VMC sample. Specifically, the VMC sample will be compared to samples from other historic burial grounds. It is anticipated that the VMC sample will show high rates of infectious disease and a higher mortality risk than other populations due to the low socioeconomic and migrant status of the individuals interred there.

Question 3: Putting the cemetery in context with the historical record suggests a set of expectations of particular kinds of pathologies. How do these expectations compare with the pathologies documented in the skeletal remains?

As previously stated, to date no burial records or inmate specific hospital records have been located for the entire time period the cemetery was in use. City and county level public health documents are available that note disease prevalence and health issues in the area. Some of the diseases noted include infectious processes that impact the skeleton, primarily tuberculosis, syphilis, coccidiomycosis, and generalized infection. Additionally, illness such as pneumonia, phthisis, and small pox are noted, which despite being fast acting disease, still hold the potential for generalized skeletal response. While pathologies that can be determined from skeletal remains are limited to long term chronic issues (due to bone remodeling timing), and several pathogonomic diseases, the historical record tends to under-represent chronic multi-focal disease processes. It is anticipated that the skeletal sample will exhibit a wider variety of pathological conditions sample wide, and per individual, than the historical record. The low socioeconomic and migrant nature of the sample should also result in higher rates of infectious disease processes being present than the larger county, state, or county wide historic record.

Question 4: How does VMC compare to similar cemeteries in terms of the consequences of structural and institutional behavior?

Observations related to the health and nutritional status of the VMC sample are compared with similar samples. Similar studies show high mortality and morbidity rates during the time the VMC cemetery was in use. Although several historical cemetery samples are used in the comparison, two specific sites will be the main focus: Milwaukee County Institution Grounds (MCIG), Milwaukee Wisconsin, and Alameda-Stone, Tucson Arizona. Both samples provide for a comparative study of health as they represent a similar time period and/or context in which the VMC cemetery was in use. The MCIG sample allows for comparisons with another indigent sample from the same time period. The Alameda-Stone cemetery was selected because of its rural western context and 19th century timeframe. In addition, the demographics established for each cemetery are compared with the VMC cemetery. The comparison of prevalence rates for the various assessed pathologies by age, sex, and ancestry are used to address the similarities and differences between subsets of each sample. It is anticipated that VMC will be more similar to MCIG due to the institutional nature of the burial sample.

Question 5: Are there changes in the cemetery in terms of the spatial organization, and might these be attributed to change over time or differential treatment of health?

There is an unfortunate assumption that potter's field burials are devoid of material culture. Though they tend to have fewer grave goods, there is still ample material culture that can have traditional mortuary archaeological analysis applied. The analysis of grave goods, coffin construction, and spatial patterning in conjunction with biological categories such as age, sex, ancestry, and pathological conditions will be conducted to determine if additional health patterns and cemetery use patterns are present. Currently the 2015 site report by Rehor and Beck provides only a cursory analysis of the sites artifacts and spatial patterning. Additionally, analysis of the grave goods and coffin construction is performed to see if there are any temporal distinctions within the cemetery. Clustering by biological profile or categories of grave goods indicates differential treatment of specific burial categories. Similarly clustering of temporarily diagnostic artifacts would elucidate the timing of burials within the grater cemetery.

Summary

These questions are not independent, but together they help me frame an interpretation of the cemetery that takes into account the historic nature of the Santa Clara Valley, the historic nature of the institution, and the biological stressors created by these unique trajectories. The skeletal analysis, mortuary analysis, analysis of associated historic documents, and comparisons of VMC to other samples all serve to explore the relative health of the cemetery. This is an opportunity to contextualize Santa Clara County and California's health within larger U.S. history in the late 19th and early 20th centuries by using primary skeletal and mortuary archaeological data.

Chapter 5: Materials & Methods

Introduction

This chapter outlines the primary research sample used for this study and the data collected from the sample. The methods used in the data collection, as well as a discussion of the comparative skeletal samples is also included.

Introduction to Excavation

In February of 2012, construction crews working on a new building at SCVMC discovered intact coffins and isolated human skeletal remains. The construction plans could not be altered to avoid the burials, so a controlled excavation was conducted to remove burials within the project area, identify the physical extent and period of use of the cemetery, and attempt to identify the individuals interred there. From July 2012 thought January 2014, URS and subcontractor D&D Osteology excavated a total of 998 in situ burials that included the remains of 1,004 individuals (Figure 10). After analysis in the on-site field laboratory, in October 2014 the remains were transferred to California State University, Chico for a 10-year curation period to allow for additional research. At the end of this 10-year period (2024) the remains will be cremated by the county and reinterred. The county has also requested a tiered return of the remains, which will begin in 2019.

The exact boundaries of the approximately 2.4 acre cemetery have not been confirmed. This size estimate is based on a 1929 county survey map, the only map located thus far that depicts the entire boundary of the cemetery. Approximately 35% of the anticipated cemetery was excavated through this project. It is highly likely that additional burials are present in the unexcavated portions of the cemetery currently covered by existing hospital infrastructure. The sample is overwhelmingly adult (967 adult, 20 subadult, 17 fragmentary), and male (643 male, 100 female, 261 indeterminate). This research project includes all burials from the excavated area of the cemetery.

Figure 10. SCVMC Excavated Burials.

On-site data collection protocols

Biological Profile

Of the total 1,004 individuals, 743 have sex assessments and 987 have estimations of age (493 of whom have specific age range estimations). The age and sex assessments consider multiple factors from several areas of the skeleton, with the number of indicators used being conditional on the completeness and preservation of the burial. The overall poor preservation seen throughout the cemetery is one reason there are so many individuals with indeterminate sex assessment and non-specific age estimations (i.e. only "Adult").

On-site osteologists recorded paleopathological observations for all individuals who exhibited signs of skeletal stress. Ortner's (2003), *Identification of Pathological Conditions in Human Skeletal Remains*, was the main reference used when making the differential diagnosis. Conditions were divided into the following categories: infectious disease, inflammation and non-specific infections, developmental defects, degenerative conditions, neoplasms and tumors, nutritional deficiencies, and other. At SCVMC, 79% of the total sample (795 individuals) exhibited some form of pathology. Many of the individuals not exhibiting pathological changes were burials whose poor preservation prevented assessment.

On-site osteological data collection relied heavily on protocols outlined in Standards for Data Collection from Human Skeletal Remains (Buikstra and Ubelaker 1994). The data collected included: an inventory of skeletal element presence and absence as well as the completeness of each element; estimations of sex and age; observations of dental pathologies; observations of pathology; observations of non-metric traits; and post-cranial measurements (cranial metric data was not collected on site due to a lack of appropriate equipment). A brief in situ osteological assessment was completed for each burial, with a more detailed analysis being conducted later on-site. Descriptive notes and photographs were also collected. Ancestry assessment was not preformed onsite at the beginning of the project (approximately first 600 burials), so a re-analysis was done via photographs after the project was completed.

Age

Age estimations for adult burials were based on multiple lines of evidence, with the scoring of several cranial and pelvic features (when present). Primary methods for age estimation of adults included auricular surface (Lovejoy et al. 1985); pubic symphysis phases using the Suchey-Brooks method (Brooks and Suchey 1990) or the Todd method (Todd 1920); fourth sternal rib end following the Iscan method (Iscan et al. 1984a, 1984b, 1985); and cranial suture fusion using the Meindl and Lovejoy (1985) method. Secondary age indicators such as overall body size, and degenerative changes such as osteoarthritis, osteoporosis, and dental attrition were also considered. Age estimation for subadults was based on dental development and epiphyseal fusion (Baker et al. 2005, Schaefer et al. 2009). It should be noted that generally osteologists are excellent at aging younger individuals because age related changes are due to growth and development, allowing for a finer degree of specificity. As the skeleton ages, these indicators shift to degenerative changes, making the age estimations broader. Additionally, there is an "age wall", where individuals older than 50-60 tend to look alike, so the finely detailed age estimations are lost and instead ranges such as 50+ must be given.

Sex

Biological sex estimation was completed using standard methods outlined in Buikstra and Ubelaker (1994), focusing on the pelvis and skull. With regard to pelvic features, the sciatic notch width was the most commonly used sex estimation as it was the most common feature preserved in the skeletal sample. Other features of the pelvis, specifically the pubic were poorly preserved. Interpretation followed Blanchard (2010) and Walker (2005), where scores of 3-5 are likely male, a score of 1 is likely female, and a score of 2 is indeterminate. Further interpretation of sciatic notch contour considered Bruzek (2002). When the pubic bone was present;shape, sub-pubic angle, and presence or absence of a ventral arc and preauricular sulcus was recorded following Buikstra and Ubelaker (1994).

Secondary methods included scoring non-metric cranial traits and measurements of articular surfaces. Cranial traits scored (per Buikstra and Ubelaker 1994) included nuchal crest, mastoid process, supraorbital ridge, mental eminence, contour of the supraorbital margin, and angle of the ascending ramus of the mandible. When the humeral head, glenoid fossa, or femoral head were present the appropriate diameter or height measurement was taken. These measurements were used to estimate sex based on Trotter (1970 in Bass 2005).

Ancestry

Ancestry was assessed based on cranial traits which have been demonstrated to correlate with regional ancestry (Gill 1998; Gill and Rhine 1990; Hefner 2007, 2009; Rhine 1990; Scott and Turner 1997). Individuals were categorized as: Asian, African, European, Latino, or Indeterminate. Probable assessment of ancestry required a minimum of three strong indicators supporting that classification. If fewer than two traits were scorable, or if the present traits were ambiguous, ancestry was classified as indeterminate. The relative strength of traits (see Table 1) was based on multiple sources (including Anderson 2008; Bass 2005; Birkby et al. 2008; Brooks et al. 1990; Gill 1998; Gill and Rhine 1990; Rhine 1990; Scott and Turner 1997; and White et al. 2011). Preference was given to traits classified in the work of Hefner (2007, 2009).

Trait Strength	Non-Metric Traits Used for Ancestry Assessment
Strong	Interorbital breadth, nasal bone contour, nasal aperture width, incisor shape (shoveling), vault suture complexity, presence of Wormian bones, and presence of post-bregmatic depression.
Medium	Anterior nasal spine form, alveolar prognathism, nasal overgrowth, supra-nasal suture ("metopic trace"), sagittal keeling, zygomatic form, dental crowding, and winged incisors.
Weak	Orbit shape, palate shape, mastoid tubercle form, chin shape, dental occlusion (e.g., edge-to-edge, overbite), depressed nasion, femoral curvature, gonial eversion, malar tubercle form, transverse palatine suture form, zygomatico-maxillary suture form, cranial breadth & cranial length (as non-metric categories), Carabelli's cusps on molars, presence of an Inion hook at the external occipital protuberance, and cranial styloid process length.

Table 1. Non-metric traits used to ancestry assessment. Table source Rehor and Beck 2015:5-5.

Archaeology

Burial associated artifacts were recorded in the field while in-situ, as well as described on the excavation forms during the collection process. Most artifacts received only a cursory in-field analysis, while unusual artifacts such as coins, jewelry, or any artifact that could provide information regarding individual identity or date of burial was further examined in the field before removal to the URS' laboratory in Oakland, CA. Field examination of artifacts included gentle washing, soaking in alternating baths of citric acid or baking soda/vinegar to remove corrosion. Leather and fabric artifacts were dry-brushed and set out to dry before being bagged. All burial associated artifacts were cleaned and washed at the URS' laboratory. Artifacts were sorted by material and group, following the classification system from the Anthropological Studies Center's SHARD How-To Manual (2008), which is informed by South's (1977) functional artifact description categories. A unique catalog number was assigned to each artifact, incorporating the originating burial's provenance number. Burial associated artifacts were divided into two main categories; mortuary and cultural. Mortuary artifacts are any object directly associated with the coffin itself. Cultural artifacts include items placed in the coffin on or with the body

Coffin locations were recorded using a total station by individuals from the Foothill College department of Applied Anthropology. Surveyors recorded each corner of the coffin, which was used to document the coffin shapes (Rehor and Beck 2015).

Validation Study

In July 2016, a validation study was conducted on a sub-sample of 63 individuals (currently housed at California State University, Chico) to assess the accuracy of the data collected on-site. Overall discrepancies between laboratory and site data were minimal. During laboratory analysis four individuals were assessed as probable or possible male/female, while the on-site analysis had given a definitive assessment of male/female. In each case, the specific portion of the skeleton used onsite to assess sex (i.e. the sciatic notch) was not observable in the laboratory due to the poor preservation and the fragmentary nature of the remains. There was a single individual with an age discrepancy (aged 30-40 onsite but 60+ in lab) due to conflicting auricular surface scores. There were not any major discrepancies with the pathological data. The ancestry assessments have some discrepancies (n=4), but this may be due to the methods used. This validation study demonstrates confidence in the on-site osteological assessment. I acknowledge that future laboratory analysis of these remains may contradict some of the on-site analysis, but I remain confident in the larger assessments and trends that can be made from the on-site data.

Paleopathology & Indicators of Health

This research uses the osteological and archaeological information recorded on the primary excavation forms. The data was transcribed from the primary forms and standardized. An examination of the pathological, age, sex, and ancestry trends present among the SCVMC skeletal remains was used to establish morbidity patterns for the sample. A study of the general health and nutritional status of the sample included an examination of the presence and absence of specific and non-specific disease possesses. Variables examined include: porotic hyperostosis, periosteal lesions, and pathognomonic lesions (tuberculosis, syphilis, mycosis). References consulted for interpretation of trauma and pathology on-site included Aufderheider and Rodriguez-Martin (2006), Mann and Hunt (2005), Netter (2003), Ortner (2003), and Waldron (2009). The poor preservation of the skeletal remains prohibits the inclusion of stature and growth measurements. Out of the total 1,004 burials 79% of the total sample (795 individuals) exhibited some form of pathology. Records from the county and state board of health were compared to the skeletal data to provide additional context for assessing the impact of public health initiatives. Specifically, the potential for differential treatment and access to health-related resources based on social inequalities was examined in order to address research question one and two.

Age and sex estimations recorded on-site were used to separate the sample into subsets. These subsets consist of general categories such as male vs. female. The prevalence rate for specific pathogens and non-specific indicators of stress will be compared across the subsets. In addition to sex-based subsets, specific age-based categories were established. The categories will follow categories used on-site: fetus (in utero or perinatal); infant (0-3 years); child (4-10 years), juvenile (11-17 years); subadult (<18 years); adult (>18 years), young adult (18-34 years); middle adult (35-49 years), and older adult (>50 years). Ancestry assessments recorded on-site will be used to separate the sample into the following categories: Asian, African, European, Latino, Mixed-Other, and Indeterminate. However, as previously stated, ancestry assessment was not conducted on-site routinely until after the 600th burial. URS employees at San Francisco State University reassessed some individual burials in person. No individuals were previously scored as Native American.

Demographic Analysis

A demographic analysis employing various Siler and Gompertz mortality models, as well as correspondence and transition analysis was used to compare the osteological age-at-death assessments of the 493 SCVMC individuals with specific age estimations. A mid-point was taken for each osteological age estimation (i.e. an age estimation of 40-60 was recorded with a midpoint of 50). The data set includes a Hazard Function, Gompertz Hazard, and a Siler Hazard

(Chamberlain 2006; Gage 1991; Holman 2001; Konigsberg and Frankenberg 2002; Konigsberg and Herrmann 2002; Trask 2010; Wood et al. 1992, 2002) run in R using Lyle Konigsberg's hazard model code (available at http://konig.la.utk.edu). The output α_1, β_1, α_3, and β_3 parameters were then input into Nick Herrmann's paleodemographic modeling program to compare each data set. The parameters were graphed using their respective models. The log likelihood ratio and χ^2 tests of the individual α and β parameters were estimated in the MLE computer program (Holman 2001). Hazard analysis generates survivorship and mortality models. Survivorship is the probability that an individual will survive to a specific age (Chamberlain 2006). The probability of surviving beyond a specific age ranges from 1.0 (a 100% chance of being born) and 0.0 (a 0% chance of survival beyond the maximum recorded age). Mortality is the probability of a segment of the population that will die within a given age interval (Chamberlain 2006).

Historical Archives

Historical records associated with the SCVMC hospital and cemetery, as well as Santa Clara County were used to identify cultural factors that would have impacted the skeletal sample. Specifically, the Santa Clara County Hospital patient intake register, 1880 U.S. federal pauper and indigent census, U.S. census data, accounts from various local newspapers, coroner's reports, California Board of Health biennial report, and the California Board of Charities and Corrections biennial report were used to further elucidate the socio-political context of the time. The California Board of Health biennial report and California Board of Charities and Corrections biennial report are used to examine the city and counties efforts towards public health initiatives and their impact on the death rates within the county. These sources will be examined to address research questions two and three. The historical sources will be used to address questions related to public health and institutionalization. They will also be used to address expectations based on the comparison of the skeletal sample with the historical record.

In particular the Santa Clara County Hospital Patient Intake Register Volume 5 is used to establish expected demographic, examined causes of death, and to examine the different populations being treated and dying at the hospital. Information in the ledger including the categories of name, age, marital status, nativity, cause of death, date of death, date of burial or removal, and additional remarks (which noted if the individual received a county burial or if they were buried out of the area). The records of 3,076 individuals were transcribed and coded into an Excel database.

Historic Age

The age recorded in the ledger was used. There always exists the potential for slight errors in reported versus actual age, but the documented ages were accepted at face value. Only 20 individuals did not have a recorded age. Stillbirths were recorded with an age of 0.
Age data was categorized into five categories: infant (<1 year), juvenile (1-20 years), young adult (20-35 years), adult (35-50 years), older adult (50+ years).

Historic Sex

Sex was not recorded in the death record ledger, so the sex was interpreted based on individual names. Every individual was classified as male, female, or unknown. For names with questionable sex relation, the cause of death was first consulted (i.e. if the individual had a ruptured uterus = female), and if that wasn't conclusive the census was consulted to see if that individual could be located and sex could be determined. Stillbirths where no first name was given, and no sex was recorded (many stillbirths were listed with Surname, Infant, Sex i.e. "Canfield, Infant boy") were listed as unknown.

Historic Ancestry

The location of nativity was recorded. If the individual was born within the United States the state was documented, but if they were born outside of the United States only a country designation was recorded in the ledger. Nativity is unfortunately not the same as ancestry, referring specifically to the location of an individual's birth, rather than the ethnic or ancestral group they identify with and how skeletal material is classified. The nativity data was used to examine larger migration trends within the county death ledge sample but is unfortunately not directly comparable with the skeletal data.

Historic Pathology

The cause of death was directly transcribed, then matched and coded to the CDC top ten causes of death for the years covered by the ledge (1925-1933). For example, "pulmonary TB" was coded as tuberculosis, and "Chr. Endocarditis" was coded as heart disease. Causes of death that did not match the 13 causes of death listed by the CDC during 1925-1933 were coded as other.

Mission City Memorial Park

An index of burials at Mission City Memorial Park was compiled from the cemetery's internment records (1874-1997) by Larry DeJanvier and made publicly available on the Santa Clara County Historical & Genealogical Society website[7]. The website scraping tool import.io was used to convert the website data into structured csv files. The scraped data was cleaned and organized (i.e. fixing any parsing issues). Categories included in the data are: last name, first name, middle name, birth date death date, age, sex, place of death, and location of burial. Deaths

[7] https://www.scchgs.org/onlineindexes/missioncem.html

are the county infirmary were noted as “S.C. County Hospital”, “Santa Clara County Hospital” and “County Hospital”. Mission City Memorial Park had an active potter’s field from 1913-1937 (Rehor and Beck 2015:7-43).

Comparative Skeletal Samples

As previously stated, there are only a small number of well-documented historical cemetery excavations. Milwaukee County Institution Grounds (MCIG) and Alameda-Stone excavations served as the primary comparative samples. MCIG and Alameda -Stone are two of the largest 19th and 20th century cemeteries excavated to date (aside from SCVMC). Additionally, their geographic, temporal, and cultural contexts are in part complimentary to SCVMC. Both Alameda-Stone and MCIG have also been highly contextualized in both their archaeological and historic settings (Milligan 2010; Richards 1997; Goldstein 2012; Goldstein et al. 2012a, 2012b; Heilen and Sewell 2012; Heilen et al. 2012; Sewell et al. 2012). This presents a unique opportunity for the systematic analysis and comparison of three of the largest excavated historical cemeteries in the U.S. To date, these cemeteries have not been compared to each other. The Voegtly Cemetery will also be used as a comparative sample to include a cemetery with a vastly different context (community burial ground) and location (East Coast). See table 2 for site summaries.

Milwaukee County Institution Grounds

In 1991, 1992, and 2013 portions of the Milwaukee County Institution Grounds (Milwaukee, Wisconsin) cemetery were excavated. This cemetery was in use from August 1882 until July 1925 (Richards 1997; Richards and Kastell 1993) As results from the 2013 excavations are still forthcoming; data from the 1991 and 1992 excavations will be used. The excavated sections yielded a total of 1,649 burials. 1,061 were adult remains, and 588 were classified as subadult's. MCIG was established to provide a burial ground for not only Milwaukee's various institutions, but members of the wider community that could not afford burial fees elsewhere, as well as unidentified individuals.

Milligan's (2010) dissertation examined pathological and nutritional conditions within a sub-sample of both the adult (n=491) and subadult (n=373) remains. A majority of the subadult remains were less than 1 year of age (88.3%). The adult burials include 406 males, 57 females, and 28 indeterminate individuals. Milligan's (2010) study looked at several factors related to nutritional stress and infectious disease and thus will serve as the main MCIG data set for this research project. Specifically, the paleopathological analysis included the following: liner enamel hypoplasias, porotic hyperostosis, cribra orbitalia, long bone metrics, periosteal reactions, osteomyelitis, pathologies associated with tuberculosis and treponemal infection, and degenerative processes.

Site Name	**Location**	**Time Period**	**No. of Individuals**	**Source**
Milwaukee County Institution Grounds	Milwaukee, Wisconsin	1882-1925	1,649	Milligan 2008, 2010
Alameda-Stone	Tucson, Arizona	1860's – 1881	1,386	Heilen & Gray 2010, Heilen 2012
Voegtly Cemetery	Pittsburgh, Pennsylvania	1833-1861	724	Uberlaker & Jones 2003

Table 2. Historical Cemetery Comparative Sample.

Alameda-Stone

The Alameda-Stone cemetery was originally used by the community members of Tucson, Arizona from the early 1860's through 1881. It was excavated as part of the Joint Counts Complex Archaeological Project in 2006. The project completely excavated 1,083 grave features (representing 1,381 individuals), 736 post-cemetery period features, 3 prehistoric features, and several prehistoric and historical artifact scatters (Heilen 2012, Heilen and Gray 2012). The individuals buried there were of diverse cultural, religious, and biological backgrounds, making this cemetery a unique comparison site. The archaeologists and biological anthropologists working on this project worked diligently to re-associate the cultural affinity of individual graves to fulfill burial agreements with potential area descendant groups.

As reported in the 2010 technical report (Trask 2010), the Alameda-Stone cemetery sample included a total of 226 females, 314 males, and 846 indeterminate individuals. The sample includes 730 adults, 650 subadults, and 6 individuals of indeterminate age. Factors assessed related to nutritional stress and paleopathology were as follows: linear enamel hypoplasia, periosteal reaction, osteomyelitis, pathologies associated with tuberculosis and treponemal disease, neoplasms, degenerative conditions, cribra orbitalia, and porotic hyperostosis (Leher et al. 2010; Lincoln-Baab and McClelland 2010).

Voegtly

The Voegtly Cemetery was in use from 1833 to 1861 and is associated with the Voegtly Evangelical Lutheran Church in Pittsburgh, Pennsylvania. The proposed highway expansion was going to impact the cemetery, thus 724 burials were exhumed and analyzed by Doug Ubelaker and colleagues from the Smithsonian Institution (Ubelaker and Landers 2003:1). Extensive osteological analysis was performed on the sample including demographic and pathological examinations. The pathological observations included trauma, periosteal lesions, lytic lesions, tuberculosis, degenerative joint disease, Harris lines, cribra orbitalia, and dental health including carious lesions and enamel hypoplasia's. The Voegtly sample included a total of 76 females and 95 males. The sample includes 249 individuals under the age of 1, and an additional 187 between the ages of 1-5. The remaining individuals include 86 under the age of 25, 130 between the ages of 25-50, and 34 individuals over the age of 50.

Statistical Analysis

In order to examine the relationships between age, sex, ancestry, pathology, and artifact categories statistical analysis, including frequencies and descriptive statistics were performed. Two principle methods employed include contingency tables using Chi-Square and Correspondence Analysis.

Chi-square tests (with Fisher's Exact tests or Yates Correlation as appropriate), were calculated to determine if there was an association between age, sex, ancestry, pathology, and artifact categories. Because all 2x2 contingency tables had an N >40, if a cell had a value of <10 a Yates Correction was also tabulated.

Correspondence Analysis allows for more than two variable categories to be compared to each other. Correspondence analysis transforms contingency tables information into a two-dimensional graphic used to visualize patterns, relative dispersion, and total variance. Correspondence analysis relies on contingency table profiles, masses, and chi-square distances (Hefner 2007). All correspondence analyses were conducted using R 3.2.3. The specific R code was provided by Dr. Hefner.

Spatial statistics

A spatial autocorrelation average nearest neighbor test was performed in ArcGIS. The average nearest neighbor test determines if the selected geospatial attribute is spatially clustered or dispersed. If the nearest neighbor ratio (index) is less than 1, the pattern exhibits clustering. If the ratio is greater than 1, the trend is towards dispersion. When conducting a nearest neighbor analysis the boundary effect must be taken into consideration. The nearest neighbor statistic assumes that there is boundless space, so when a finite area is investigated that may sever potential connections between nearest neighbors, and the results are biased by raising the average distance between nearest neighbors (Carr 1984, Pinder et al. 1979:431).

A midpoint was established for each burial as the average nearest neighbor test requires a single attribute for the spatial analysis. Biological profile, coffin shape, and artifact data was added to the coffin GIS attribute table. This allowed individual attributes to be selected and analyzed using the average nearest neighbor test.

Summary

The methods used in this study are based upon accepted measures of health and mortuary analysis as discussed in Chapter 2. The goal of the comparative analysis is to examine indicators of health between samples using data types they have in common. No two data sets are identical. The skeletal samples are impacted by deferring levels of preservation, research goals of the data collectors, and how the data was collected, categorized, and documented. The statistical tests used attempt to limit the differences between data sets. Similarly, it is acknowledged that archival data, such as the Santa Clara County Hospital patient intake register, are not infallible. Archival documents are subject to the inherent biases of their textual evidence and are often biased towards particular privileged groups. The historical narrative created by the historical documents must be carefully considered.

Chapter 6: Results from VMC

Introduction

This chapter addresses the Santa Clara Valley Medical Center historic-era cemetery (VMC), while chapter 7 addresses the results of comparisons with similar cemeteries and archival material. The complete VMC skeletal sample was used.

Skeletal Results

This section presents the results of data constructed from skeletal analysis.

Demography of Skeletal Sample

The age and sex assessments considered multiple factors from several areas of the skeleton, with the number of indicators conditional on the completeness and preservations of the burial. Of the total 1,004 individuals, 743 have sex assessments and 987 have estimations of age (493 of whom have specific age range estimations). The overall poor preservation seen throughout the cemetery hindered more detail assessments for many burials. The cemetery is overwhelming adult (see Table 3) and male (see Table 4). The lack of females (7%) and subadults (6%) presents unique challenges for demographic reconstruction and comparison. The 493 individuals with specific age estimations are the focus of the demographic work.

Age	Count	Frequency
Sub-adult (<25)	63	6%
Adult (25-59)	746	74%
Older Adult (60+)	168	17%
Indeterminate	27	3%
Total	1004	100%

Table 3. VMC Broad Age Category Distribution.

Sex	**Count**	**Frequency**
Male	**720**	**72%**
Female	**75**	**7%**
Indeterminate	**209**	**21%**
Total	**1004**	**100%**

Table 4. VMC Broad Sex Category Distribution.

Age

Age categories were recorded as both fine and course levels of detail. The data was originally recorded as infant (<1 year), subadult (1-20 years), young adult (20-35 years), adult (35-50 years), older adult (50+ years), and indeterminate (see Table 5, Figure 11). Due to the relatively few number of young individuals in the sample, and to make statistical analysis more straight forward, the age categories were coarsened into subadult (<25 years), adult (25-50 years), older adult (50+ years), and indeterminate (see Table 6, Figure 12).

Age Fine	Count	Frequency
Infant	13	1%
Subadult	15	1%
Young adult	35	3%
Adult	746	74%
Older adult	168	17%
Indeterminate	27	3%
Total	1004	100%

Table 5. Age Categories Fine Typology.

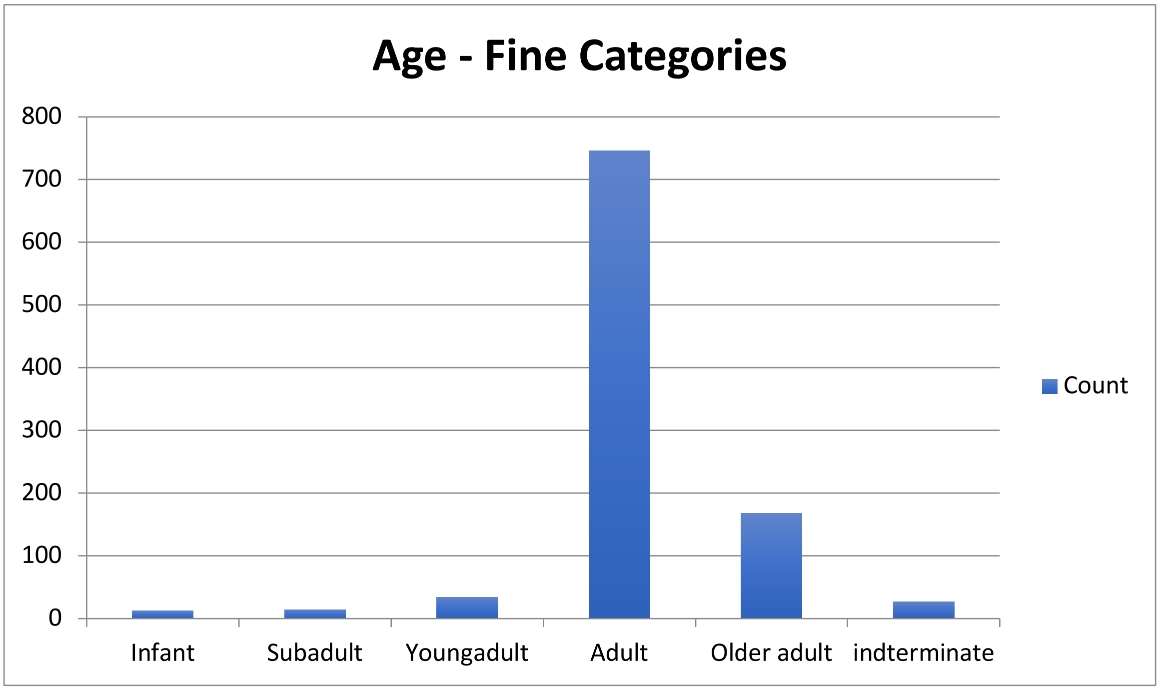


Figure 11. Age categories by count.

Age Course	Count	Frequency
Sub-adult	63	6%
Adult	746	74%
Older Adult	168	17%
Indeterminate	27	3%
Total	1004	100%

Table 6. Course Age Categories.

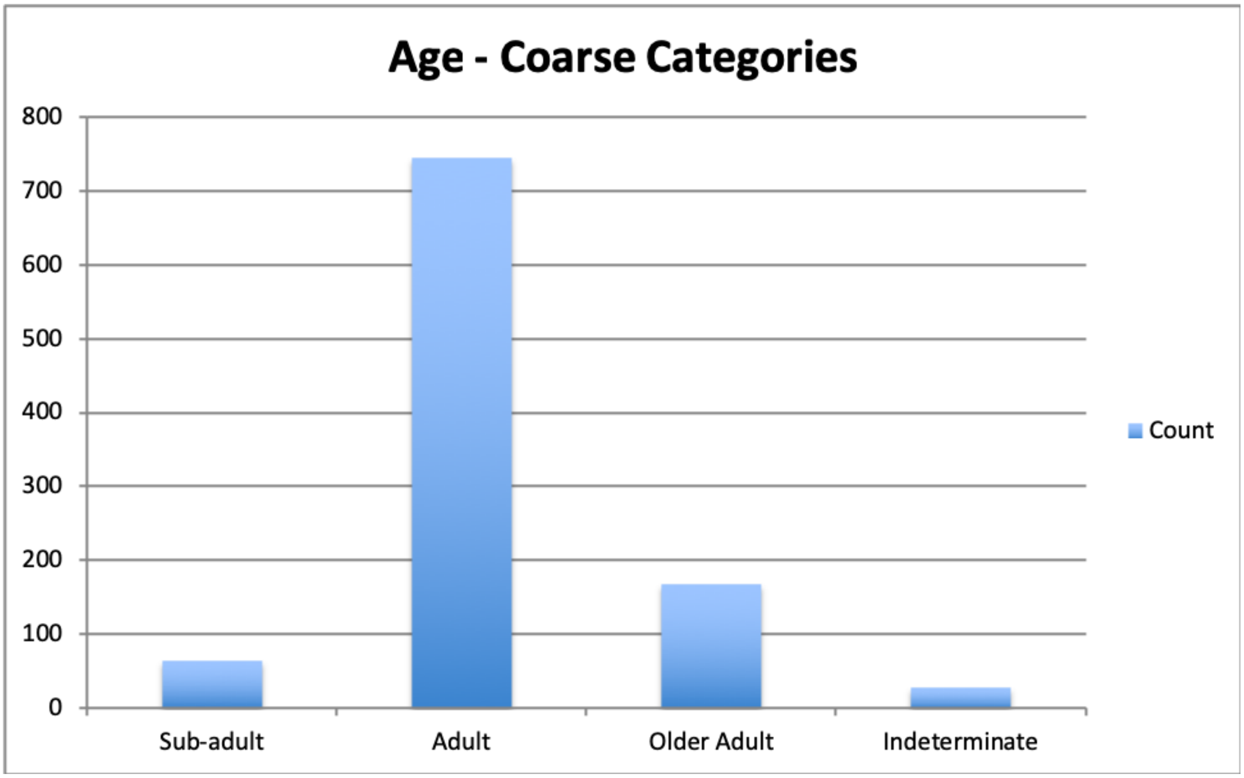


Figure 12. Coarse Age Categories.

An overwhelming (91%) portion of the sample is comprised of individuals over the age of 20 (See Figure 13). Since only approximately 35% of the total cemetery was excavated it is possible subadults existed within the cemetery but were segregated into a “babyland” that was not excavated. Another possible explanation is that children were buried elsewhere, possibly cared for by the many Benevolence Societies in the area. The death of a child is treated differently from adult deaths (Curl 1972; Mitford 1963; Sweeney 2014). There is a social stigma associated with being buried in a potter’s field, and children may have been spared this. The demography of the Santa Clara Valley was also heavily skewed to adult males due to the large amount of immigrant and migrant workers in the area working in agriculture and canning. This data is also represented visually in the age colored-coded map in Figure 14.

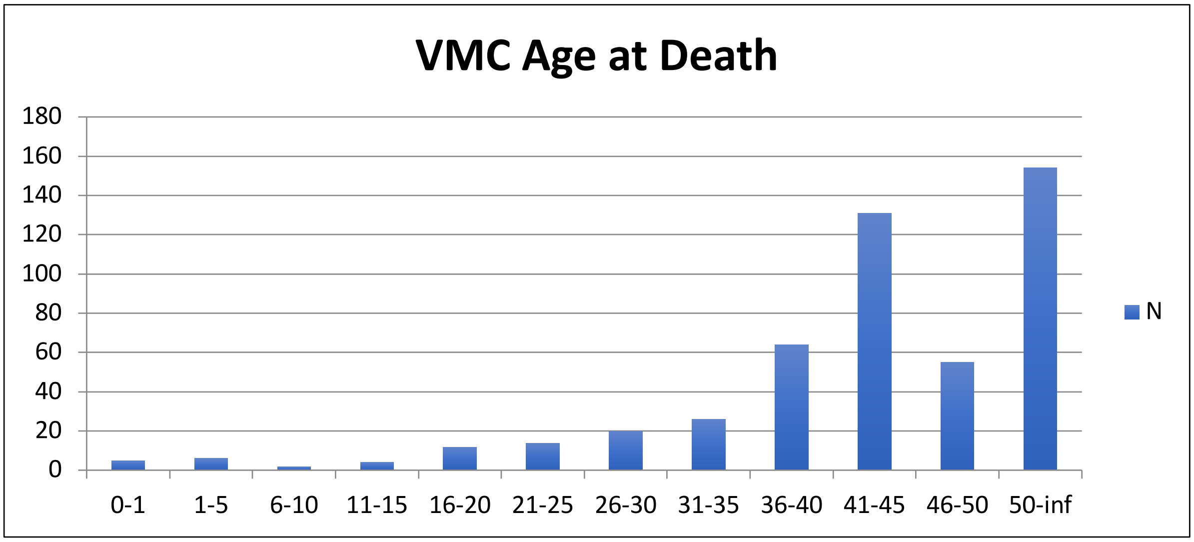


Figure 13. VMC Age at Death.

Sex

Sex categories were recorded as fine, and course. Fine categories are possible male, probable male, male, possible female, probable female, female, and indeterminate. These categories were coarsened to make statistical analysis more straightforward; the coarse categories are male, female, and indeterminate (see Table 7, Figure 15).

Males comprised 72% of the total sample (90.5% of the sex-able sample when indeterminates are removed). The lack of females is somewhat surprising, but not totally unexpected. Similar to the lack of subadults, it's possible that females are buried in a separate section of the cemetery that was not excavated. It's also probable that this is also an effect of the overall demographic proportions of the area at the time. The large number of indeterminate individuals (21%) is largely due to preservation issues. See Figure 16 for a map with sex color-coded.

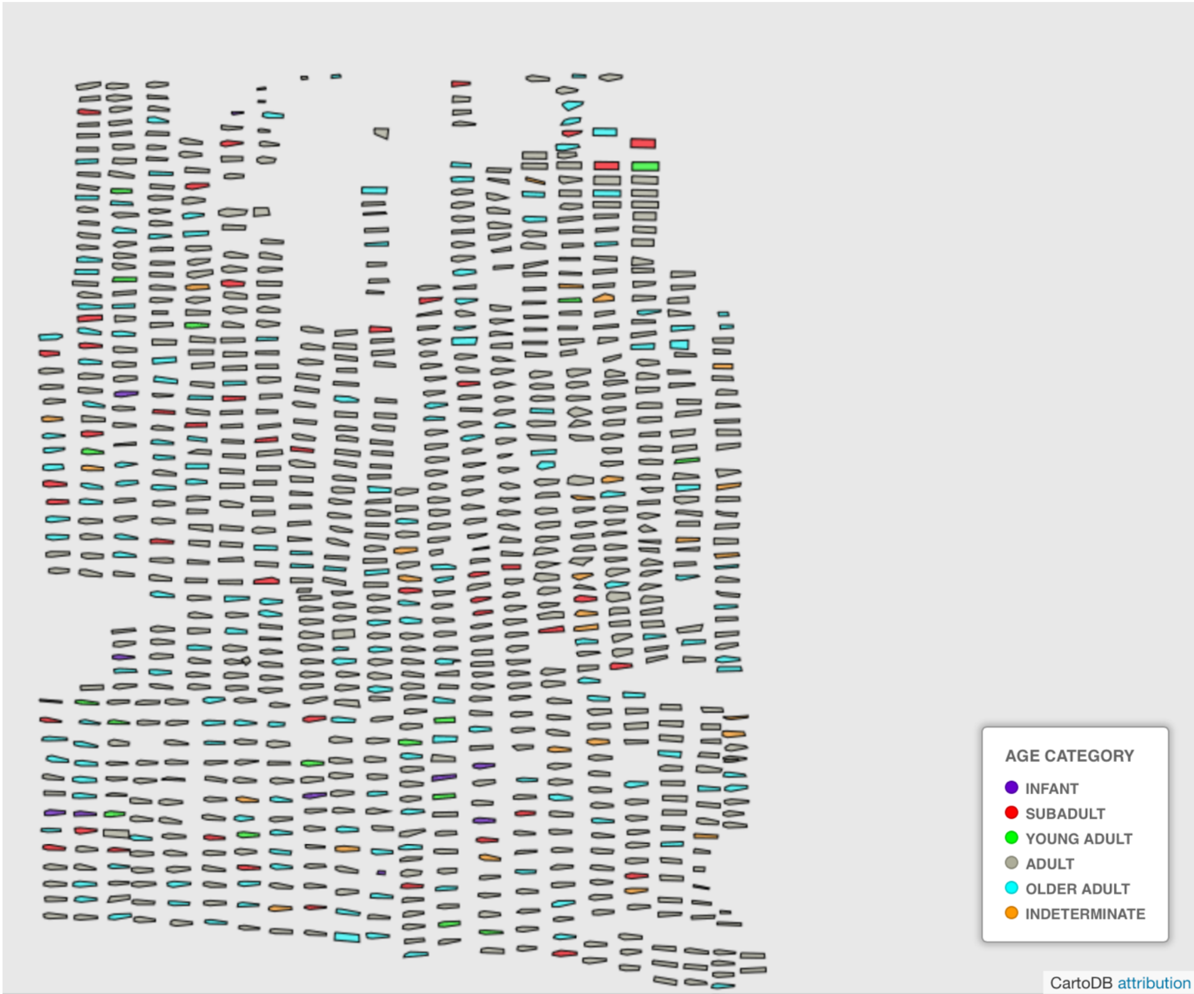


Figure 14. Map of burials colored coded by age categories.

Sex	Count	Frequency
Male	720	72%
Female	75	7%
Indeterminate	209	21%
Total	1004	100%

Table 7. Course Sex Counts.

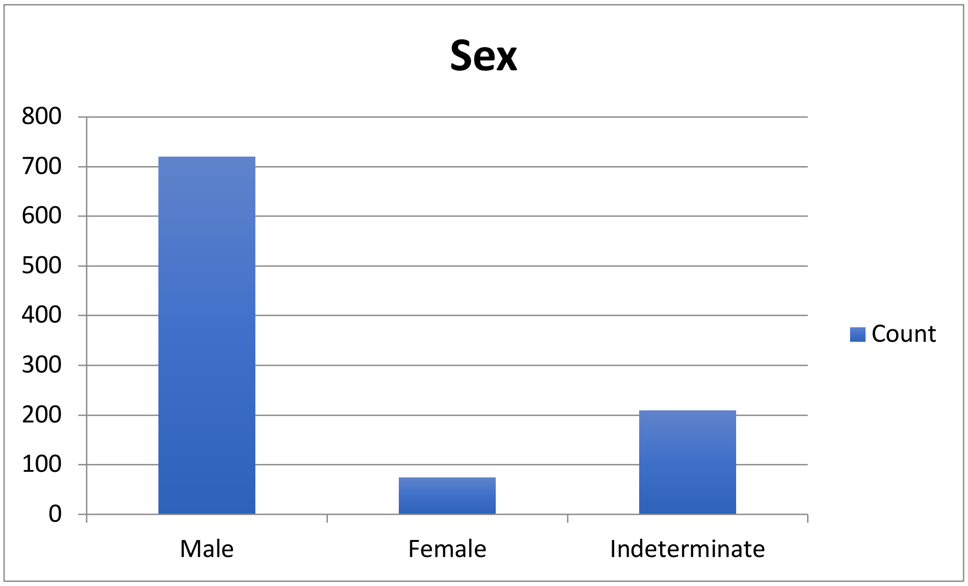


Figure 15. Course Sex Counts.

Ancestry

A majority of the burials (n=589; 58.9%) did not have a conclusive ancestry assessment. Of the remaining 411 burials the most prevalent ancestry assessed was the combined Asian/Latino (n=251; 61%), followed by European (n=106; 24%) and African American (n=54; 12.25%). With only 41% of the cemetery having ancestry assessments, further comparative and descriptive statistics were not run.

Demographic Analysis

The males and females were compared using hazard models (see Table 8 for α and β values). As seen in table 9, the log-likelihood difference was -179.016 , (though it should be noted that the program used for the log likelihood ratio is conservative and nearly always results in statistically significant differences) indicating that there are no significant differences between the male and female skeletal sample in terms of mortality and survivorship ratios.

Figure 16. Map of burials color-coded by course sex.

Sex	α_1	β_1	α_3	β_3
Female	0.002361463	1.01	0.017429365	0.027701375
Male	0.02982873	1.0135133	0.1711696	0.02877075

Table 8. α and β values males v. females.

Sex	X^2	df	Log likelihood difference	p
Female v. Male	358.032	2	-179.016	<0.0001

Table 9. Log likelihood difference males v. females.

The probability density, Figure 17, demonstrates that males and females in the sample have the same probability of being a specific age at death. The probability of mortality (Figure

18), as well as probability of survivorship (Figure 19) is nearly identical between males and female. This may be a byproduct of the disparity between the number of males and females in the sample.

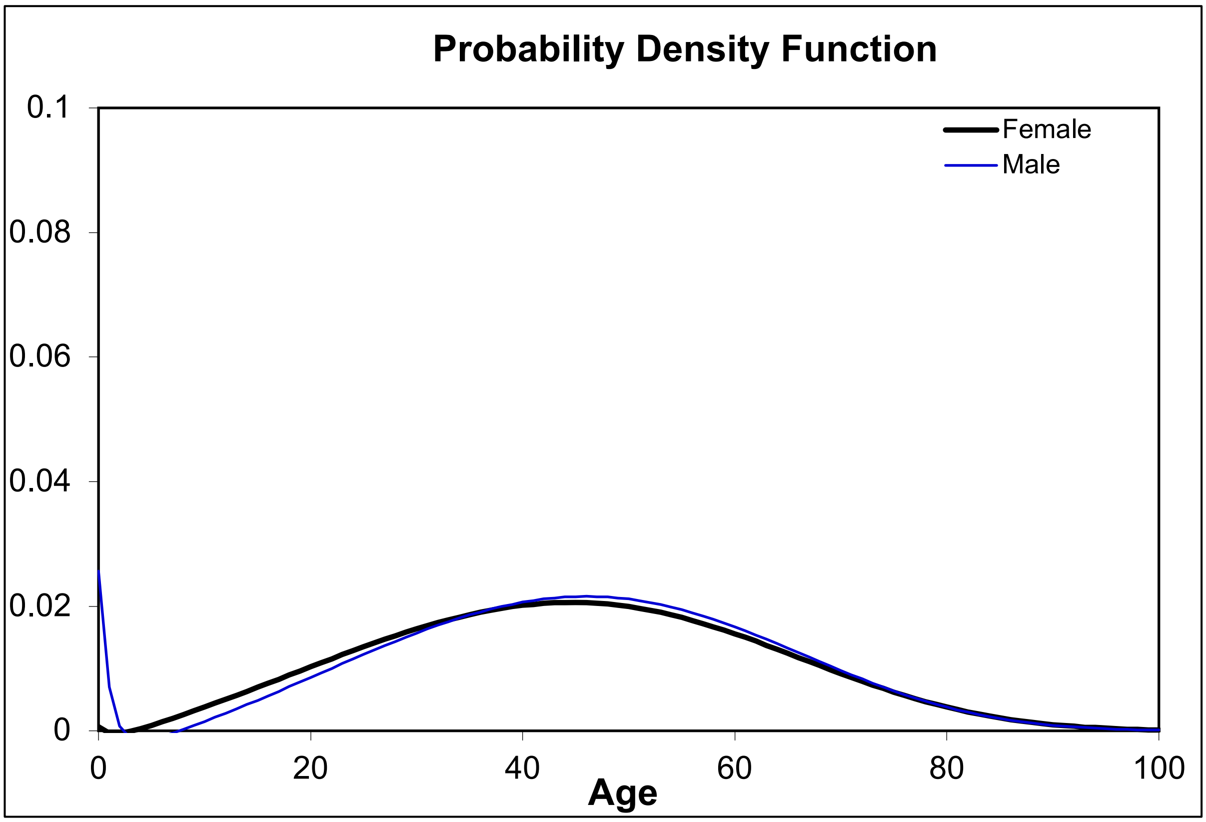


Figure 17. VMC Male v. Female Probability Density Function.

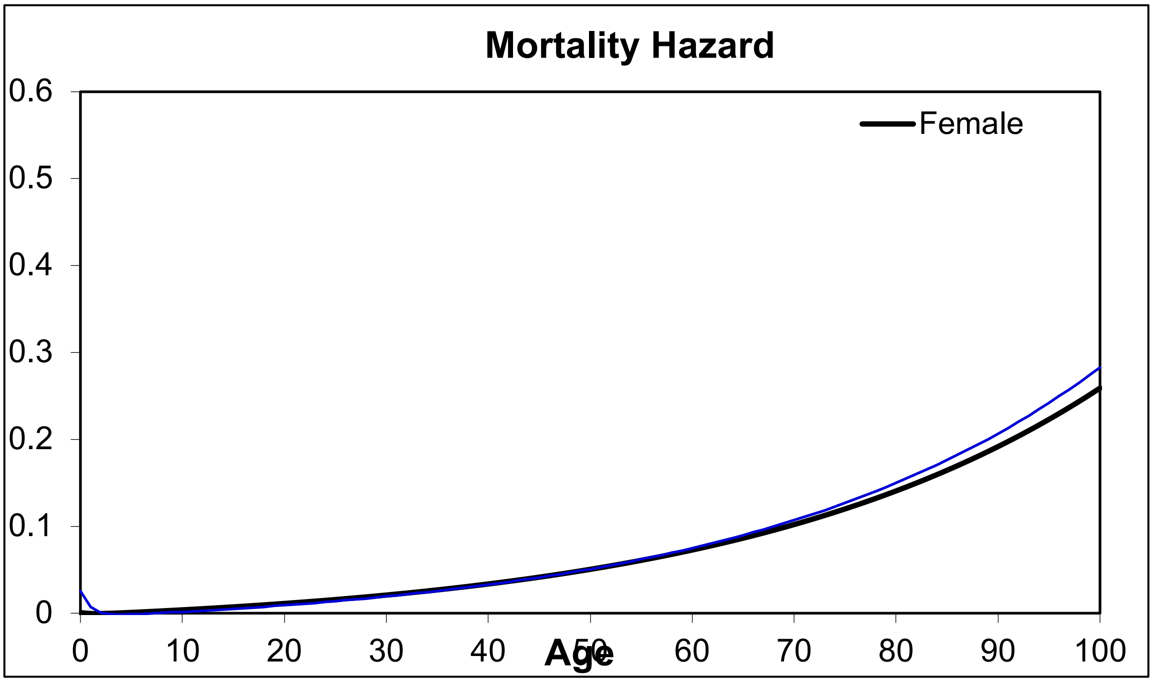


Figure 18. VMC Male v. Female Mortality Hazard.

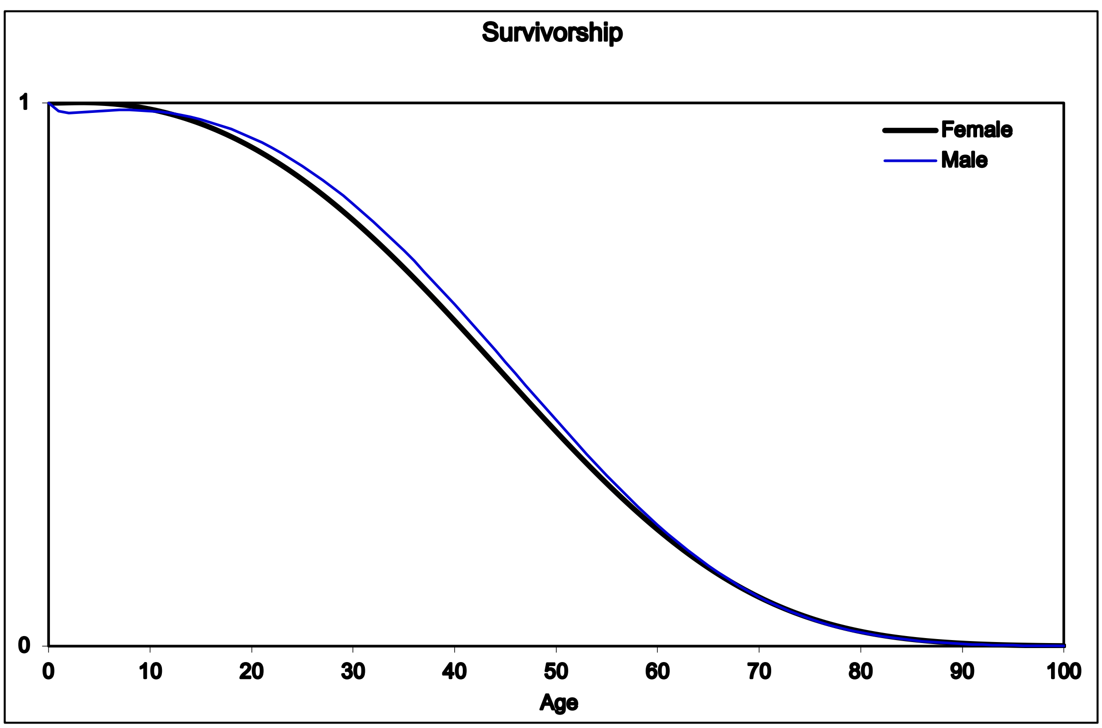


Figure 19. VMC Male v. Female Survivorship.

Pathology

Nonspecific Infection

Periostitis and Osteomyelitis

In the sample 42% of individuals (n=424) had observable non-specific infections (see Table 8). In terms of the sex frequency of non-specific infections among males it is 49% and for females is it 66%. Localized infections involving 1-2 skeletal elements occurred in 57% of individuals with periostitis (n=240). Systemic infections involving 3+ skeletal elements occurred in 43% of individuals with periostitis (n=184). For age the frequency of non-specific infections for subadults is 41%, adults 39%, and older adults 62.5%. Included in the non-specific infection totals are individuals with osteomyelitis and localized chronic non-specific infections.

Osteomyelitis (see Figure 20 and 21) is an infectious condition that begins within a bone's marrow spaces and primarily affects the endosteal surface. Osteomyelitis can result from a multitude of stressors including the introduction of pyogenic bacteria, viruses, fungi, and multicelled parasites (Mast and Horwitz 2002; Ortner 2003:181). Osteomyelitis was documented in thirty-five individuals (males=25, females=3, and 7 individuals of indeterminate sex). Localized chronic infectious such as sinusitis, mastoiditis (infection of the mastoid), or otitis media (ear infection) were documented in thirty-five individuals (males = 27, females = 7, and one juvenile of indeterminate sex). Four of the individuals with mastoiditis had evidence of surgical intervention: three unilateral mastoidectomies and one bilateral mastoidectomy (see Figure 22).

Specific Infections

Coccidioidomycosis (Valley Fever)

Two adult males were identified as having fungal infections consistent with Coccidioidomycosis, aka Valley Fever. Coccidiodomycosis is found in warm, arid, desert-like regions in the Western Hemisphere. This fungus is endemic to large portions of California (Yang et al. 2011), the desert Southwest, and parts of Mexico and South America (Brown et al. 2013; Ortner 2003:326). The organisms are found in alkaline, sandy soil, commonly 10-30 cm beneath the surface (Brown et al. 2013;186), and are thus routinely encountered by construction workers, agricultural workers and archaeologists. The bone foci may be solitary or at multiple sites with symmetrical involvement (Resnick and Niwayama 1995:2510). The bone lesions tend to be lytic and may be associated with periosteal reactions. The most characteristic aspect of coccidioidomycosis lesions is that they are common in areas typically spared by other infections including bony prominences, small bones such as carpals, tarsals, and patella. Destructive rib and vertebral body lesions as well as lesions of the skull may be present (Ortner 2003:326-327).

Treponemal Infections

Both acquired and congenital syphilis was observed in the sample. Eleven individuals were diagnosed with tertiary syphilis (see Figure 23). Ten of these individuals were adult males, and one was an older adult of indeterminate sex. The diagnosis of tertiary syphilis included documenting saber shins, carries sicca, and nongranulomatous and gummatous inflammation of long bones (Ortner 2003).

Figure 20. Burial 685 overview, hematogenous osteomyelitis.

Figure 21. Close up of Burial 685 right femur hematogenous osteomyelitis.

Figure 22. Burial 218 mastoidectomy, left mastoid.

Age Category	Subadults	Adults	Older Adults	Indeterminate	Total
Males	21	241	95	n/a	357
Females	4	18	8	n/a	30
Indeterminate	1	30	2	4	37
Total	26	289	105	4	424

Table 10. Non-specific infections by Age and Sex.

Figure 23. Burial 732 tertiary syphilis with saber shins.

Congenital syphilis was identified in three individuals; two young adults and one subadult. Each diagnosis was based on the presence of severe enamel defects (see Figure 24) and the pathognomonic enamel defects known as Hutchinson's Incisor and Mulberry Molar's (Figure 25) (Hillson 1996; Hillson et al. 1998). Congenital syphilis is passed from infected mothers to the fetus in the womb (Ortner 2003).

Figure 24. Burial 736 enamel defects and calculus, congenital syphilis. Photo courtesy of Karen Gardner.

Figure 25. Burial 736 mulberry molar, congenital syphilis. Photo courtesy of Karen Gardner.

Tuberculosis

Ten individuals were diagnosed with possible tuberculosis infections. The individuals were all adult (males = 7, females = 2, and one adult of indeterminate sex. Each diagnosis was based on characteristic skeletal lytic lesions associated with tuberculosis, especially lesions of the vertebra and plural surface of the ribs (Ortner 2003). Because skeletal lesions in patients with tuberculosis are rare, the number of individuals with active tuberculosis at the time of their death may have been much higher; especially given known rates of historical prevalence. Poor preservation of the thoracic cavity may have also impacted the number of diagnoses.

Age and Sex Differences

For each indicator of health the sample was examined for observable differences based on age or sex. Tables 11-14 summarize the totals for males and females respectively. Pearson's chi-square was run to test the statistical significance of differences between the age and sex categories with significance set at the $p<0.05$ levels.

A significant difference does not exist between males and females for non-specific infections ($\chi^2 = 2.497$, df= 1, p= 0.114062). A significant difference does not exist between males and females for tuberculosis ($\chi^2 = 0.557$, df= 1, Yates Correction p = 0.4553), Coccidioidomycosis ($\chi^2 = 0.209$, cf = 1, Yates Correction p = 0.6477), and Tertiary Syphilis ($\chi^2 = 0.233$, df =1, Yates Correction p= 0.6293). Congenital Syphilis was not examined by sex due to the subadult status of individuals with Congenital Syphilis.

The sample was also examined for age-related differences between those classified as sub-adults, adults, and older adults. The lack of individuals in specific categories (i.e. zero young adults with Coccidioidomycosis or only Adults having Tuberculosis) prevented Chi-squares tests

Sex	Present	Absent
Male	357	363
Female	30	45

Table 11. Non-specific infections by sex.

Sex	Present	Absent
Male	7	713
Female	2	73

Table 12. Tuberculosis by sex.

Sex	Present	Absent
Male	2	718
Female	0	75

Table 13. Coccidioidomycosis by sex.

Sex	Present	Absent
Male	10	710
Female	0	75

Table 14. Tertiary Syphilis by sex.

from being run. The only comparison that could be run is non-specific infections and there statistically significant difference between age categories ($\chi^2 = 31.6662$, df = 2, p = < 0.00001), see table 15.

Age	Present	Absent
Subadult	26	37
Adult	289	457
Older Adult	105	63

Table 15. Non-specific infections by age.

Mortuary Archaeological Analysis

Coffins

All of the internments at VMC occurred in redwood coffins. As a county institution the hospital was required to publicly advertise calls to bid on the contract for indigent burial services. Though the undertakers contracted to perform these services varied over the years, each was required to provide the burial containers. Redwood was a convenient and cost-effective resource, with lumber mills present in the nearby Santa Cruz Mountains. Coffin construction and dimensions were analyzed to explore shape and construction patterning within the cemetery. Coffin shape and decoration reflects the prevailing mortuary trends and should reflect changes in attitudes towards death. Potter's burials should reflect larger burial container trends, but retain only the most basic, least expensive, portions of prevailing mortuary beliefs.

Length

Coffin length was gathered from the burial excavation record forms. The specificity of the measurement varied depending on who took the measurement, with some individuals rounding to the next ¼ inch, and others recorded to the third decimal place. To standardize the measurements the recorded number rounded down if <.5, and up if >.5. Coffin length that was noted to be disturbed, impacted by the backhoe, or highly damaged so as to potentially obscure the true coffin length was removed from the calculations. The unit of measurement to inches, as is standard for historical site recording. Length ranged from 21-92 inches. Length is also very close to a normal distribution (see Table 16, Figure 26).

Mean	72.38446089
Median	73
Mode	72
Std dev	5.93734184

Table 16. Coffin Length.

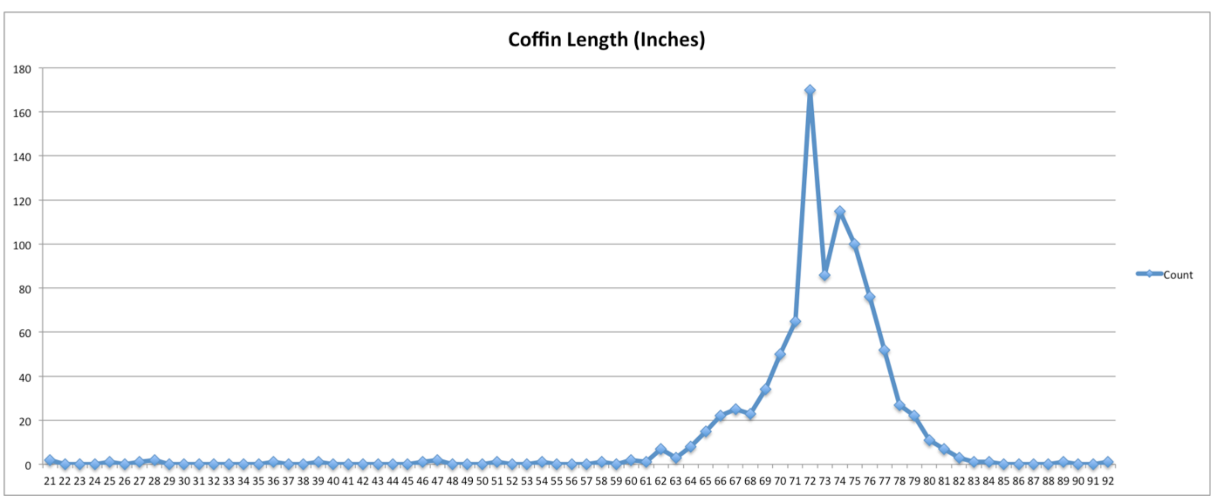


Figure 26. Coffin Length Counts, length in inches.

An average coffin length of 73 inches equates to roughly 6 feet long. This is not unexpected as a six-foot length is a standard cut of milled lumber (Rangel 2016). A range of variation exists; with the shortest coffins belong to subadults. All coffins less than 50 inches in length contained subadults, indicating that even in the potter's field variation in coffin construction was performed for children. This is logical, as using a larger burial container would not be an economical decision.

Depth

Coffin depth (height of the side board) was gathered from the burial record forms. The measurements were rounded down if <.5 and up if >.5. The unit of measurement was standardized to inches, and burials where true depth could not be determined were removed. Depth ranged from 1-22 inches (see Table 17, Figure 27).

Mean	6.75
Median	7
Mode	7
std dev	2.25

Table 17. Coffin Depth.

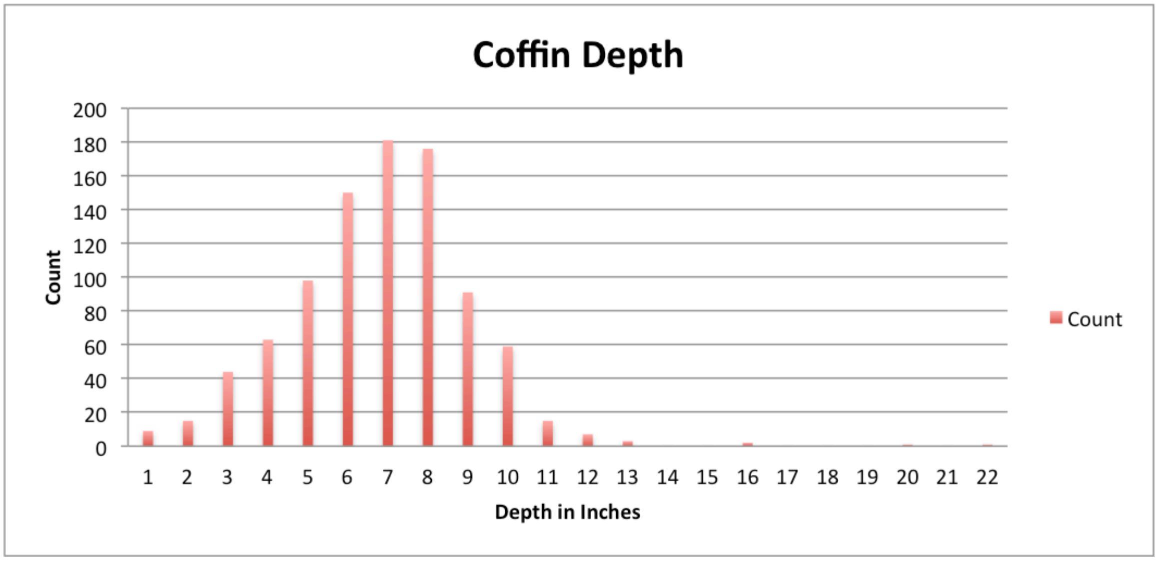


Figure 27. Coffin Depth Counts.

The range of coffin depths may be a result of taphonomic processes, as well as overall coffin size. Nearly all of the coffins were slightly to severely crushed from the pressure exerted from the parking lot above them. However, the average depth was 6.75 inches, with the descriptive statistics approaching a normal distribution.

Width

Coffin width was gathered from the burial record forms. The measurements were rounded down if <.5 and up if >.5. The unit of measurement was standardized to inches, and removed burials noted to be damaged thus obscuring true maximum width. Width measurements were taken at both the shoulder and foot regions of the coffin. The widest measurement, which a majority of the time was the shoulder width, was selected as each coffin's width measurement. Width ranged from 5-50 inches (see Table 18, Figure 28).

Mean	17.04
Median	17
Mode	17
Std dev	3.00

Table 18. Coffin Width.

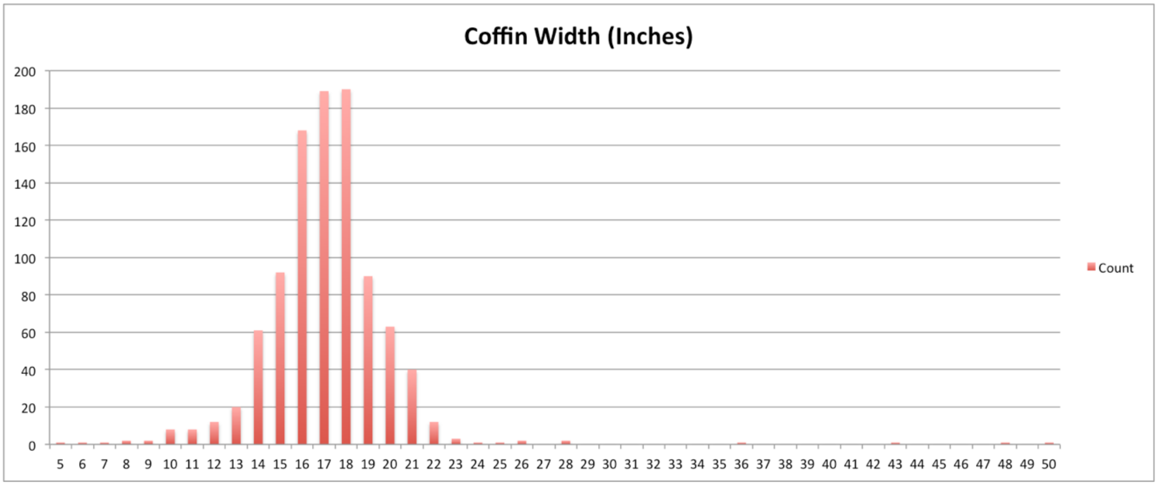


Figure 28. Coffin Width Count.

Coffin width, similar to the length appears to conform to a standardized size of a 1 ½ foot width at the shoulder, with the descriptive statistics conforming to a normal distribution.

Shape

The shape of the coffin was recorded as hexagonal (widest at the shoulders), rectangular (straight on all sides), tapered (trapezoidal), double, other, and indeterminate (see Table 20, Figure 21). It should be noted that double does not indicated two stacked burials (those were each recorded for individual coffin shape), but rather a hexagonal coffin inside a larger rectangular box.

Hexagonal coffins comprised a majority of the sample (74%), followed by rectangular (15%), and tapered (5%). This is not surprising, as hexagonal coffins were the most typical shape during this time period (Bell 1990; Coffin 1976). See Figure 30 for a color-coded map of burials by coffin shape.

Coffin Shape	Count	Frequency
Hexagonal	745	74%
Rectangular	149	15%
Tapered	53	5%
Double	7	1%
Other	6	1%
Ind	44	4%
Total	1004	100%

Table 19. Coffin Shape Count & Frequency.

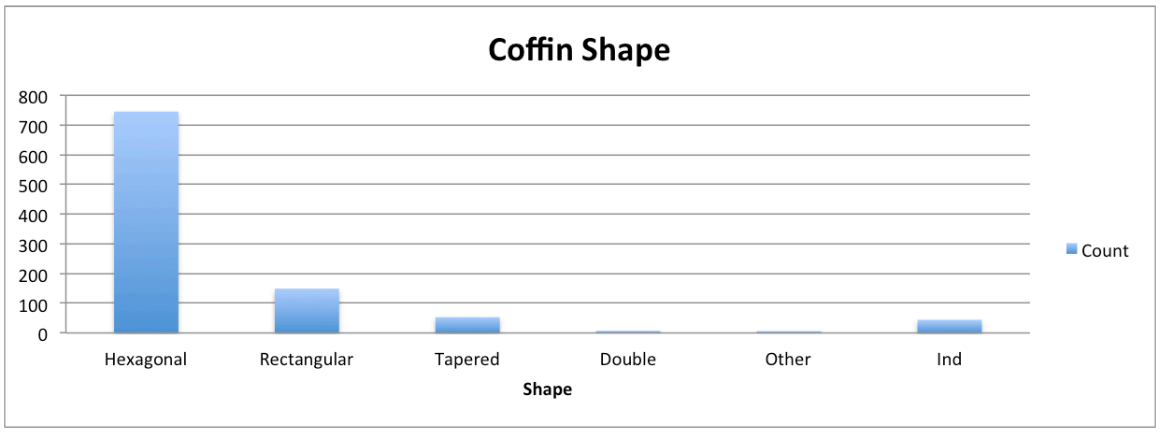


Figure 29. Coffin Shape Counts.

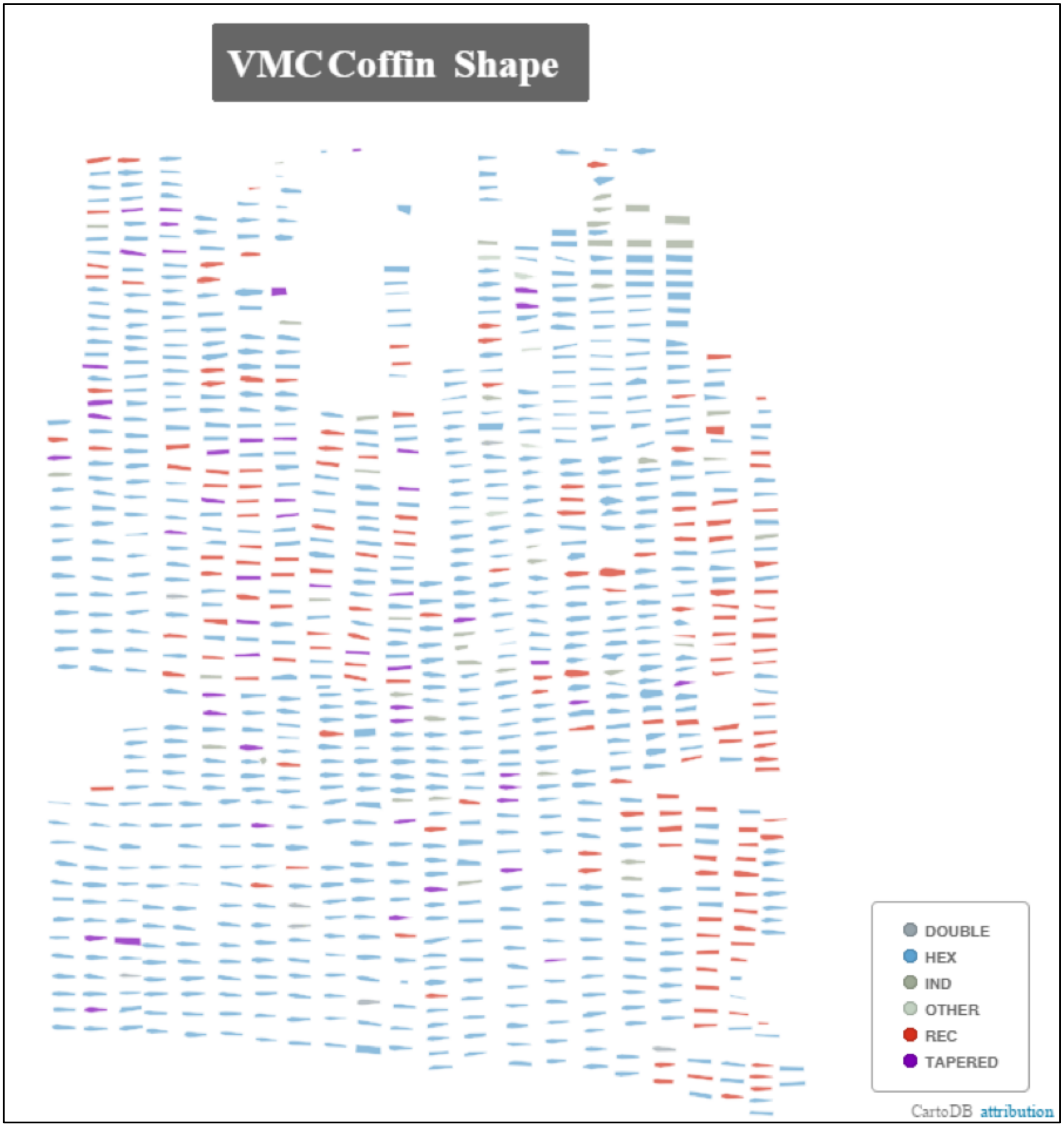


Figure 30. Burial Map color coded by shape.

Grave Goods

Clothing Related Artifacts

Buttons

Buttons were recorded by type (bone, ceramic, clay, cuprous, ferrous, indeterminate, plastic, Prosser, shell, wood, wool), and presence/absence per burial (see Figure 14). Burials were also recorded as no buttons, one type of button present (see Figure 31 or 32), or multiple types of buttons present (see Table 20 and Figure 33).

Burial with buttons	669
Burials without buttons	335
Burials with multiple types	279
Burials with one type	390

Table 20. Button Pattern Types by Burial Count.

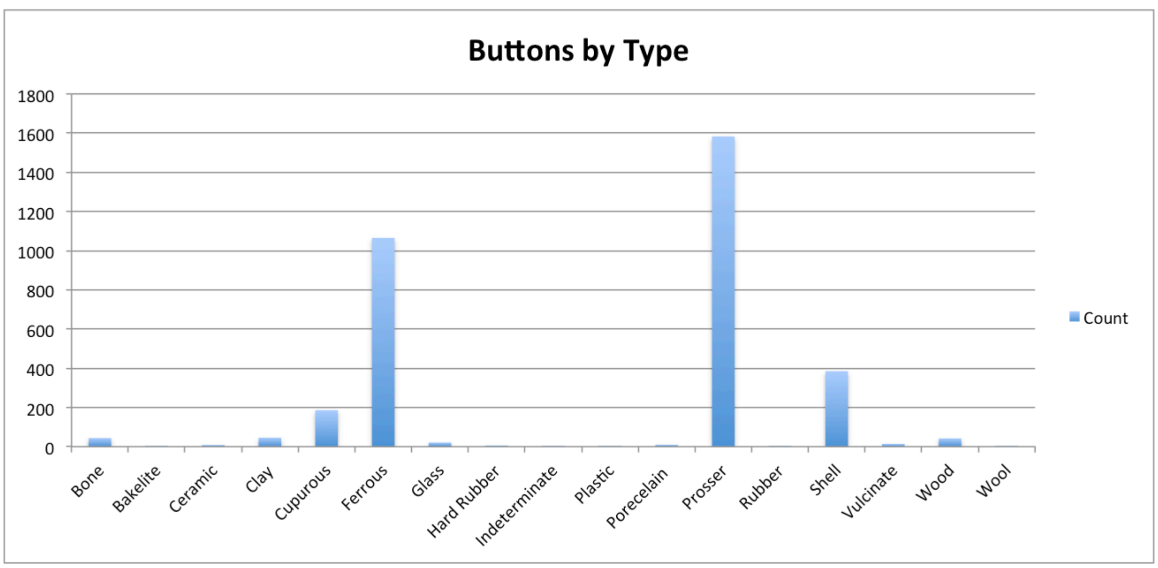


Figure 31. Total Number of Buttons by Button Material Type.

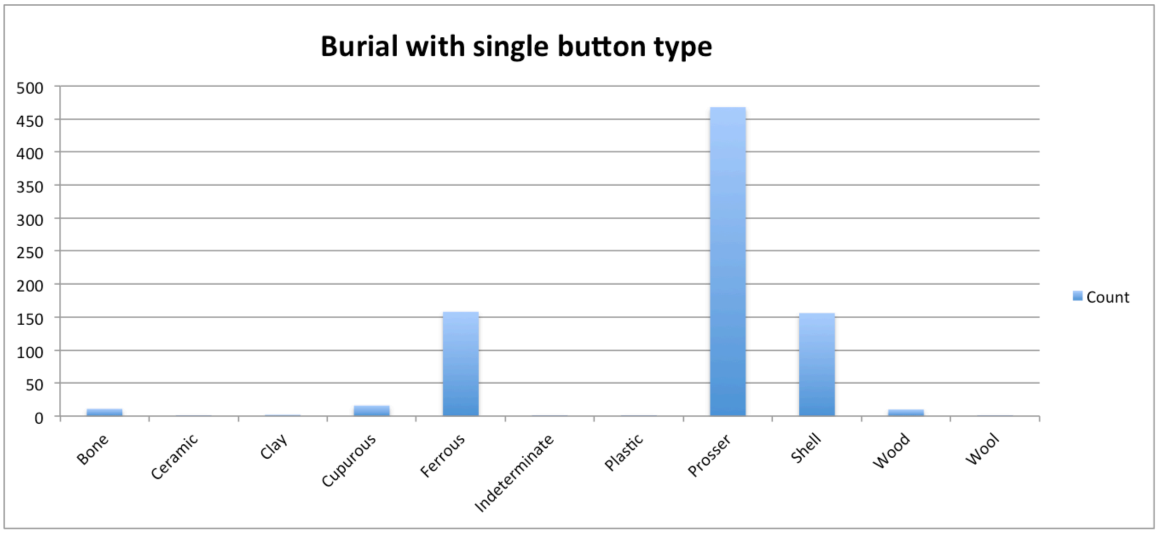


Figure 32. Count of Button Material Types in burials with a single type of button present.

Prosser buttons were the most common button type overall (46%), followed by ferrous (31%) and shell (11%). Just over half (n=390, or 54%) of the burials had only a single button type present. They followed the overall trend with mostly Prosser (57%), followed by ferrous (19%), then shell (19%). Burials with multiple buttons (n=279) contained 3 times the overall number of buttons (n=2229). The burials with multiple button types exhibit a different overall button count pattern. Ferrous buttons (n=884, 40%) outnumber Prosser (n=856, 38%). It's possible that these buttons are related to pants with multiple buttons closures. Ferrous buttons occur in 220 burials, and in 49 burials (22%) ferrous is the only button type.

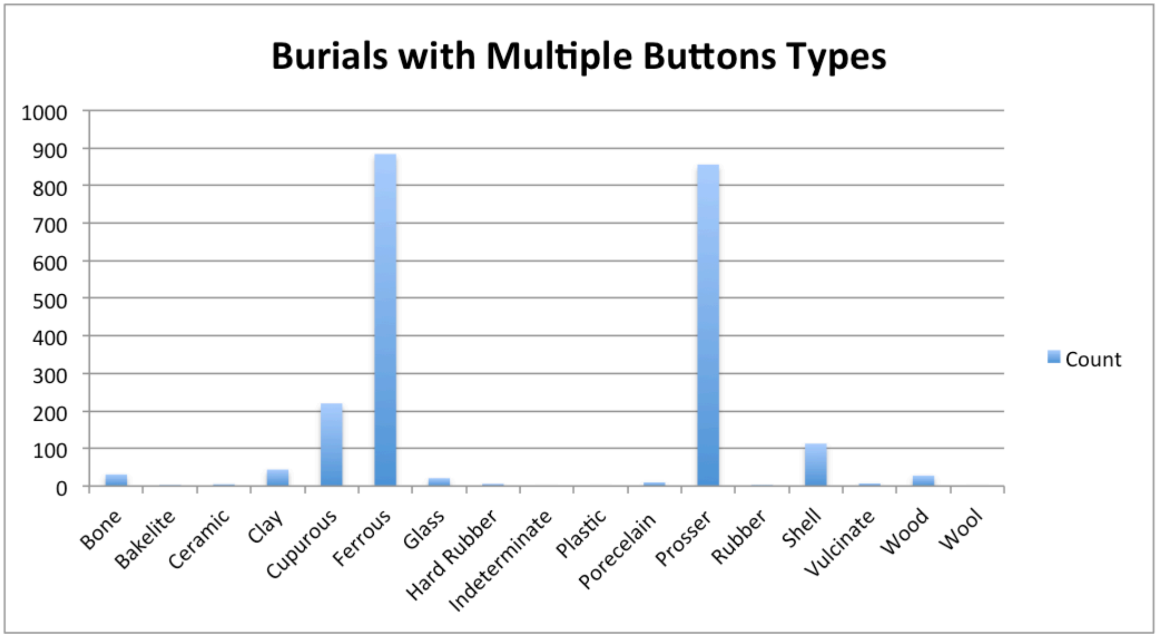


Figure 33. Count of button material type in burials with multiple types of buttons.

Other Clothing Fasteners

The clothing fastener recorded on the excavation forms were assigned to 11 different categories (safety pin, suspender, buckle, rivet, collar stud, grommet, fastener, garter, hook and eye, clasp, corset stay; see Figure 34). The most prevalent types of clothing fastener were safety pins (n=345 from 249 burials) followed by grommets (n=175 from 87 burials), rivets (n=143 from 47 burials) and suspender claps (n=133 from 82 burials).

Jewelry

Seven jewelry categories were identified (ring, earring, charm, medal, pendant, locket, and brooch). Rings were the most prevalent jewelry type with n=28 (from 24 burials, four individuals had a ring on each hand). Overall jewelry was not a well-represented grave good

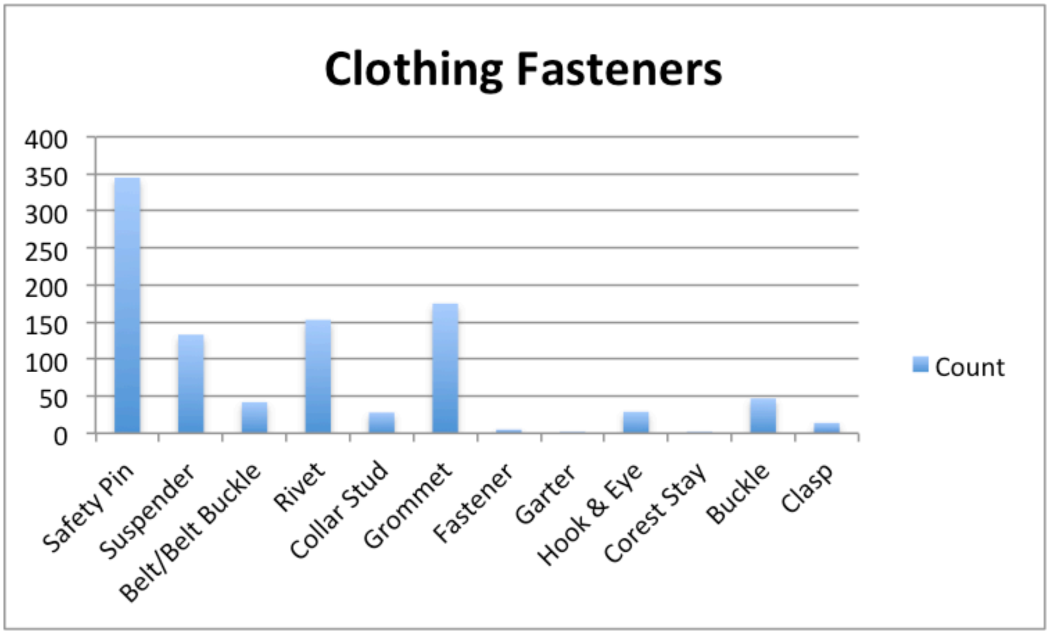


Figure 34. Clothing Fastener Count.

type, which is not unexpected given the lower socio-economic status of the individuals buried at VMC (see Figure 35). Of the 28 rings six were 14 or 18 carat gold wedding bands (see Figure 36), two were silver, and the rest were plated or non-precious metal. For example, the gold plated ring recovered from Burial 932 was stamped WL & CO. W.L. & Co marketed low karat solid gold rings that "Look Like Gold. Sound Like Gold. Wear Like Gold" that were sold for as low as 25 cents (see Figure 37). The remaining rings were unadorned bands (n=6) and signet rings (n=4).

Rings were recovered from burials of males (n=15), females (n=6) and individuals of indeterminate sex (n=4). There is a statistically significant association with rings and sex (χ^2 = 9.246, p= 0.00236). With regards to age rings were only recovered from burials of adults (n=18) and older adults (n=7). There is not a statistically significant relationship between rings and age (χ^2 = 1.5616, p= 0.211434).

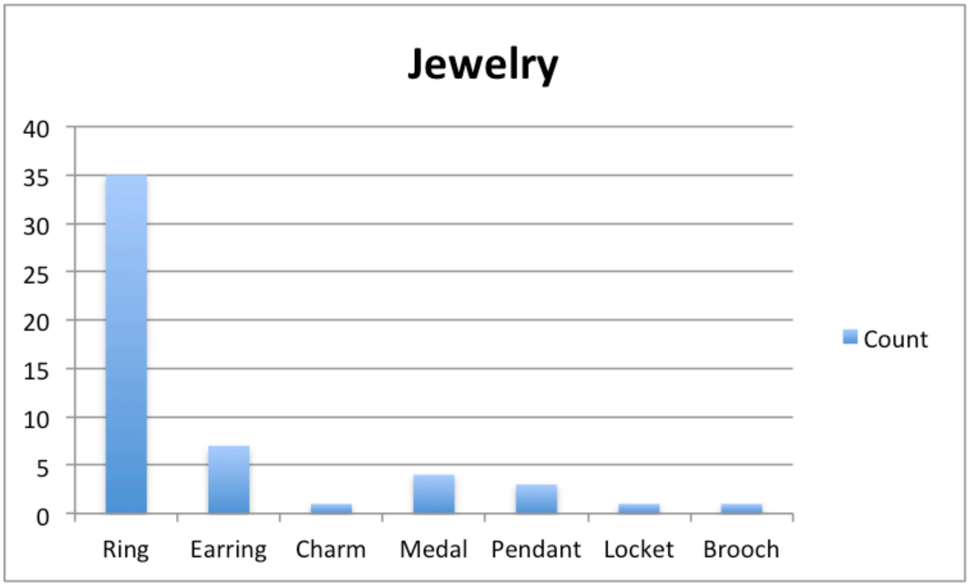


Figure 35. Jewelry Count by Type.

Figure 36. Burial 199 two gold rings with makers marks and engraving. Ring 1 hall marks HA (Hyde Aston Jewelers)/18 (18k gold standard)/Anchor (Birmingham England Assay Office)/Face (Queen Victoria)/Y (1873). Ring 2 engraved initials I (or A)/D/B.

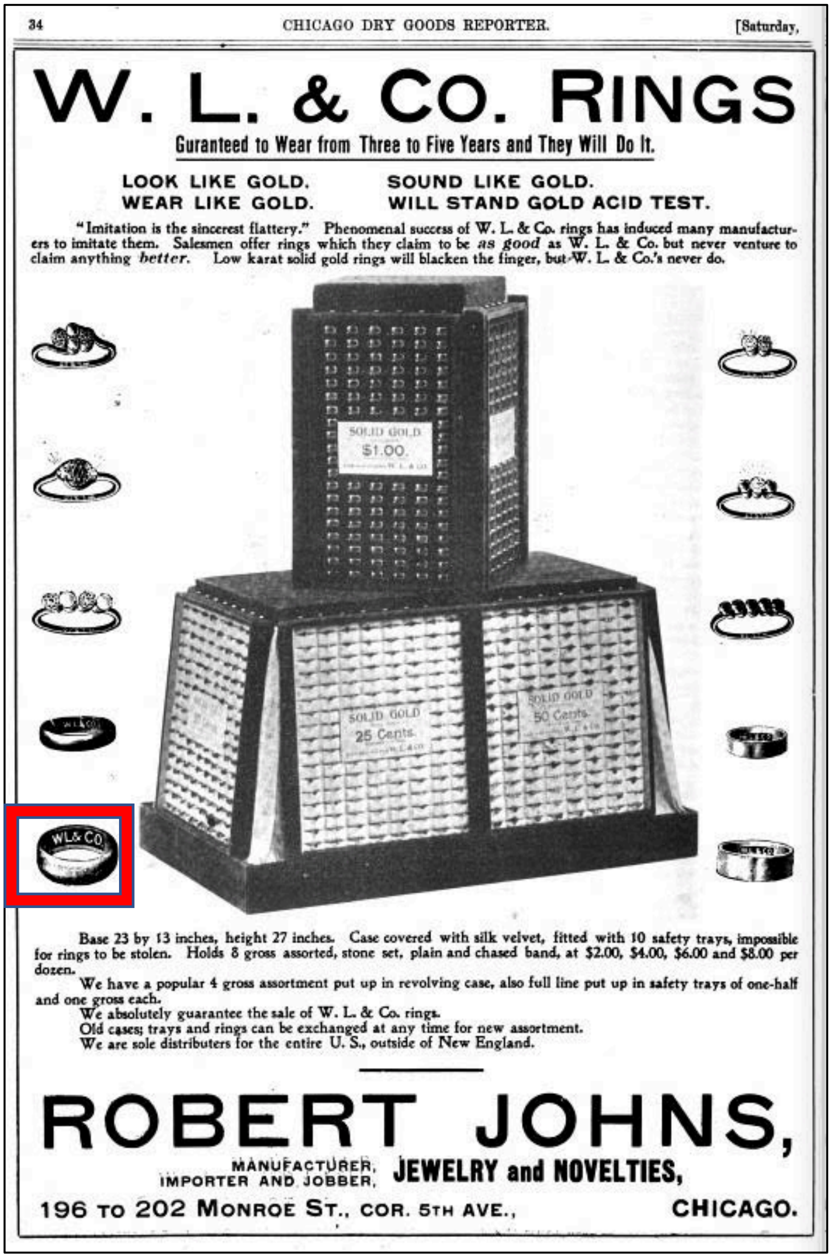


Figure 37. Advertisement for W.L. & Co Rings (Chicago Dry Goods Reported 1900). Rings from Burial 932 highlighted by red rectangle.

Religious Artifacts

Religious artifacts (rosary, crucifix, saint medal) were found in 38 burials (see Figure 38). Rosaries, Crucifixes and Saint Medals are common markers of Catholicism. Medals were only counted as religious is the preservations was good enough to detect religious symbols or writing. Twenty six percent of burials had multiple religious objects (n=10). Multiple religious objects occurred in the following combinations: Two contained a rosary and a medal; One contained a rosary, second crucifix, and medal; Four contained rosary and a second crucifix; Two had a medal and crucifix combination; and one contained two medals.

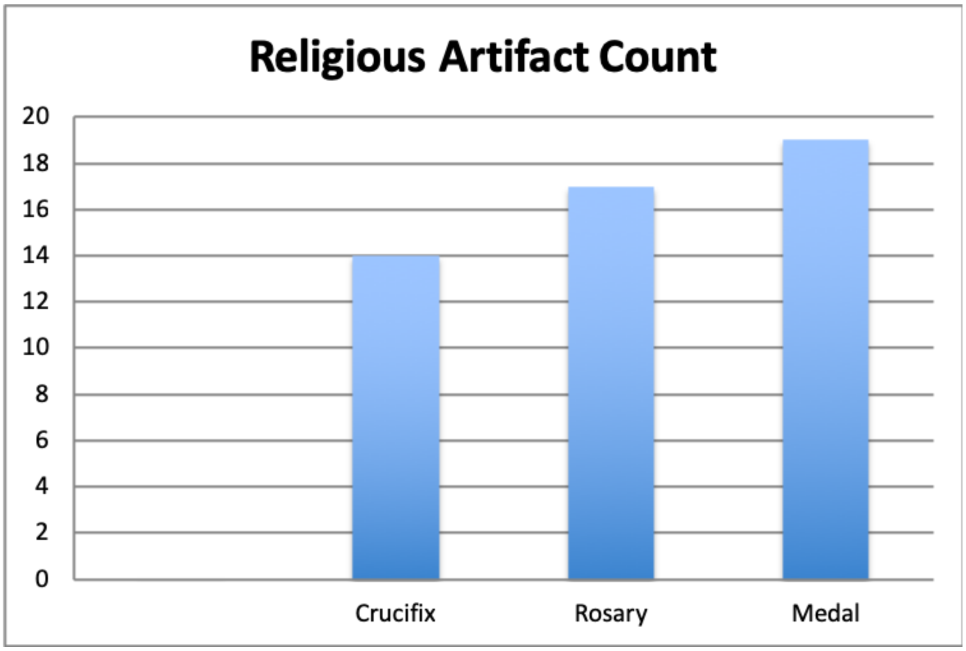


Figure 38 Religious Artifact Count.

Religious artifacts were recovered from male (n=21), female (n=8), and an indeterminate sex (n=1) burials. There is a statistically significant relationship between religious artifacts and sex (χ^2= 11.6075, p = 0.000657. Religious artifacts were recovered from subadult (n=4), adult (n=27), and older adult (n=6) burials. There is not a statistically significant relationship between religious artifacts and age (χ^2= 1.2141, p=0.544959).

Rosary's were present in 15 burials including 8 males, 6 females, and an unsexed subadult. There is a statistically significant relationship between sex and rosary presence (χ^2= 18.6329, p=0.000016). Rosary's were recovered from subadult (n=1), adult (n=12), and older adult (n=4) burials. There is not a statistically significant relationship between age and rosary presence (χ^2= 0.4876, p=0.783635).

Crucifixes not related to rosaries were present in 10 burials including 8 males and 2 females. There is not a statistically significant relationship between sex and crucifix presence (χ^2= 1.3233, p=0.24998). Crucifixes were recovered from adult (n=12) and older adult (n=1) burials and there is not a statistically significant relationship between age and crucifix presence (χ^2= 1.0042, p=0.316287).

Religious medals were recovered from 18 burials including 8 males, 6 females, and 4 unsexed subadults. There is a statistically significant relationship between the presence of religious medals and sex (χ^2=18.6329, p=0.000016). Religious medals were present in subadult (n=4), adult (n=13), and older adult (n=1) burials. There is a statistically significant relationship (χ^2=8.5618, p=0.01383) between religious medals and age.

Burial Categories

The presence and absence of specific grave good patterns was used to segment the burial population into three categories: unknown individuals (no personal artifacts), hospital direct internments (presence of hospital clothing button pattern, see Figure 39), and community members (all other artifacts). Community members are the most prevalent group (n=700, 70%), followed by unknown individuals (n=179, 17.9%) and hospital direct (n=121, 12.1%). Note that only primary burials were examined for burial categories, thus burials from other contexts were not included, thus n=1000. See Table 21 for sex distribution, and Table 22 for age distribution. There is no statistically significant relationship between sex (χ^2 = 1.3437, df = 1, p = 0.510762) or age (χ^2 = 4.8054, df = 3, p = 0.307855) and the burial categories.

Figure 39. Burial 832 Hospital Internment button pattern. Image courtesy of URS.

Burial Category	Male	Female
Community	505	57
Hospital Direct	97	7
Unknown	118	11

Table 21. VMC Burial Categories by Sex.

Burial Category	Subadult	Adult	Older Adult	Indeterminate
Community	49	506	126	19
Hospital Direct	7	94	18	2
Unknown	6	139	28	6

Table 22. VMC Burial Categories by Age.

The sample was also examined for burial category related differences for indicators of health (see Tables 23- 25). Only non-specific infection shows a significant difference (χ^2 = 6.3588, df = 2, p = 0.041611). Other indicators of health did not show significant differences: Syphilis (χ^2 = 4.2036, df = 2, Yates Correction p = 0.254635); Tuberculosis (χ^2 = 0.1052, df = 2, Yates Correction p = .7457); Coccidioidomycosis could not be compared because it only occurred in the community burial category.

Burial Category	Present	Absent
Community	289	411
Hospital Direct	64	57
Unknown	71	108

Table 23. VMC Non-Specific Infections by Burial Category.

Burial Category	Present	Absent
Community	7	693
Hospital Direct	3	118
Unknown	4	175

Table 24. VMC Syphilis by Burial Category.

Burial Category	Present	Absent
Community	9	691
Hospital Direct	2	119

Table 25. VMC Tuberculosis by Burial Category.

Spatial analysis

An average nearest neighbor test was conducted for multiple variables to determine if any geo-spatial patterns exist. The results are presented in Table 26.

	Observed Mean Distance	Expected Mean Distance	Nearest Neighbor Ratio	z-score	p-value
All burials	1.15	1.03	1.12	7.11	**0.000000**
Females	3.90	3.51	1.11	1.86	0.063
Males	2.69	3.10	0.866	-2.05	**0.011**
Subadults	3.29	3.92	0.84	-2.38	**0.01735**
Adults	1.27	1.19	1.07	3.48	**0.000492**
Older Adults	2.42	2.49	0.97	-0.70	0.4851
Hexagonal Coffin	1.24	1.17	1.05	2.98	**0.0029**
Rectangular Coffin	2.03	2.57	0.79	-4.85	**<0.001**
Tapered Coffin	3.55	3.99	0.89	-1.51	0.13
Double Coffin	16.13	8.69	1.85	4.32	**<0.001**
Hospital Button	2.57	2.87	.091	-1.78	0.074
Community	1.32	1.23	1.064	3.26	**0.001117**
Unknown	2.18	2.28	0.95	-1.2	0.2303

Table 26. Average Nearest Neighbor Results, significant bolded.

If the nearest neighbor ratio (index) is less than 1, the pattern exhibits clustering. If the ratio is greater than 1, the trend is towards dispersion. As expected with a planned historic cemetery, when all of the burials are considered they form a highly statistically significant regular pattern, with a nearest neighbor ratio of 1.12 (p<0.000000). Females are dispersed (neared neighbor = 1.11, p=0.063) and male burials are clustered (nearest neighbor = 0.86, p=0.011). However, since males comprise over 70% of the sample, the clustering may be a product of sample size.

When age is examined subadult burials are clustered (nearest neighbor = 0.84, p = 0.01735), adult burials are dispersed (nearest neighbor = 1.07, p = 0.000492), and older adult burials are random (nearest neighbor = .97, p = 0.4851). See Figure 40 for subadult burial locations. Burials of subadults are concentrated in the southern and northwest portions of the cemetery.

Hexagonal coffins are dispersed (nearest neighbor = 1.05, p=0.0029), while rectangular coffins (nearest neighbor = .79, p<0.001) and tapered coffins (nearest neighbor =.89, p=0.13) cluster, although only rectangular coffins reach statistical significance.

With regards to burial categories the hospital direct burials do cluster (nearest neighbor = .091, p=0.074) see Figure 41, although slightly above the p=0.05 significance threshold. The community member (nearest neighbor = 1.06, p = 0.001117) are dispersed. Given that community members are the largest burial category (n=700), this may be a product of the sample size. Unknown individuals (nearest neighbor = 0.95, p = 0.2303) are randomly dispersed.

Comparing Coffin Shape with other variables

In order to investigate any potential patterns among the coffin shape variables chi squared and correspondence analysis was conducted comparing coffin shape with coffin length, width, depth, age, sex, button patterns, and jewelry.

Sex

The chi-squared tests indicated that there was no statistically significant relationship between coffin shape and sex (Chi squared = 2.59, p=0.2739, Cramers V = 0.0584), see Figure 42 and Table 27. However, a two-way correspondence analysis revealed that males group with hexagonal coffins, and females with rectangular and tapered (see Figure 43, inertia = 0.0034), with 100% of the variation being explained by sex.

Age

Similar to sex, a simple chi-squared analysis did not reveal any statistically significant relationships between coffin shape and age (χ^2 = 2.34, p= .67, Cramers V = 0.035), see Figure 44 and Table 28. However, the correspondence analysis (inertia= 0.0022) revealed a relationship

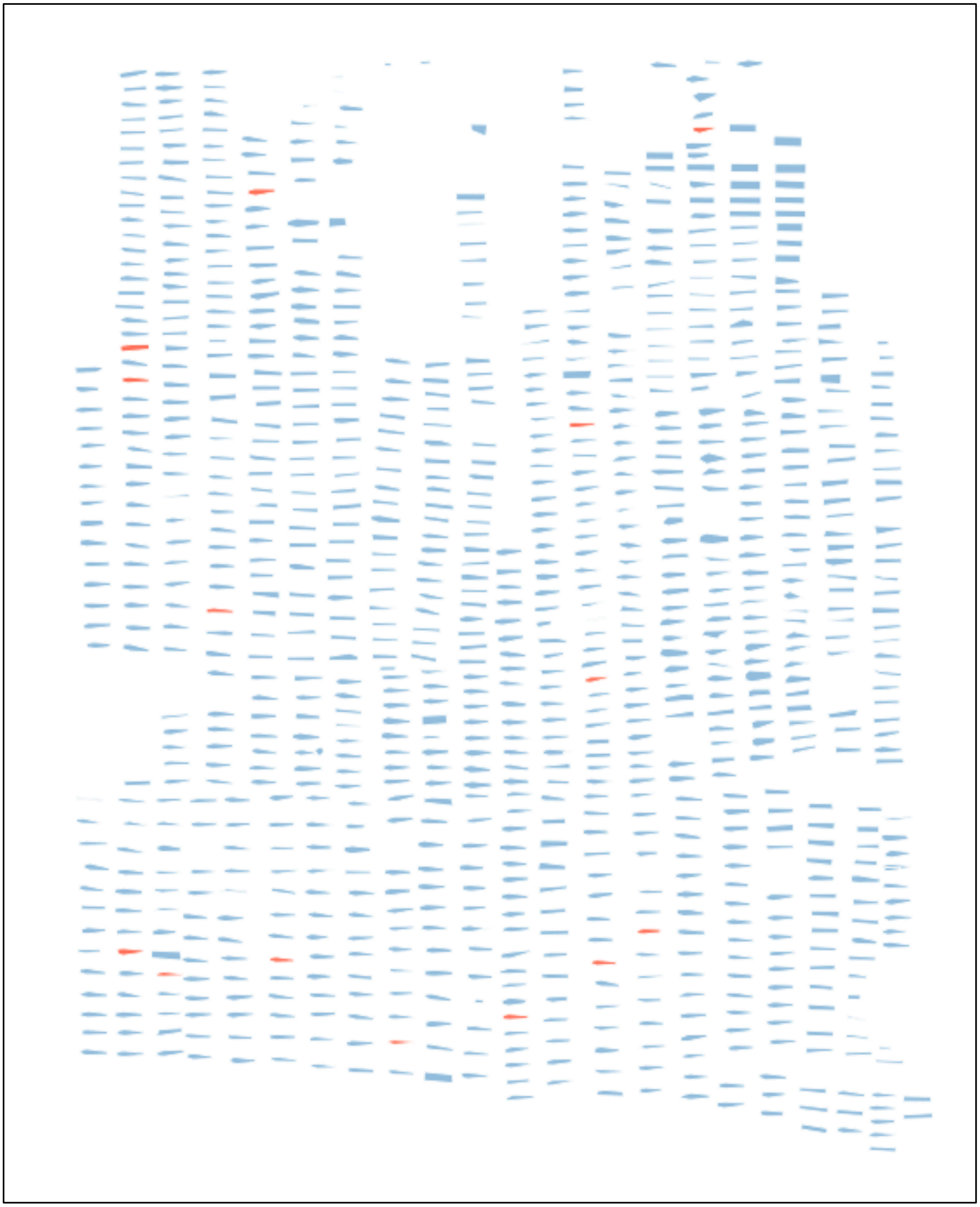


Figure 40. Burials by age, Subadult burials (<25 years of age) are red.

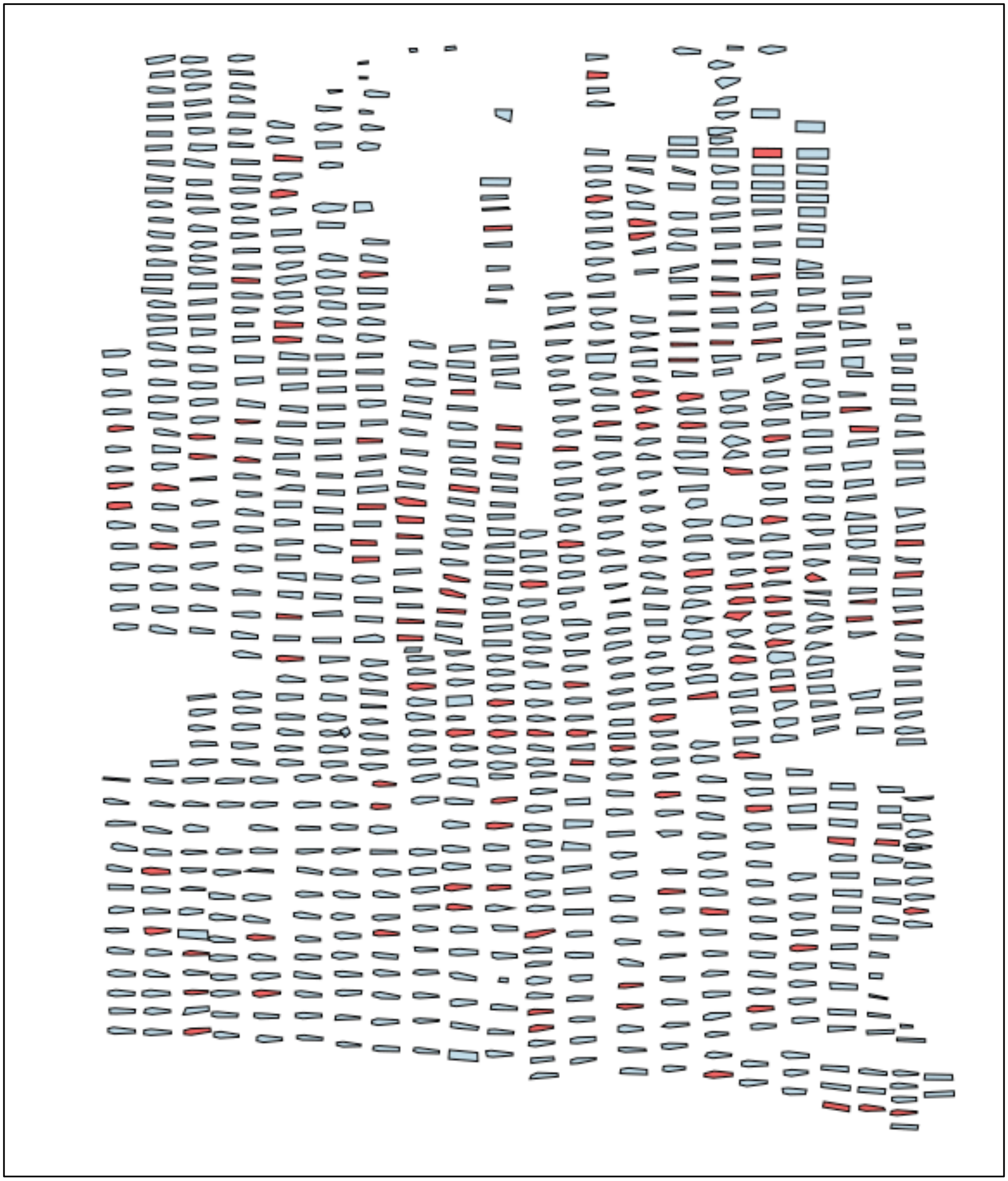


Figure 41. Map showing hospital button category individuals, individuals with hospital button pattern in red.

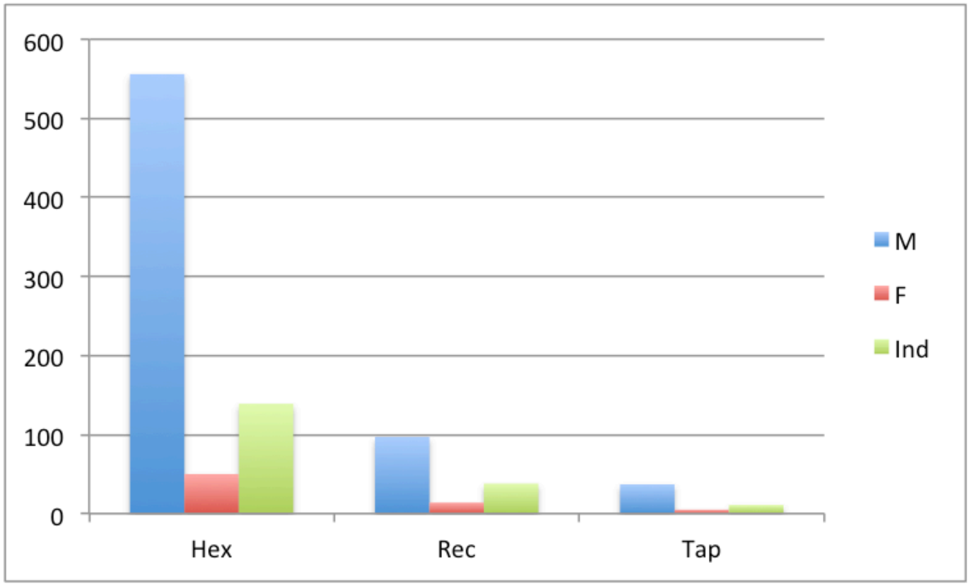


Figure 42. Coffin Shape by Sex.

	Male	Female
Hexagonal	556	50
Rectangular	97	14
Tapered	37	5

Table 27. Coffin Shape by Sex.

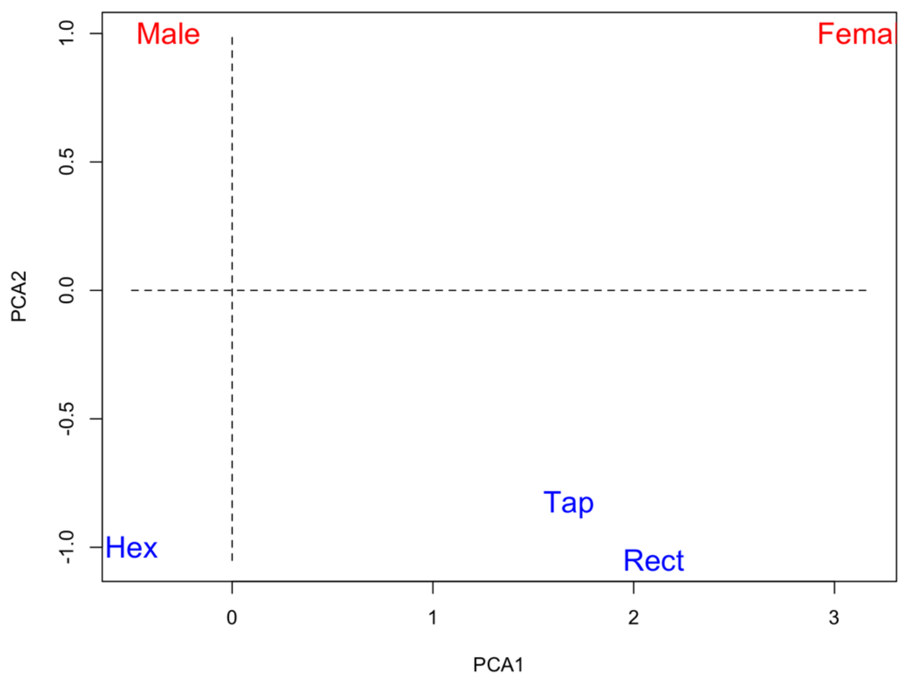


Figure 43. Correspondence Analysis of Sex v. Coffin Shape.

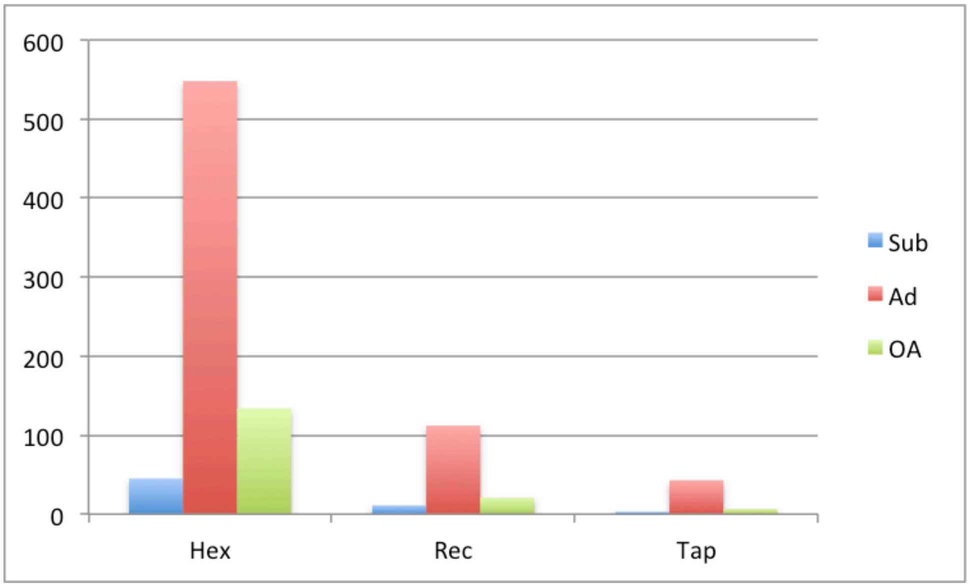


Figure 44. Coffin Shape by Age.

	Subadult	Adult	Older Adult
Hexagonal	45	548	134
Rectangular	11	112	21
Tapered	3	43	7

Table 28. Coffin Shape by Age.

between rectangular and tapered coffin with subadults, and hexagonal coffins and adults/older adults (See Figure 45).

Coffin Dimensions

At first glance there is little variation between the descriptive statistics (mean, media, mode) for coffin length, width, or depth by coffin shape. Most of the shapes follow a near normal distribution (See figures 46-48 and Tables 29-31). The lack of size variation by shape may indicate that regardless of shape, specific coffin dimensions were being required to bury the indigent dead.

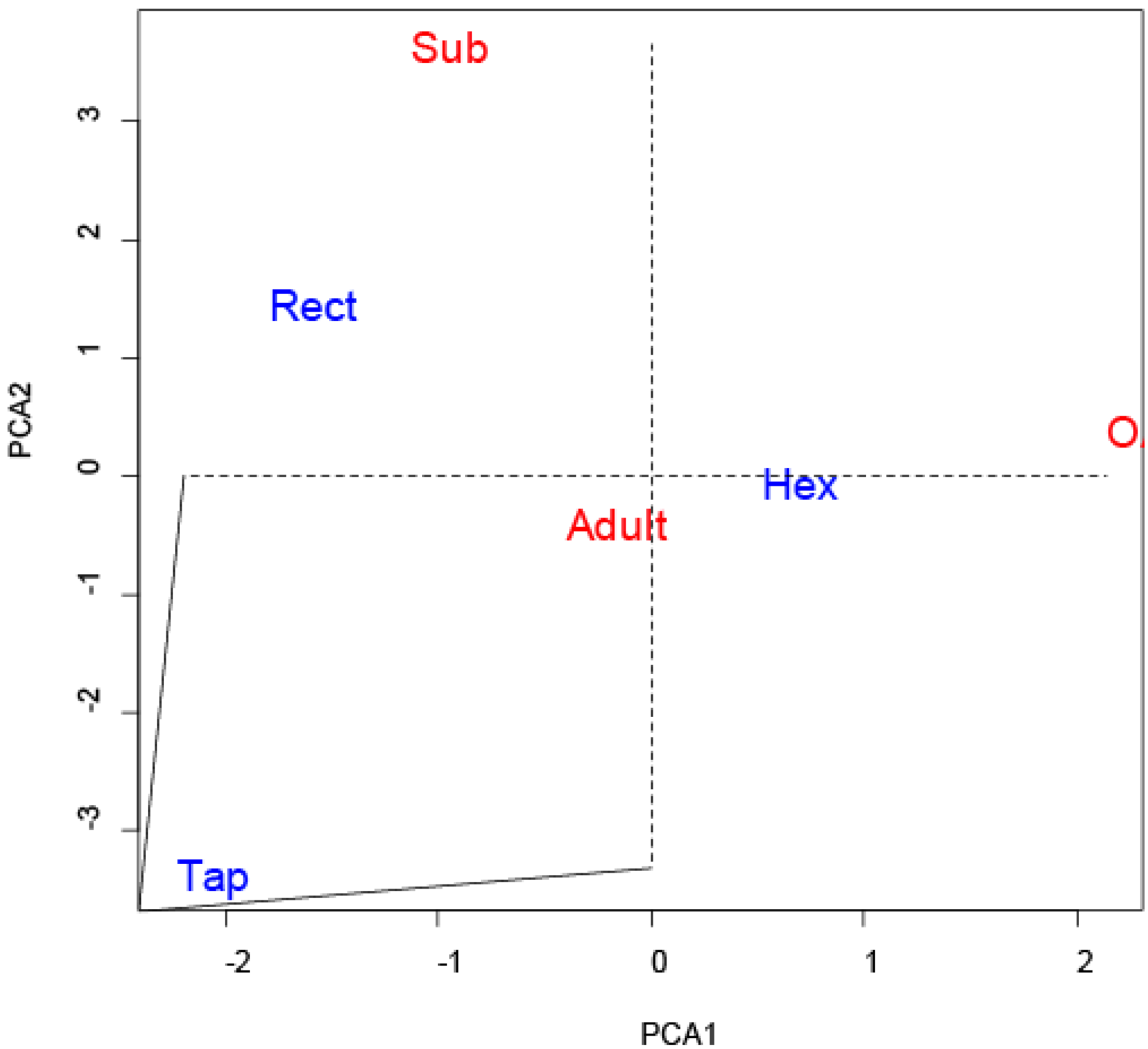


Figure 45. Correspondence Analysis of Coffin Shape by Course Age Group.

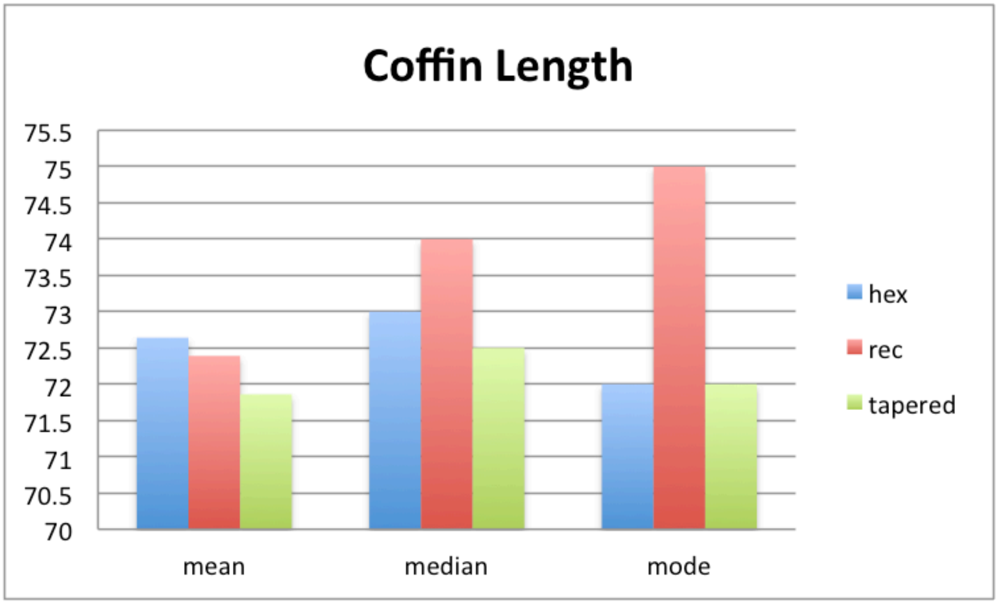


Figure 46. Coffin Length by Shape.

Coffin Length	Hexagonal	Rectangular	Tapered
Mean	72.64	72.39	71.86
Median	73	74	72.5
Mode	72	75	72

Table 29. Coffin Length Descriptive Statistics (length in inches).

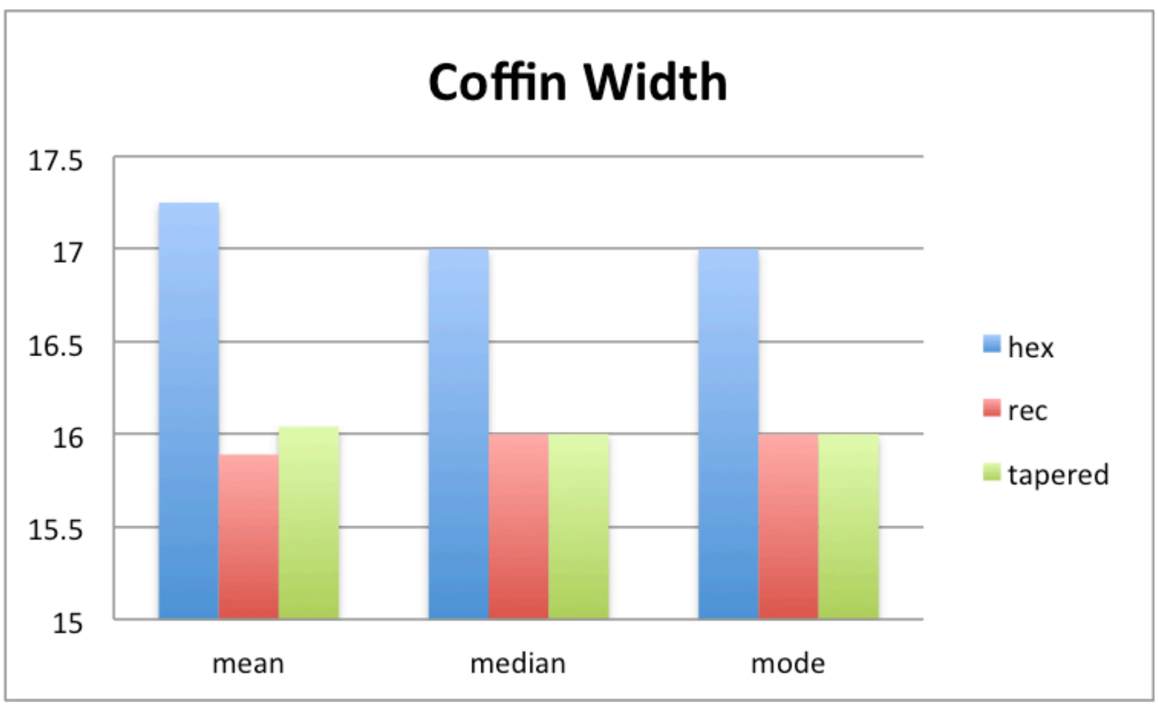


Figure 47. Coffin Width by Shape.

Coffin Width	Hexagonal	Rectangular	Tapered
Mean	17.25	15.89	16.04
Median	17	16	16
Mode	17	16	16

Table 30. Coffin width descriptive statistics (width in inches).

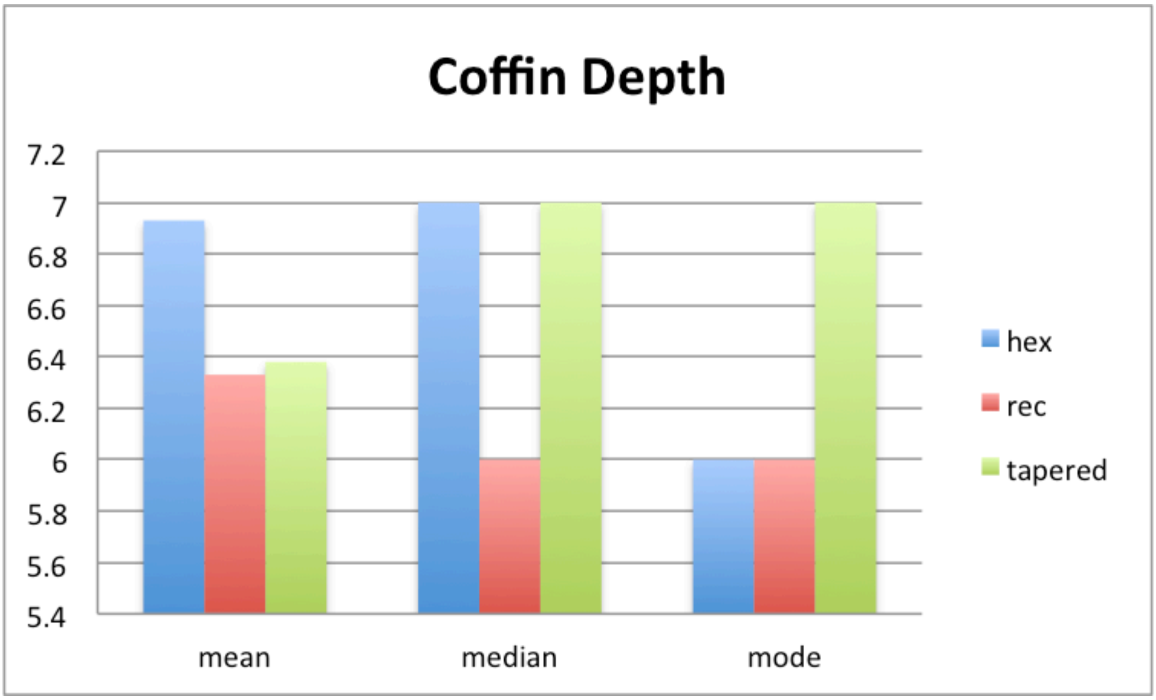


Figure 48. Coffin depth by shape.

Coffin Depth	Hexagonal	Rectangular	Tapered
Mean	6.93	6.33	6.38
Median	7	6	7
Mode	6	6	7

Table 31. Coffin depth descriptive statistics (depth in inches).

Coffin dimensions and shape coffin shape does not equate to temporal pattern as they occur in all sections of the cemetery. The standardization of the size amongst the shapes perhaps suggests that specific dimensions were required for these burials. The shape preference may have been determined by the specific funeral home that was subcontracted to handle indigent burials, which varied by year.

Artifacts

Buttons

Button types, and pattern variations were examined for differences between geospatial location, age, sex, button co-occurrence, and coffin shape patterns (Figure 49).

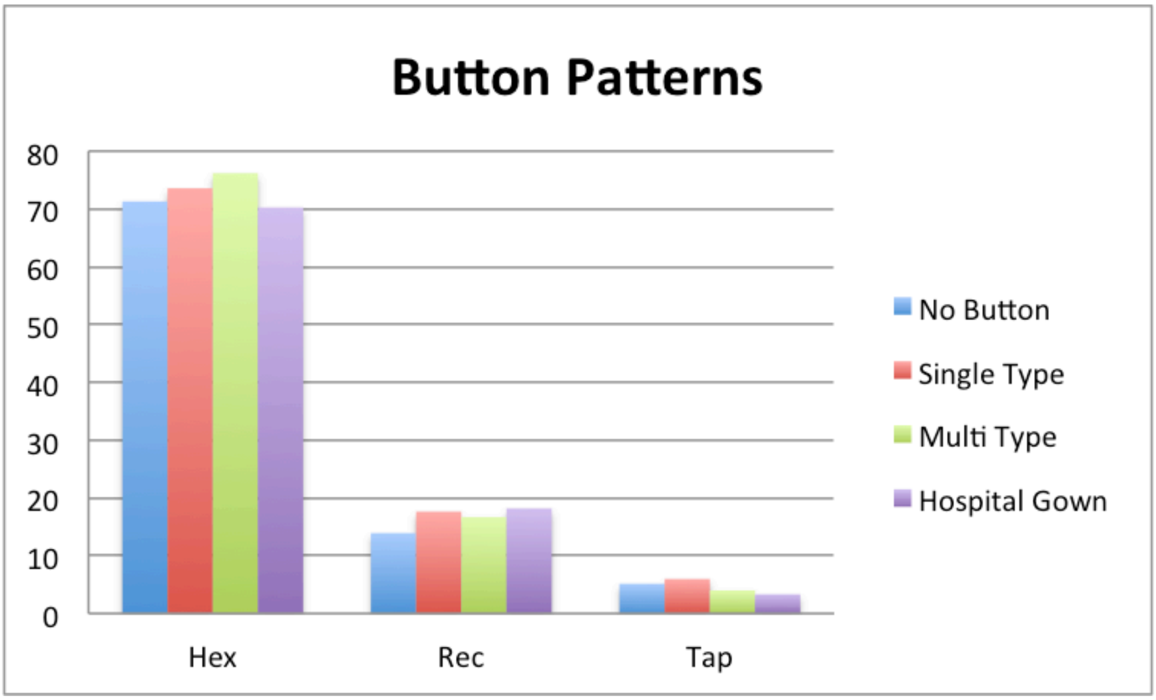


Figure 49. Button patterns by coffin shape.

Four distinct button patterns were identified; no buttons, a single type of button, multiple types of buttons, and the previously discussed hospital gown pattern, which were evenly represented by each, coffin type.

Single Button Type Burials

Single button type burials were examined for patterns with sex, age and coffin shape. With regards to coffin shape, correspondence analysis indicates that burials with a single button type are co-occurring with rectangular and tapered coffins, but burials without the single button type correspond with hexagonal coffins (chi square = 1.325, inertia = 0.0014), with 100% of the variation being explained by presence/absence, see Figure 50.

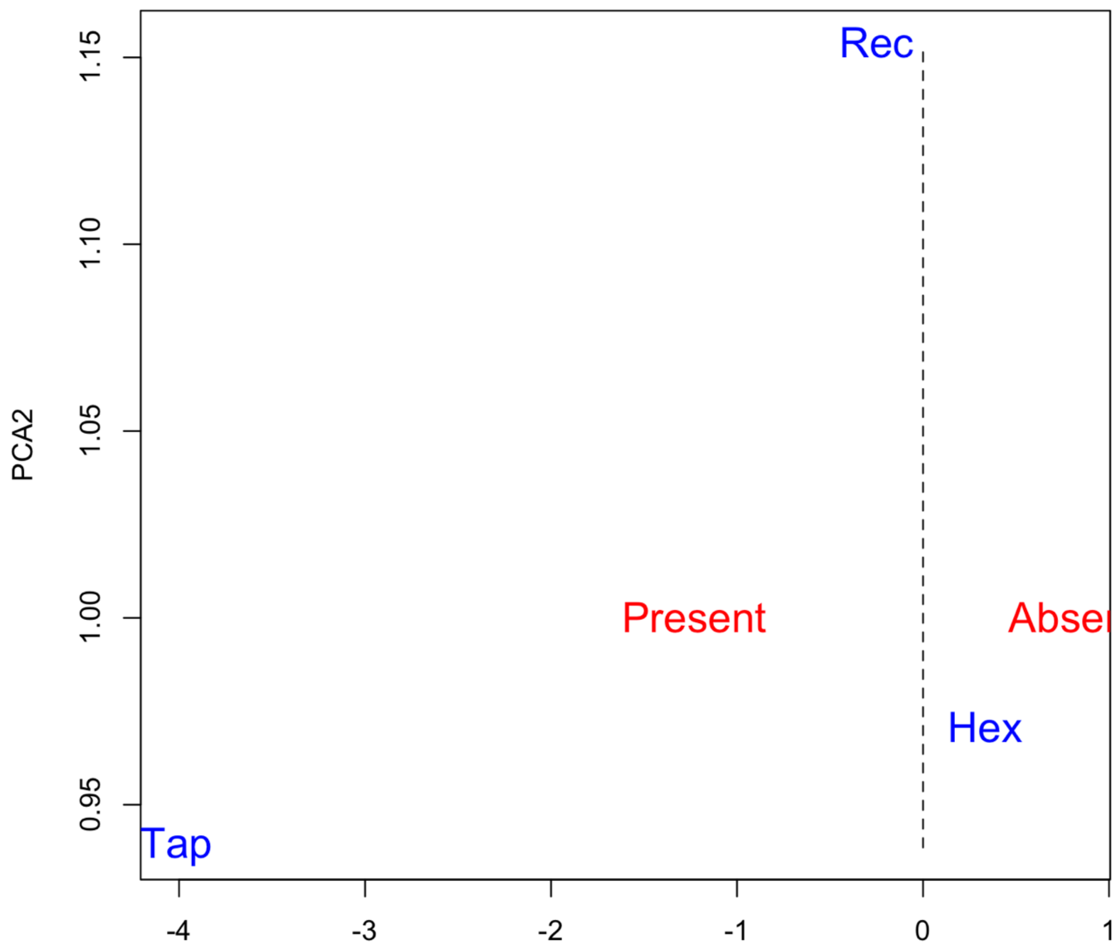


Figure 50. Burials with single button type Correspondence Analysis by Coffin Shape and pattern presence absence.

A correspondence analysis examining single button type burials by sex and coffin shape (chi square = 3.28, intertia = 0.02) reveled that males with only one type of button as associated with tapered and rectangular coffins, while females are associated with hexagonal. 100% of the variation is explained by sex, see Figure 51.

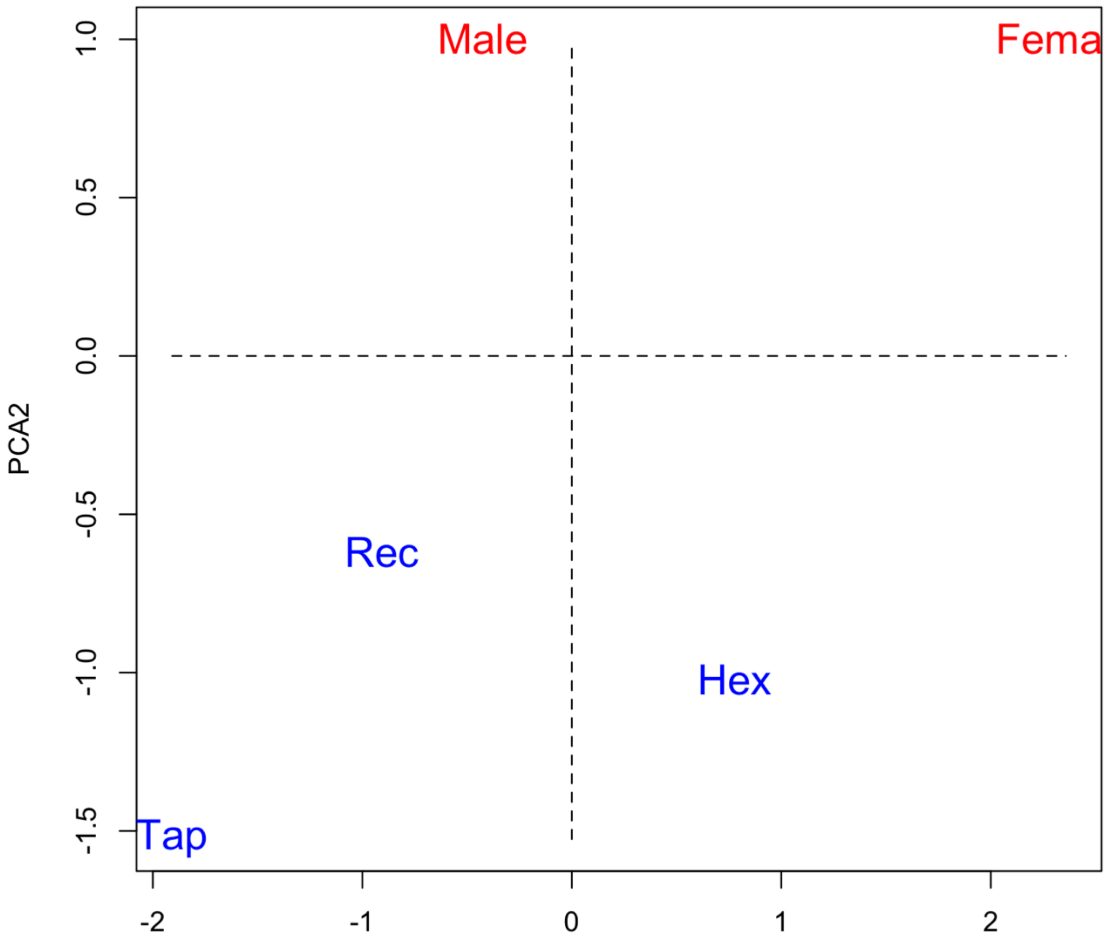


Figure 51. Burials with single button type correspondence by sex and coffin shape.

A correspondence analysis was also performed examining single button type burials by age and coffin shape (chi square = 3.848, inertia = 0.0118). Subadults corresponded with rectangular coffins, while adults and older adults were both associated with tapered and hexagonal coffins, see Figure 52.

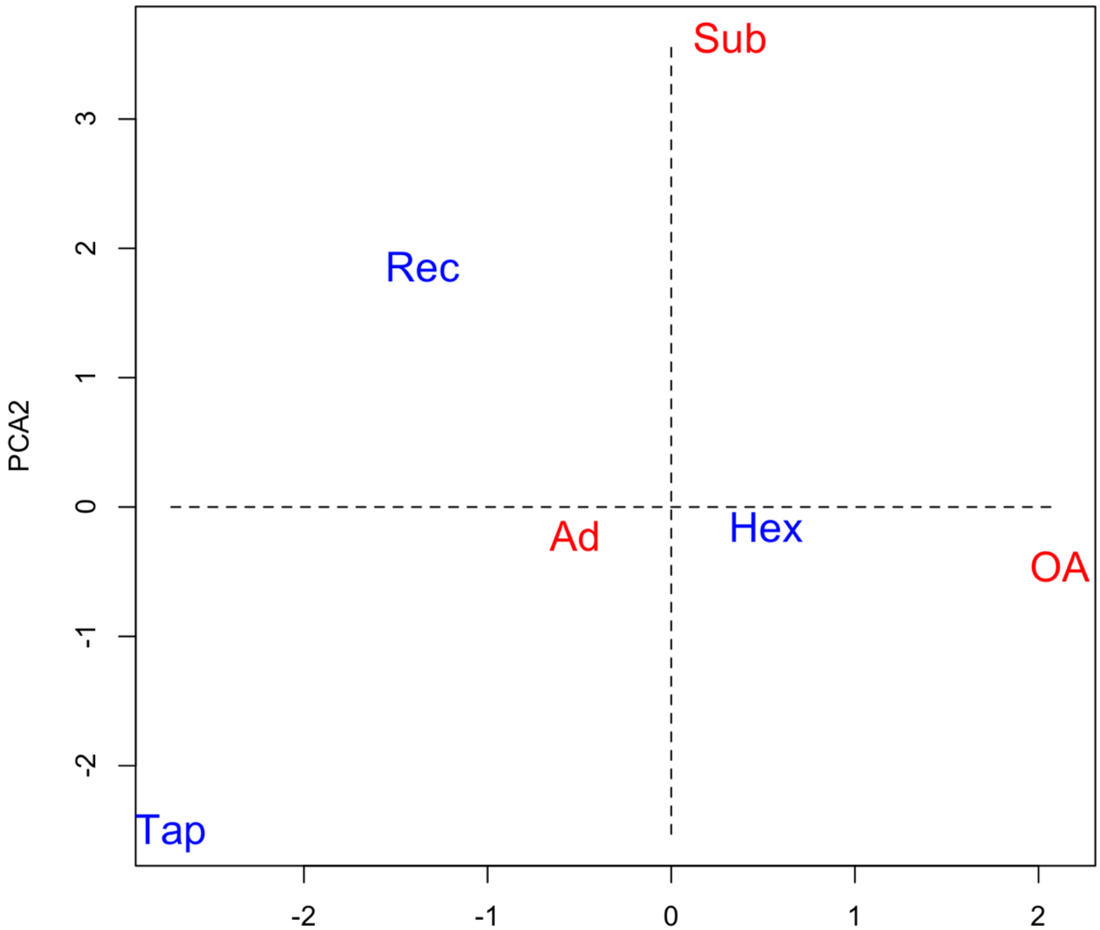


Figure 52. Burials with single button type correspondence analysis by age and coffin shape.

Multiple Button Burials

There are 279 burials with multiple types of buttons (M = 218, F = 13). A correspondence analysis was performed (chi square = 2.39, intertia = 0.018), indicating that hexagonal coffins are associated with both males and females, but males are more likely to be associated with rectangular coffins, and females with tapered, see Figure 53.

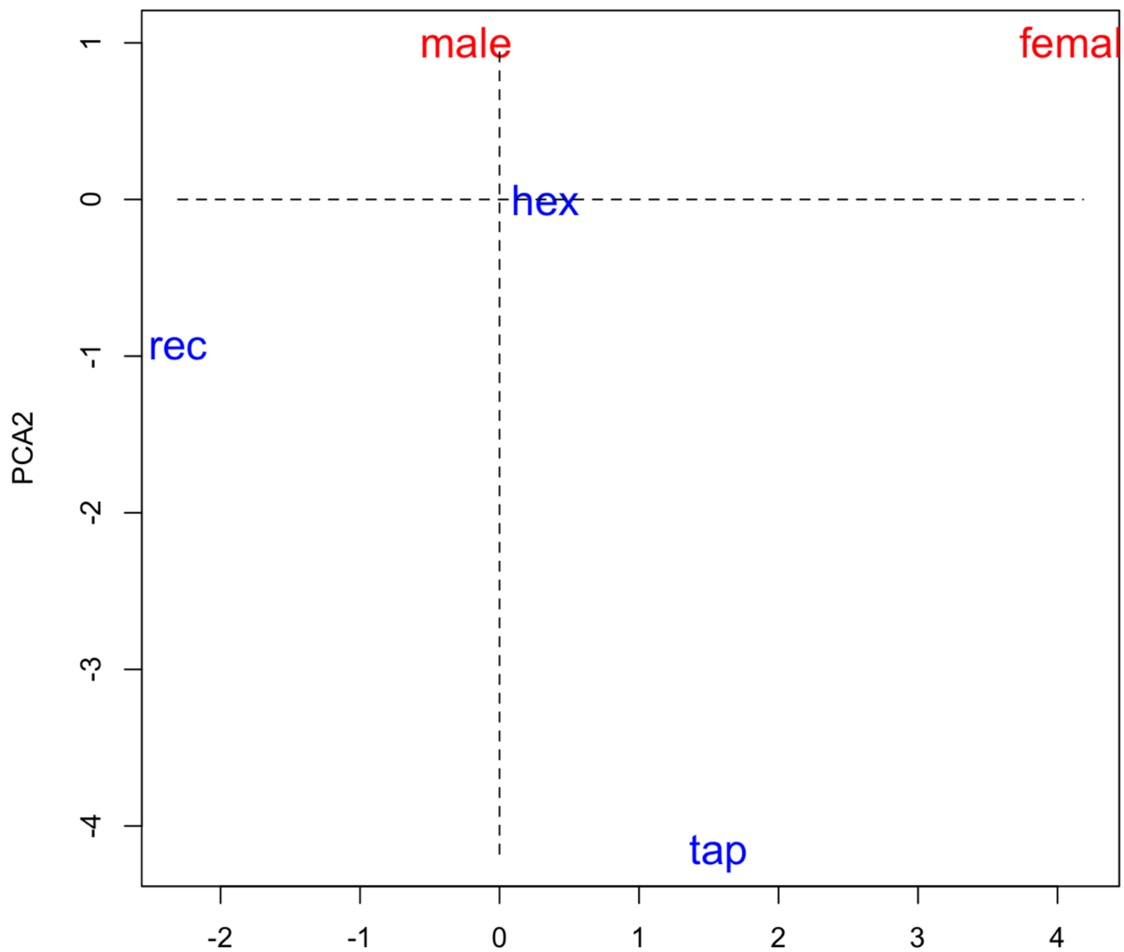


Figure 53. Burials with multiple button types correspondence analysis by sex and coffin shape.

All Button Categories

The three button categories (no buttons, multiple styles of button, single types of button), were examined to see if any sex-linked patterns existed, see Table 32.

	No Button	Multiple Button Types	Single Button Types
Male	212	218	291
Female	36	13	27

Table 32. Button categories by sex count.

A correspondence analysis (Chi square = 12.65, p= 0.003, Cramer's V = 0.1207, inertia = 0.0159) indicated that male is associated with multiple button types and single button types, while females are more likely to have no buttons, see Figure 54.

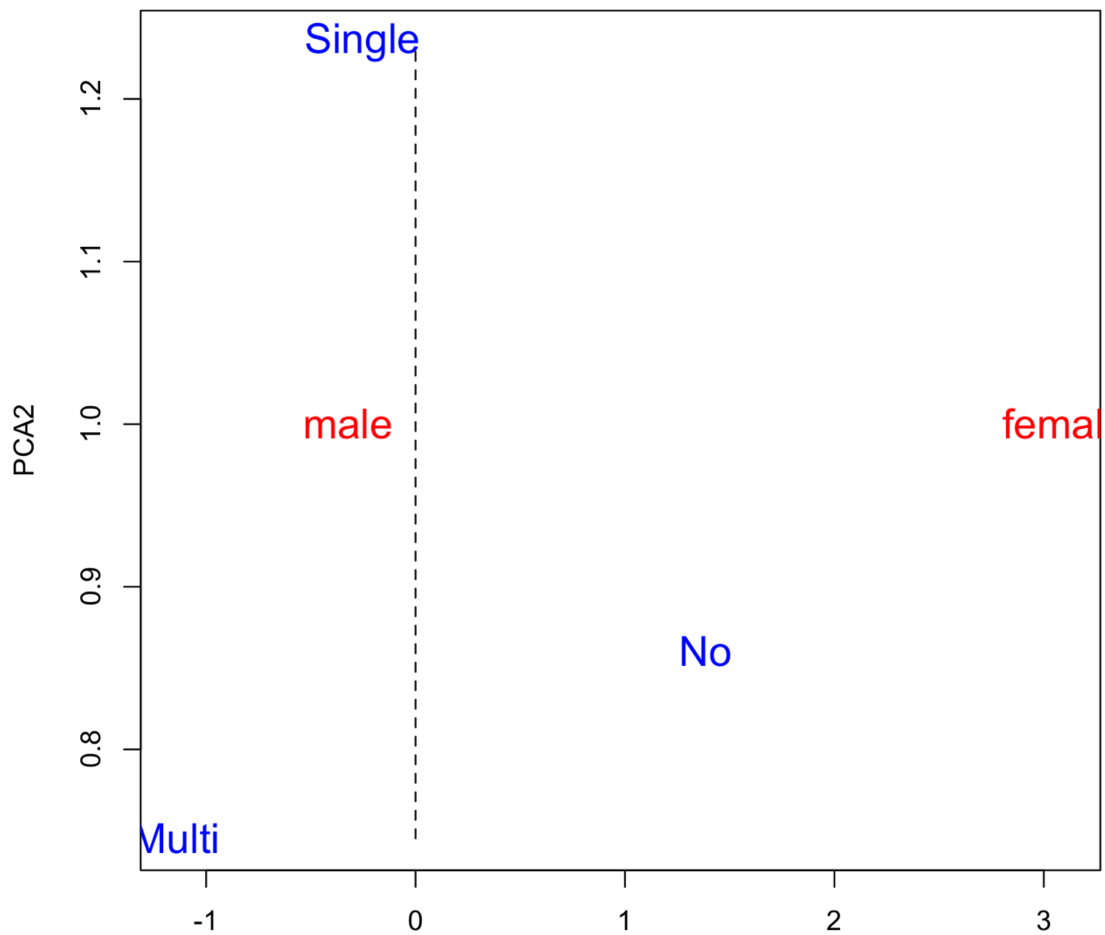


Figure 54. Button categories by sex.

Button Co-Occurrence

Buttons within the multiple button type burials were examined for type co-occurrence. A multiple correspondence analysis was performed (see Table 33, Figure 55). Button types with a positive co-occurrence include; cuprous/clay/ferrous, Prosser/clay/ferrous, Prosser/bone, and ferrous/cuprous.

	Bone	Clay	Cuprous	Ferrous	Prosser	Shell
Bone		0.14	0.129	0.177	-0.125	0.003
Clay	0.14		-0.005	0.003	-0.024	-0.038
Cuprous	0.129	-0.005		0.023	0.194	0.21
Ferrous	0.177	0.003	0.23		0.168	0.425
Prosser	-0.125	-0.024	0.194	0.168		-0.178
Shell	0.003	-0.038	0.21	0.425	-0.178	

Table 33. Button co-occurrence correspondence analysis transformed variables.

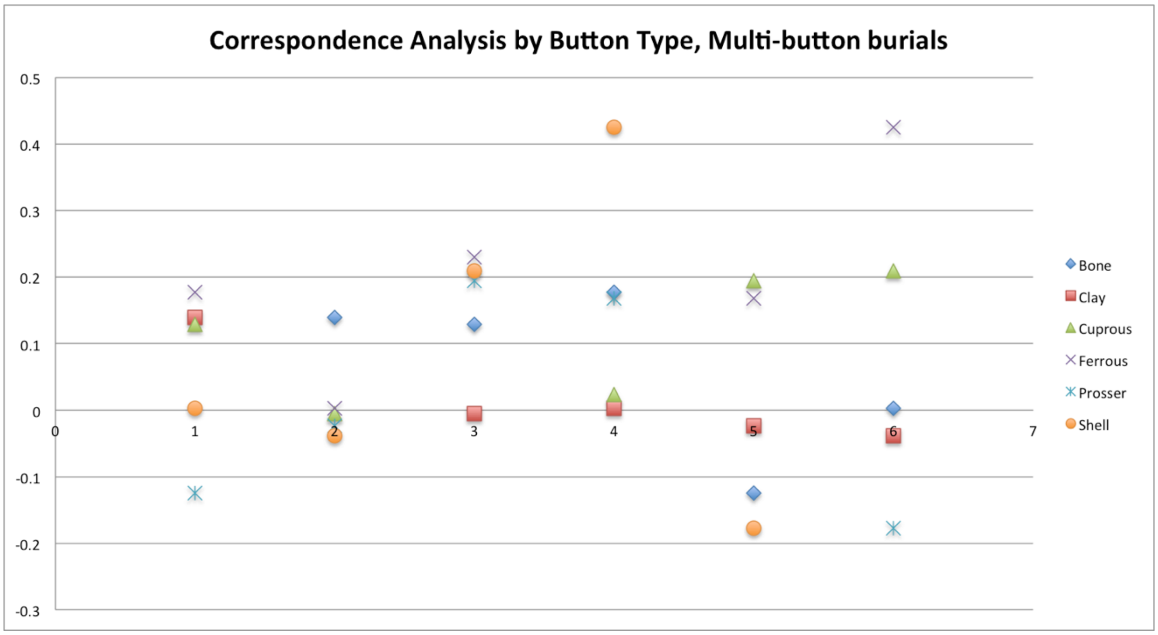


Figure 55. Button type correspondence analysis.

Religious Artifacts

Correspondence analysis (chi squared = 2.054, inertia = 0.079) indicates that males with religious artifacts are associated with tapered and hexagonal coffins, while females are associated with rectangular coffins, see Figure 56.

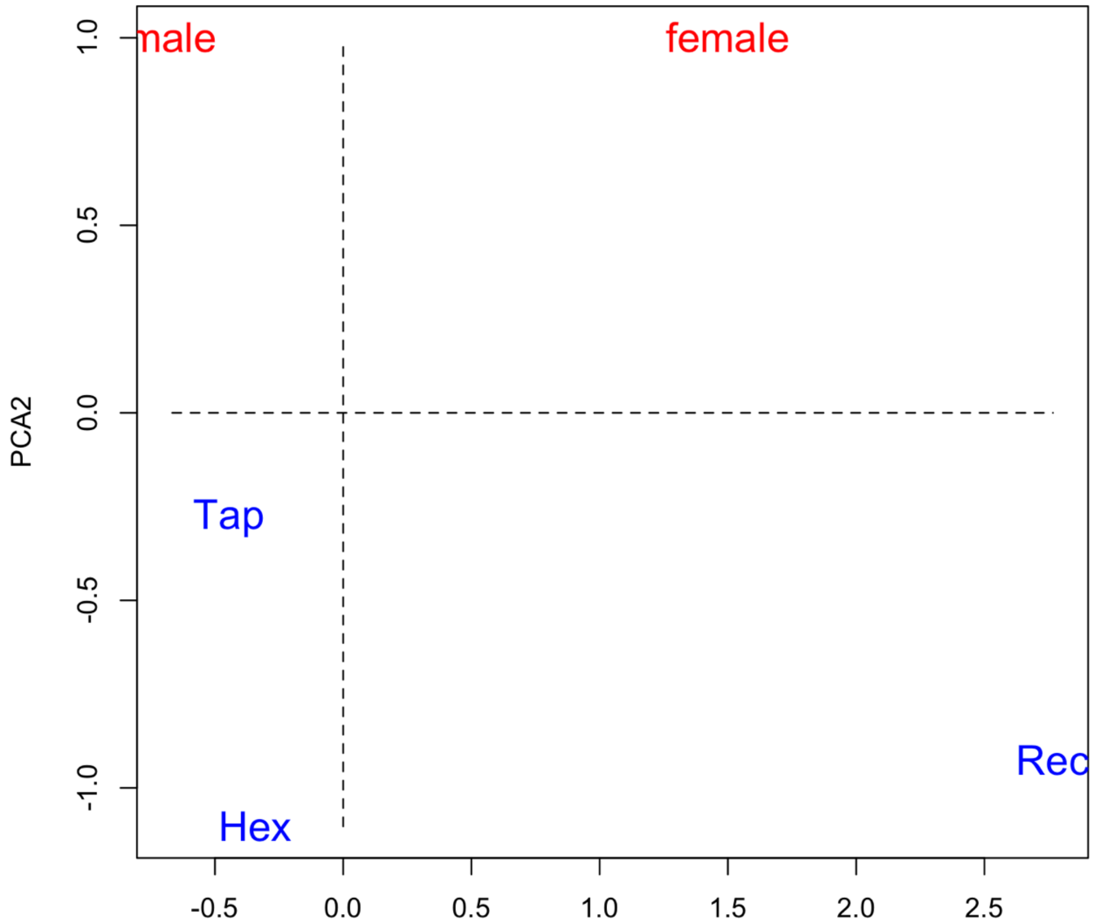


Figure 56. Burials with Religious Artifacts by Sex and Coffin Shape.

Summary

This analysis clarified several major trends in the SCVMC cemetery. First the cemetery is comprised of mostly adult males, but this is not surprising considering the historical context of the area. Males and females faced the same mortality and survivorship rates. The lack of subadults, specifically younger individuals under the age of 10, indicates that the subadults are either in an unexcavated portion of the cemetery or were buried elsewhere. Of the individuals assessable for ancestry, Asian/Latino is the most prevalent category.

Overall, the sample shows evidence for specific and non-specific disease. The high rates of non-specific infections, including localized and systemic, suggest that many individuals interred in the cemetery were afflicted with chronic, acute infections. The low rates of tuberculosis and syphilis may be due to issues of preservation and low rates of skeletal involvement in disease expression.

Coffin size appears to be standardized to 6 feet by 1 ½ feet, no matter what the coffin shape was. Females correspond with tapered and rectangular coffins, while males are more closely associated with hexagonal. However, even though tapered and rectangular coffins cluster, females as a whole do not. Subadults correspond with rectangular coffins, while adults and older adults are more closely grouped with the hexagonal and tapered. The presence and absence of buttons was not associated with a specific coffin shape or age range, but females were more likely to not have any buttons. Males were more likely to have multiple buttons types, and single button types. Religious artifacts were all related to Catholicism, were found in burials of both sexes and all ages but did not cluster spatially. Grave goods were used to segment the burial population into three categories: community members, unknown individuals, and hospital direct interments. A majority of burials are community members (70%) with a wider variety of personal grave goods than the hospital direct internments (12.1%), or unknown individuals (17.9%).

The next chapter, chapter 7, will examine how the VMC burials compare to the historical record and similar skeletal samples. A discussion of the relative health of the VMC sample is included in the next chapter.

Chapter 7: Comparative Studies Results

Introduction

The previous chapter examined the results of analysis of the skeletal sample from VMC. The following chapter compares the results from Chapter 6 with the historical record and other similar skeletal samples. These skeletal samples represent similar times periods, contexts, or regional locations as VMC.

Comparing with historical records

Santa Clara Infirmary Death Record

The Hospital Death Records Volume 5, April 27th, 1925-December 21st ,1933, contains detailed accounts of the name, age, marital status, nativity, cause of death, date of death, date of burial, and name of the funeral home used (Figure 57) of individuals that died at the Santa Clara County Infirmary. Additionally, individuals that were buried by the county are noted. Although this record does not include individuals buried within the SCVMC cemetery it is the best available primary document with which to begin to understand the larger death related trends at the hospital during this time period.

Although the hospital deaths are comprised overwhelmingly of older adults (53%), infants (12%) and juveniles (10%) make up nearly a quarter of all deaths (see Table 34). Therefore, a lack of young individuals being treated (and dying) at the hospital can be ruled out. The large number of adult individuals in the cemetery is also in line with the hospital deaths. Examining all of the hospital deaths provides a wider lens into the deaths of Santa Clara County poor, as this data includes individuals that could afford private burials. Although the hospital was solely for individuals needing financial and medical aid, not all socio-economically disadvantaged individuals are the same. Therefore, it is also necessary to compare the

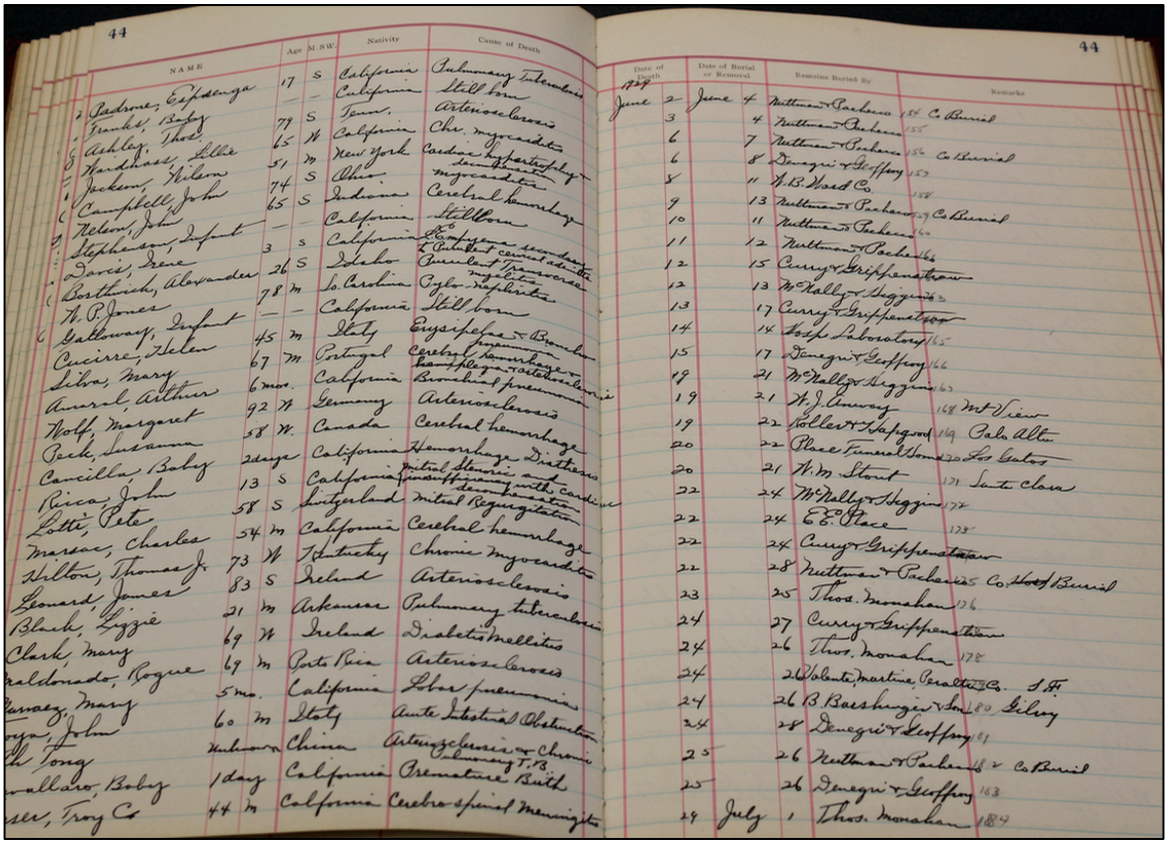


Figure 57. Hospital Death Records Volume 5 Page 44. Santa Clara County Archives Collection 2008-013 Medical Examiners-Coroner's Office Records Box 8 Volume 5.

Age Category	Count	Frequency
Infant (<1)	376	12%
Juvenile (1-20)	295	10%
Young Adult (20-35)	298	10%
Adult (35-50)	456	15%
Older Adult (50+)	1631	53%

Table 34. VMC All Hospital Deaths Age at death distribution.

VMC skeletal data specifically with hospital deaths that received county burials versus those that did not (see Tables 35 and 36).

County (48%) and private (55%) burials at the hospital are comprised mostly of older adults which is to be expected based on the other data sets. However, surprisingly 27% of county burials are infants versus only 8.5% of private burials. What might account for this disparity between the infant deaths receiving county burials (27%) and the infant burials recovered during excavation (1%)? See Figure 58. The age of infants is recorded in greater details than adults, with the months and sometimes minutes of life noted. Of the infant county burials, 68% (115 out of 170) are individuals that are noted as stillbirths, or neonatal deaths that lived less than 1 month. The stigma surrounding early neonatal death constitutes a unique social variable compared to other death age categories. The death of a child is treated differently from adult deaths (Curl 1972; Mitford 1963; Sweeney 2014), and stillbirths are treated differently from other infant deaths. The high number of county stillbirth burials may be related to the prohibition of unbaptized stillbirths being buried in consecrated ground. However, the lack of infant burials at VMC (see Figure 58 and 59) may indicate that stillbirth or not, child burials are treated differently, and they may have been buried at a more formal burial ground. In terms of sex the county burials have a more similar male to female ration to VMC than the private burials (see Table 37). There is a statistically significant difference ($\chi^2 = 225.1909$, df = 2, $p < 0.00001$).

Age Category	Count	Frequency
Infant (<1)	170	27%
Juvenile (1-20)	45	7%
Young Adult (20-35)	51	8%
Adult (35-50)	63	10%
Older Adult (50+)	300	48%

Table 35. County Hospital Deaths county burials age at death distribution.

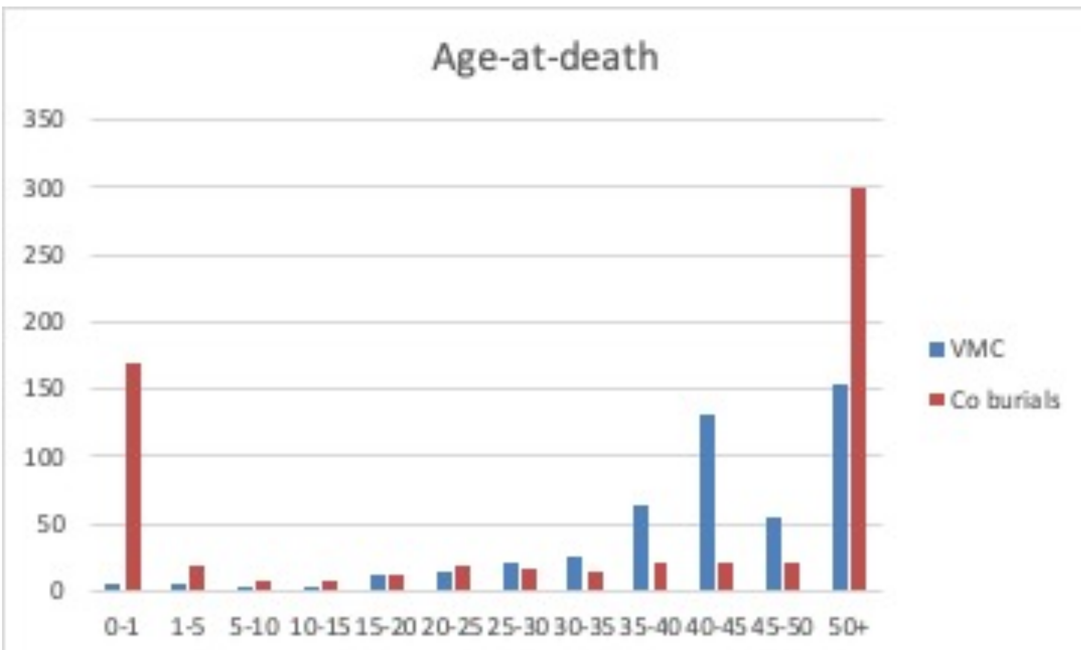


Figure 58. Age-at-death distribution of VMC and county burial hospital deaths.

Age Category	Count	Frequency
Infant (<1)	206	8.5%
Juvenile (1-20)	250	10.3%
Young Adult (20-35)	247	10.2%
Adult (35-50)	393	16%
Older Adult (50+)	1331	55%

Table 36. County Hospital Death private burial age at death distribution.

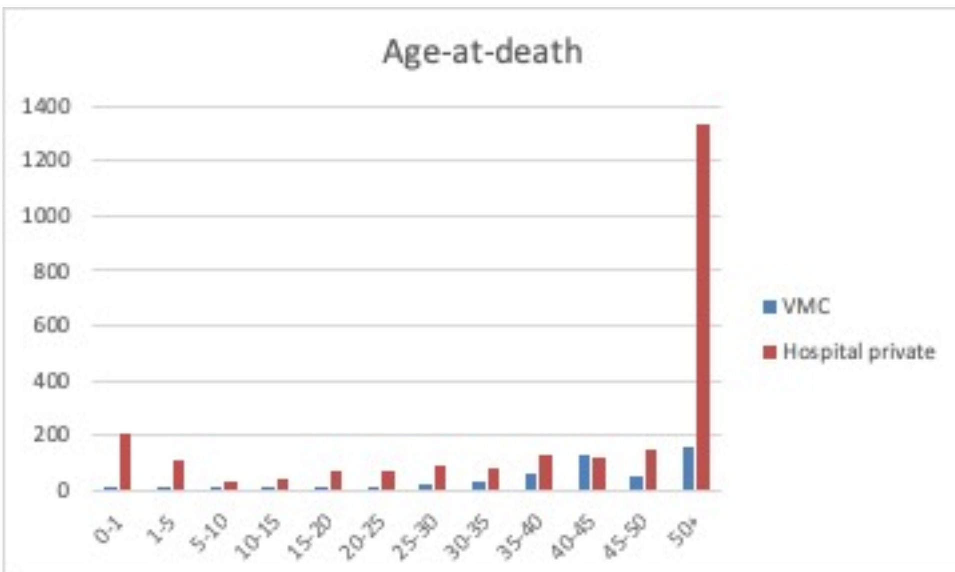


Figure 59. Hospital private burials and VMC age at death distribution.

Sample	Male	Female
VMC	720 (90%)	75 (10%)
Hospital deaths private burial	1522 (64%)	854 (36%)
Hospital deaths county burial	454 (79%)	119 (21%)

Table 37. Sex distribution of VMC, and Hospital Deaths.

The categorical age and sex data seem to indicate that the VMC burials represent a different subset of the overall county burials and hospital deaths. Employing demographic hazard modeling helps to illustrate this fact (Table 38). The VMC skeletal sample was compared to the hospital deaths receiving county burials.

Sample	α_1	β_1	α_3	β_3
VMC	0.2205644	1.18344488	0.0005764	0.10841117
County Burials	55.98467287	178.7523891626	0.002066865	0.050613834

Table 38. α_1, β_1, α_3, and β_3 parameters for VMC and county burials.

The hazard models indicate that there is a significant difference between VMC and the hospital deaths with county burials (χ^2 =393.1268, df = 2, loglikelihood difference = -196.5634, p= <0.0001). The large number of subadult deaths in the hospital county burial population skews the mortality hazard (Figure 60).

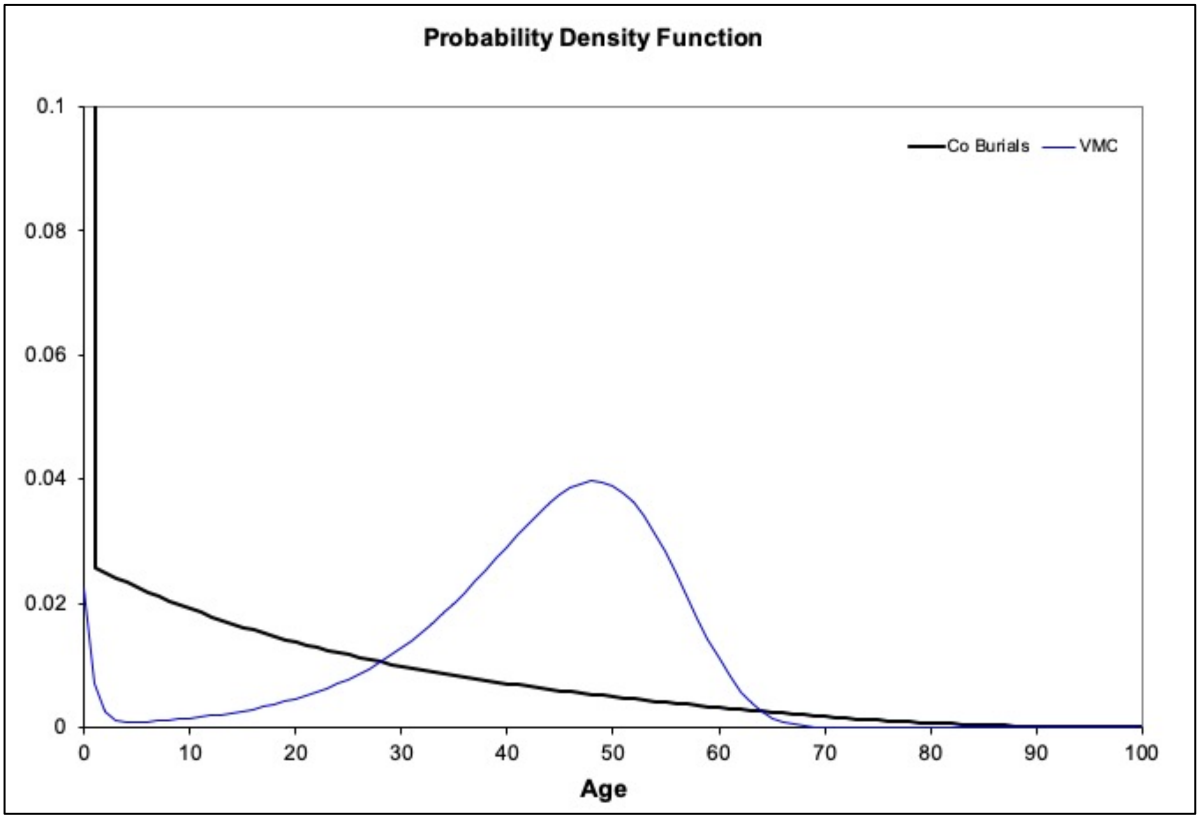


Figure 60. Probability density function of VMC and Hospital Deaths with county burials.

The difference in the large subadult population in the hospital deaths skews the mortality hazard (see figure 3). Additionally, the comparison of osteological age estimations, which are by nature broad, to actual age at death presents another explanation for some of the variation between all hospital deaths and the SCVMC cemetery. The demographic modeling also illustrates that SCVMC is different from the county burials (see figure 60), supporting the possibility that the SCVMC burials represent a different subpopulation of county burials.

The probability of mortality (see Figure 61) is different between the two samples. At VMC the probability of mortality rises dramatically after age 45, while the probability of mortality among the hospital deaths with county burials, past infancy, doesn't begin to rise until age 70. The vast difference in these ages is likely a result of differences in the data. Aging older individuals in osteology is difficult, and a with the VMC sample age specific estimations are cut off at 50+. The county hospital death register records actual, specific age at death. Therefore there are many individuals with precise ages well past 50. The oldest individuals in the county hospital death register that received county burials are 94 years old (Arthur Bulman, date of death September 9th, 1925 and Ramona Hernandez, date of death February 1st, 1931).

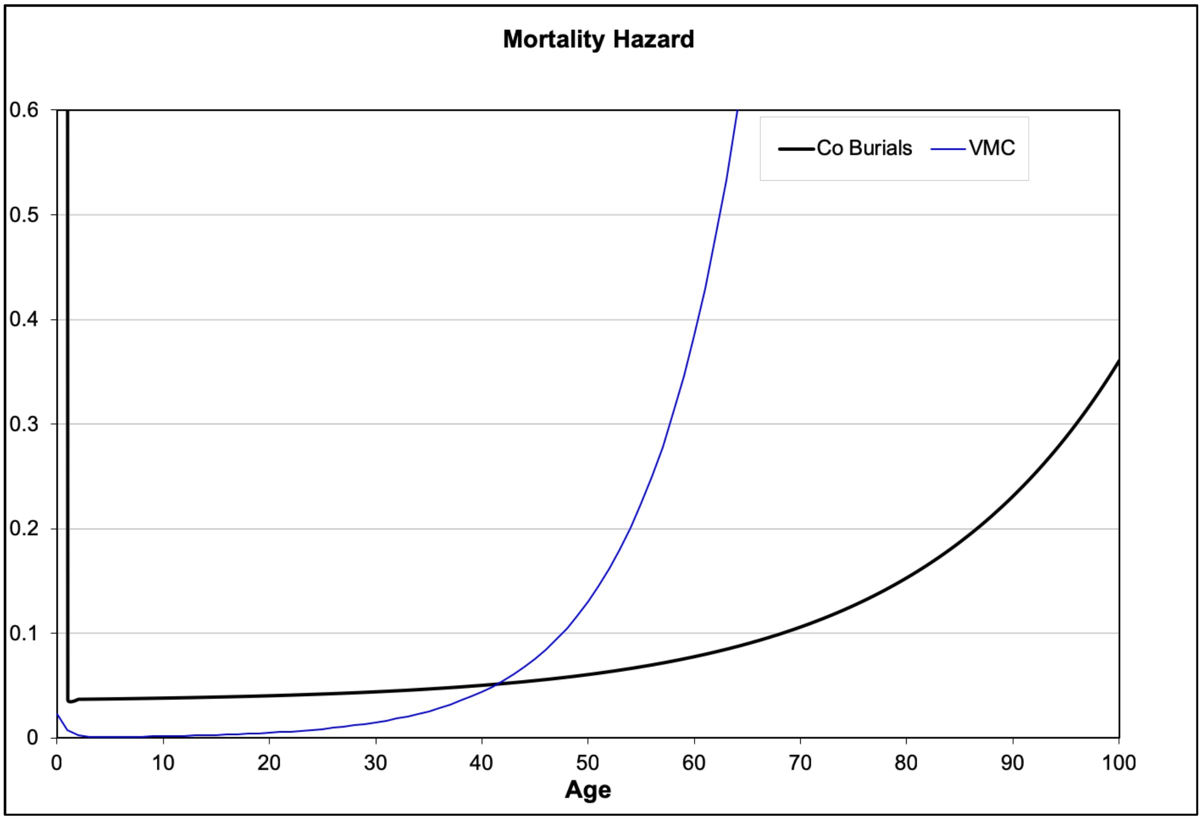


Figure 61. Mortality hazard for VMC and Hospital deaths with county burials.

The probability of surviving to the next age interval can be seen in Figure 62. Survivorship declines dramatically at VMC at approximately age 35, while the survivorship declined for hospital deaths with county burials drop immediately. However, both groups approach a 10% probability of surviving to the next age interval just before age 60. The disparity between survivorship between the two groups may be related to the type of data used: skeletal v. death records.

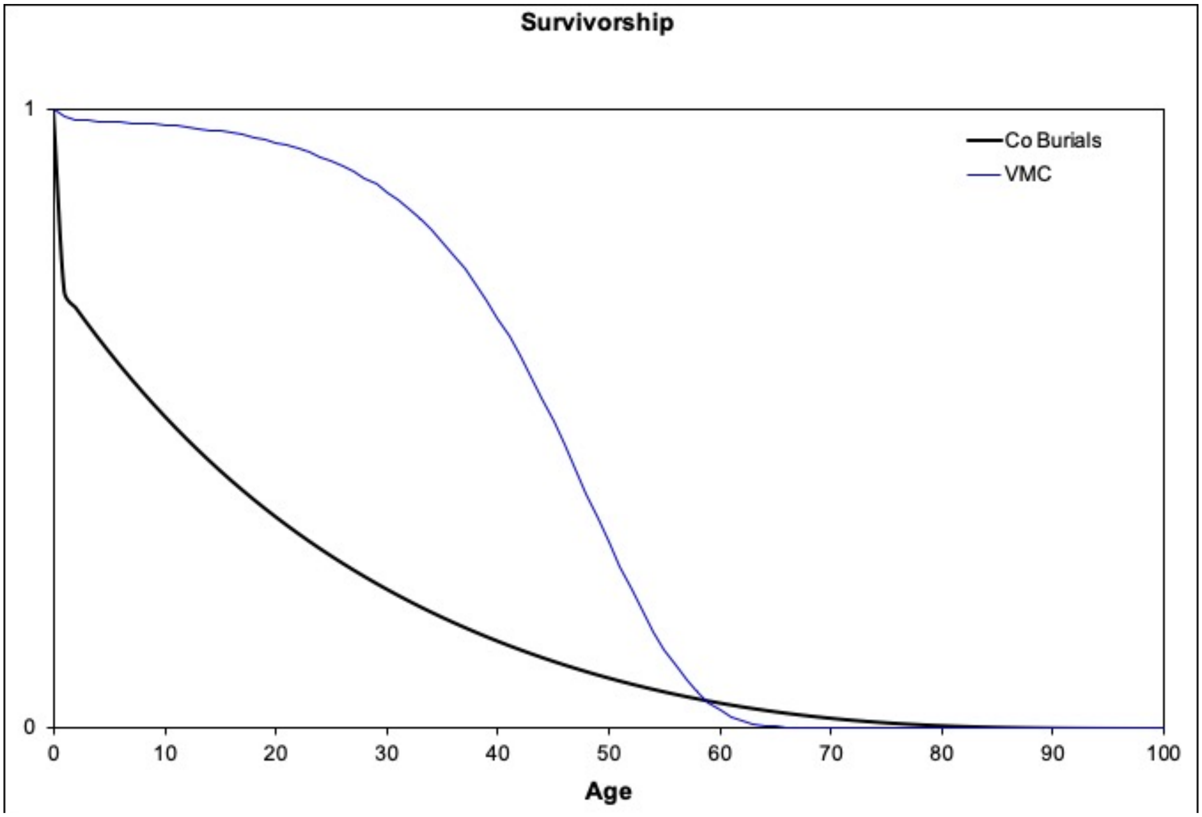


Figure 62. Survivorship of VMC and Hospital Deaths with county burials.

Nativity

According to the hospital ledger, for county burials 63% were born in the United States and 35% were foreign born (see table 6). It may be possible to infer general ancestry based on last name that would not work for married females and thus was not conducted. Interestingly 240 individuals (59% of individuals born in the U.S.) were born in California. This is undoubtedly a byproduct of the date of the death ledger (1925-1933). California was not officially a state until 1850, and the oldest individual with a California nativity was born in 1849. Additionally, by this time period many first generation born individuals would have U.S. nativity locations. Therefore, the foreign-born nativity (see table 39) highlights only a fraction of the total possible ancestral diversity. If earlier ledgers were available, the nativity would surely be slightly different.

Foreign born individuals (n=211) were documented from 35 countries (see table 40). The status of places the countries was considered at the time of birth of the individual. This is why Hawaii or Prince Edward Island are listed as their own countries, as they were incorporated into larger territories at a later date. The largest group of individuals (n=40; 19%) are from Mexico, followed by individuals from China (n=18; 8.5%). When viewed from larger geographic regions (see Table 41), Europe is the most prevalent region with 57% of foreign-born individuals.

Category	Count	Frequency
United States	403	63%
Foreign Born	211	33%
Unknown	22	4%

Table 39. Hospital Ledger County Burial Nativity.

Health

The top causes of death from 1925-1933 (see Table 42) per the Center for Disease Control (CDC) were tabulated into thirteen categories: diseases of the heart, pneumonia and influenza, nephritis, cancer and other malignant tumors, intercranial lesions of vascular origin, tuberculosis, accidents excluding motor vehicle, diarrhea/enteritis/and ulceration of intestines,

Nativity	**N**
Mexico	40
China	18
Italy	18
Germany	16
Philippines	16
Ireland	14
Denmark	9
England	9
France	7
Switzerland	7
Canada	6
Portugal	6
Austria	5
Scotland	5
Spain	5
Sweden	4
Australia	3
Russia	3
Holland	2
Hungary	2
Nova Scotia	2
Azores Islands	1
Bohemia	1
Central America	1
Czechoslovakia	1
Finland	1
Hawaii	1
Luxenberg	1
New Zealand	1
Norway	1
Prince Edward Island	1
Porto Rico	1
Slavonia	1
South Sea Island (Fiji)	1
Wales	1

Table 40. Foreign born county burial nativity by country.

Region	Count	Frequency
North America	9	4%
Central America	42	20%
South America	0	0%
Europe	120	57%
Asia	37	17.5%
Africa	0	0%
Australia	3	1.5%

Table 41. Foreign born county burials by larger geographic region.

premature birth, syphilis, motor vehicle accidents, diabetes, and other (causes of death not included in the top CDC list). All county burials in the volume 5 death register were coded based on the listed cause of death to correspond with the CDC categories (see Table 43). Diseases of the heart (20%) is the most prevalent cause of death among the county burials (Table 43). Heart disease is a very broad category and thus encompasses a number of pathological conditions. An additional issue to consider is the nature of cause of death reporting. The immediate cause of death that is listed on death certificates or death registers is the "…disease, injury, or complication that directly precedes death" (Kircher and Anderson 1989). Thus, heart failure can be precipitated by numerous pathological conditions.

There are some stark differences with the second and third highest causes of death when compared with the CDC numbers. Tuberculosis (16%) is the second highest cause of death amongst county burials but remains the 6th leading cause of death between 1925-1933

1925	1926	1927	1928	1929	1930	1931	1932	1933
Disease of the heart	‘ ’’	“”	“”	“”	“”	“”	“”	“”
Pneumonia and influenza	“”	“”	“”	“”	“”	“”	“”	Cancer and other malignant tumors
Nephritis	“”	Cancer and other malignant tumors	“”	“”	“”	“”	“”	Pneumonia and influenza
Cancer and other malignant tumors	“”	Nephritis	“”	“”	“”	“”	Intercranial lesions of vascular origin	“”
Intercranial lesions of vascular origin	“”	“”	“”	“”	“”	“”	Nephritis	“”
Tuberculosis	“”	“”	“”	“”	“”	“”	“”	“”
Accidents excluding motor vehicle	“”	“”	“”	“”	“”	“”	“”	“”
Diarrhea, enteritis, and ulceration of intestines	Premature birth	“”	“”	“”	“”	“”	“”	“”
Premature birth	Diarrhea, enteritis, and ulceration of intestines	“”	“”	Motor vehicle accidents	“”	“”	“”	“”
Syphilis	Motor vehicle accidents	“”	“”	Diarrhea, enteritis, and ulceration of intestines	“”	“”	Diabetes mellitus	“”

Table 42. Top 10 causes of death nationwide. “”” indicates that cause of death ranking matches the previous year. Data source: https://www.cdc.gov/nchs/data/dvs/lead1900_98.pdf.

Cause of Death	Number afflicted	Percentage
Disease of the heart	169	20%
Tuberculosis	129	16%
Premature birth	124	15%
Pneumonia and influenza	103	12%
Cancer and other malignant tumors	55	6%
Nephritis	41	5%
Diarrhea, enteritis, and ulceration of intestines	33	4%
Intercranial lesions of vascular origins	21	2.5%
Accidents (non-motor vehicle)	19	2%
Syphilis	15	2%
Motor vehicle accident	2	.3%
Diabetes	2	.3%
Other (Misc.)	116	14%

Table 43. Hospital Death Register causes of death by CDC categories for county burials.

nationwide per the CDC data. This also indicates that amongst the VMC skeletal sample tuberculosis rates are under-represented, likely hampered by both preservation issues and the nature of skeletal tuberculosis expression. Premature birth (15%) is the third highest cause of death amongst county burials but nation-wide it never reached higher than the 8^{th} leading cause of death during these years.

Infectious Disease

Forty five percent (n=287) of the county burials cause of death was an infectious process (see Figure 63). These diseases include infectious processes that can impact the skeleton, such as tuberculosis and syphilis. A comparison between the reported infectious causes of death in the register and non-specific infections including tuberculosis and syphilis in the VMC skeletal sample was conducted.

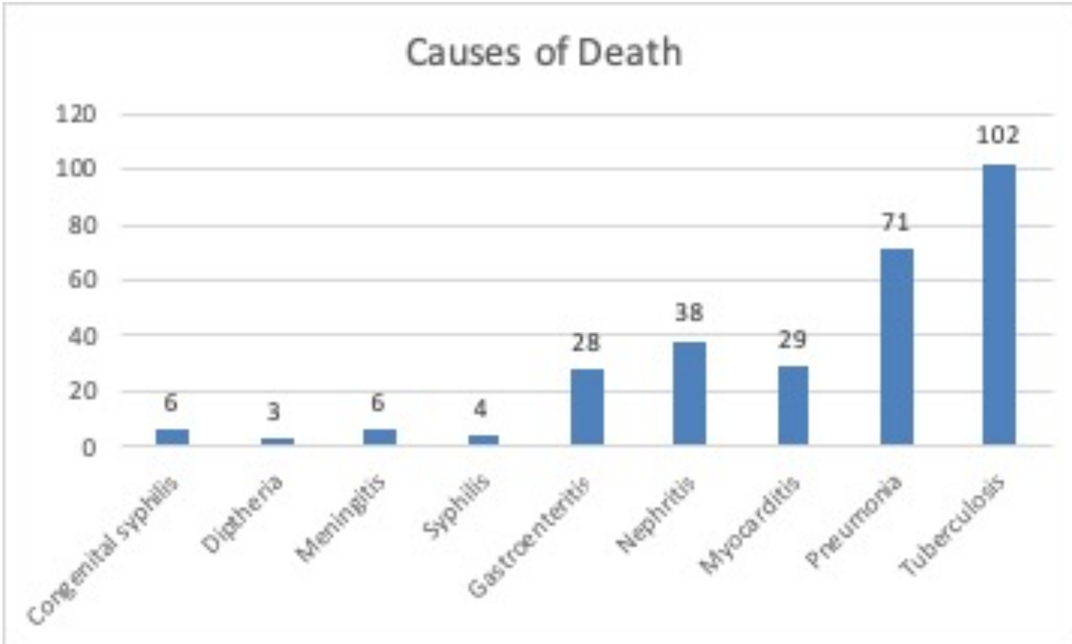


Figure 63. Number of individuals with an infectious cause of death from the hospital death register.

In the VMC skeletal sample 452 individuals (45%) were diagnosed with non-specific infections (n=424), syphilis (n=14) or tuberculosis (n=10). The resulting chi-square (χ^2 = 0.0018, df = 1) was not significant (p=.066511).

Comparative Samples

Demography

A demographic analysis employing various Siler and Gompertz mortality models, as well as correspondence and transition analysis was used to compare the osteological age-at-death assessments of the 493 SCVMC individuals with specific age estimations, to other historic samples. These comparative samples were selected due to their date, location, or context (see Table 44).

Site	Location	Date	Type	N	Source
Mission City Memorial Park	San Jose, CA	1913-1937	Pauper	1,097	www.scchgs.org/
Alameda-Stone	Tucson, AZ	1860s-1881	Community	1,386	Trask 2010
Voegtly	Pittsburgh, PA	1833-1861	Community	724	Ubelaker & Jones 2003
Milwaukee County Institution Ground	Milwaukee, WI	1882-1925	Pauper	1,649	Milligan et al. 2008, Milligan 2010

Table 44. Comparative Samples.

A mid-point was taken for each age estimation (see Table 45). For cemeteries where only broad categories were present, i.e. Young Adult 20-35, a mid-point was taken for that category. Each site had a Hazard Function, Gompertz Hazard, and Siler Hazard run in R using Lyle Konigsberg's hazard model code (available here: http://konig.la.utk.edu/). The output α_1, β_1, α_3, and β_3 parameters (see table 46) were then input into Nick Herrmann's paleodemographic modeling program to compare each site. The parameters were graphed using their respective models. The log likelihood ratio and chi-square test of the individual α and β parameters were estimated in the MLE computer program (Holman 2001, see Table 47). Note that the log likelihood ration program is very conservative, and typically results in a significant result. The similarities and differences between SCVMC and each of the sites were examined in an effort to identify similar sites to SCVMC.

Sample	0-1	1-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-infinity
VMC	5	6	2	4	12	14	20	26	64	131	55	134
Mission City Memorial Park	152	25	11	11	16	30	25	28	45	48	59	647
Milwaukee County Institution Ground	346	20	0	7	0	0	74	0	0	320	0	97
Alameda Stone Sections 1 & 2	10	0	5	0	3	0	61	0	0	60	0	8
Alameda Stone Sections 3,4,5	356	0	168	0	33	0	196	0	0	292	0	73
Voegtly	249	187	42	17	14	13	27	34	25	30	14	34

Table 45. Comparative sites age estimation midpoint counts.

Sample	α_1	β_1	α_3	β_3
VMC	0.2205644	1.18344488	0.0005764	0.10841117
Mission City Memorial Park	0.31161008	1.9349520359	0.00076708	0.6649949
Milwaukee County Institution Ground	0.331610079	1.9349520359	0.000767081	0.066499494
Alameda Stone Sections 1 & 2	0.07631628	0.986144957	0.00339331	0.08802352
Alameda Stone Sections 3,4,5	0.32785313	0.634082397	0.00678635	0.0601861
Voegtly	0.31875885	0.6703823	0.25720704	-0.6682745

Table 46. Sample α_1, β_1, α_3, and β_3 parameters.

Sample Comparison	χ^2	df	Log Likelihood Difference	P
VMC v. Mission City Memorial Park	312.216	2	-156.081	<0.0001
VMC v. Milwaukee County Institution Ground	324.896	2	-162.448	<0.0001
VMC v. Alameda Stone Sections 1 & 2	39.2706	2	-19.6353	<0.0001
VMC v. Alameda stone Sections 3,4,5	358.032	2	-179.016	<0.0001
VMC v. Voegtly	789.02	2	-391.51	<0.0001

Table 47. Statistical results for demographic comparisons between cemetery samples.

Mission City Memorial Park

The age at death information from Mission City Memorial Park (MCMP) was extrapolated from information recorded on headstones, and thus represents the specific age at death of those individuals. In order to compare this data to the VMC skeletal age ranges, the MCMP numbers were also normalized into the mid-point age range categories (see Figure 64).

Though similar, there are differences between the demographic profile of SCVMC and MCMP. The population that both samples derived for should be the same during life (individuals that lived and died in Santa Clara County that received county funded burials), so the differences may stem from issues comparing osteological with historic data, or differential burial practices. The MCMP sample has a large number of infants, specifically still births and individuals that died shortly after (n=152; 14%) compared to VMC (n=5; 1%). The MCMP data, as well as the County Hospital Death Register (post 1925), demonstrate that infant deaths were occurring at the hospital. The lack of infant burials at VMC suggests that infant burials were treated differently, either by being segregated into a different portion of the cemetery that was not excavated, or that infants were buried elsewhere (like MCMP). Both burial populations are dominated by older individuals. The MCMP sample has a larger number of individuals over the age of 50 (n= 647; 59%) compared to VMC (n=154; 31%), though the over 50 age category is the largest individual age category at VMC. This corresponds to other historic demographic data regarding the older age structure of Santa Clara County.

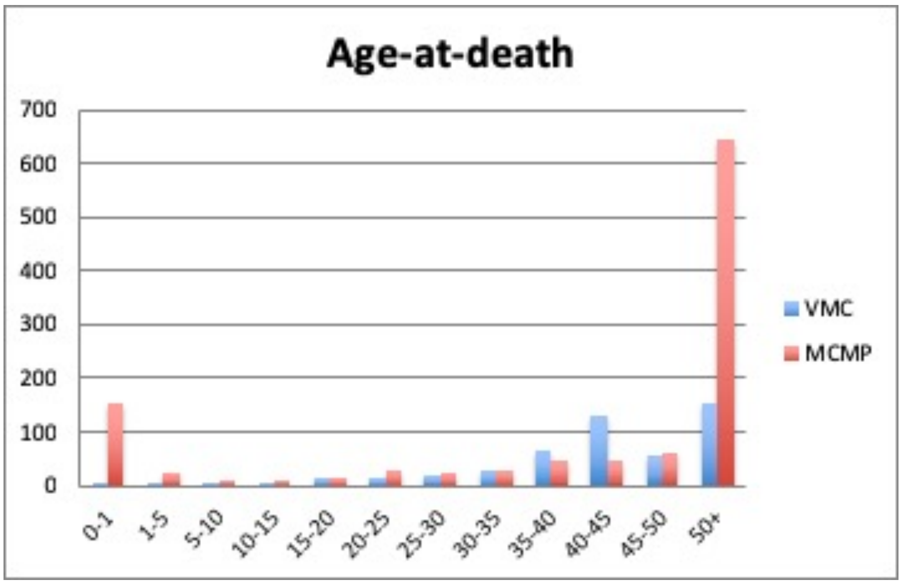


Figure 64. Age at Death results for VMC and MCMP.

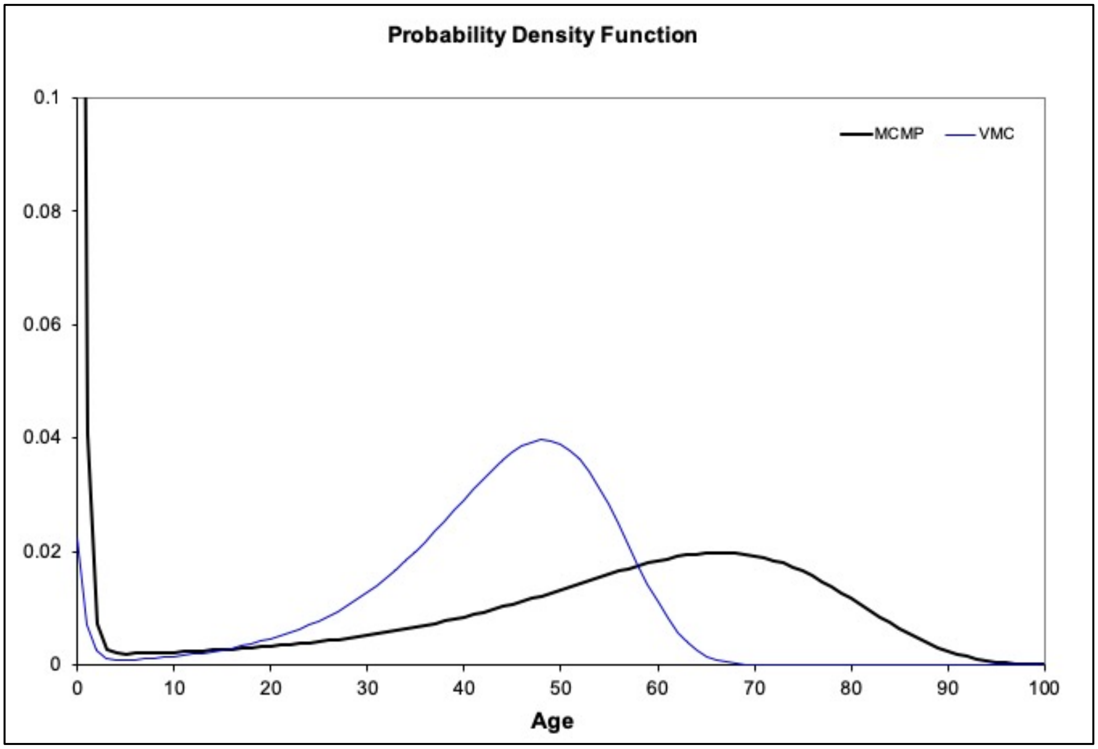


Figure 65. Probability density function for VMC and MCMP.

The hazard models indicate that there is a significant difference between VMC and MCMP regarding mortality and survivorship. The probability density (Figure 65) demonstrates that while individuals at MCMP have a higher probability of dying at birth, that the overall mortality of individuals buried at VMC faced a higher probability of dying around the age of 50 than individuals from MCMP whose probability of dying (after infancy) is highest at around age 70.

The probability of mortality (see Figure 66) is also different between the two samples. This may be a byproduct of issues in providing specific age estimates in skeletal samples over the age of 50-60 and the more detailed age at death data from the MCMP headstones. At VMC the probability of mortality rises dramatically after age 40, while the probability of mortality at MCMP does not rise until after age 60.

Similar to the mortality hazard, the probability of surviving to the next age interval (see Figure 67) is lower for individuals from VMC than MCMP. Survivorship declines dramatically at VMC at approximately age 35, while the survivorship decline at MCMP does not begin until approximately age 50. By the age of 55, individuals at VMC have less than a 10% probability of surviving to the next age interval. The MCMP samples does not face a less than 10% probability of surviving until age 80. The disparity between survivorship between the two groups may be related to the type of data used (skeletal v. headstones) or could be indicative of risk differences between the samples.

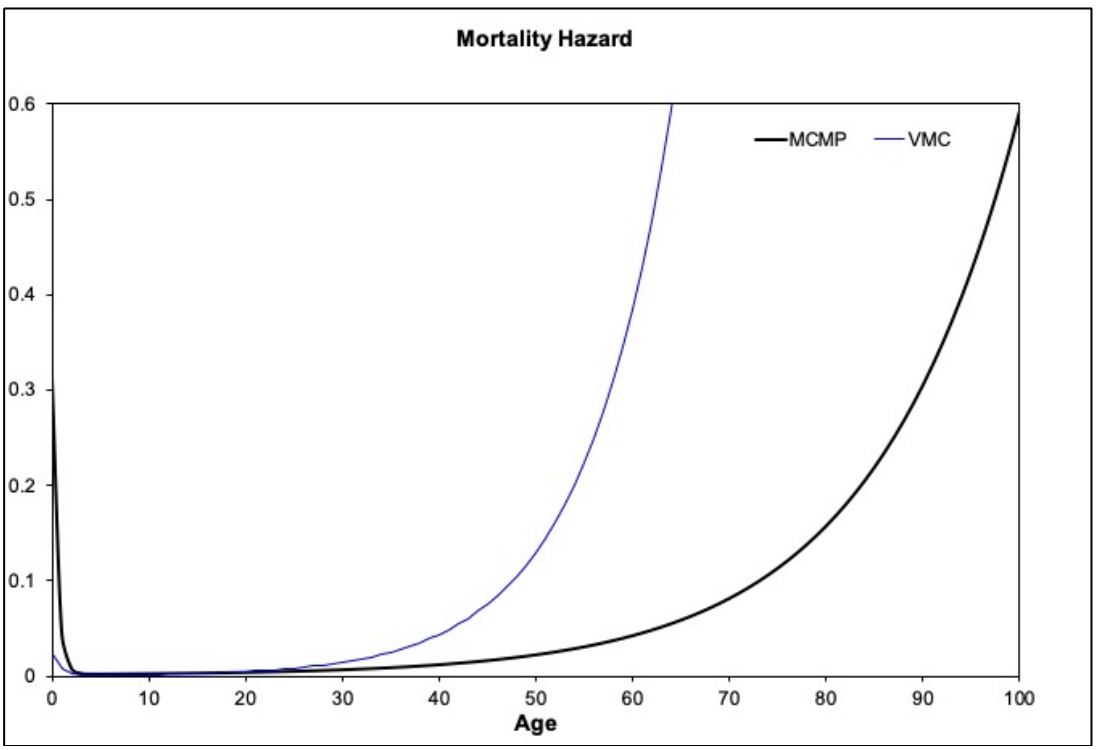


Figure 66. Mortality Hazard of VMC and MCMP.

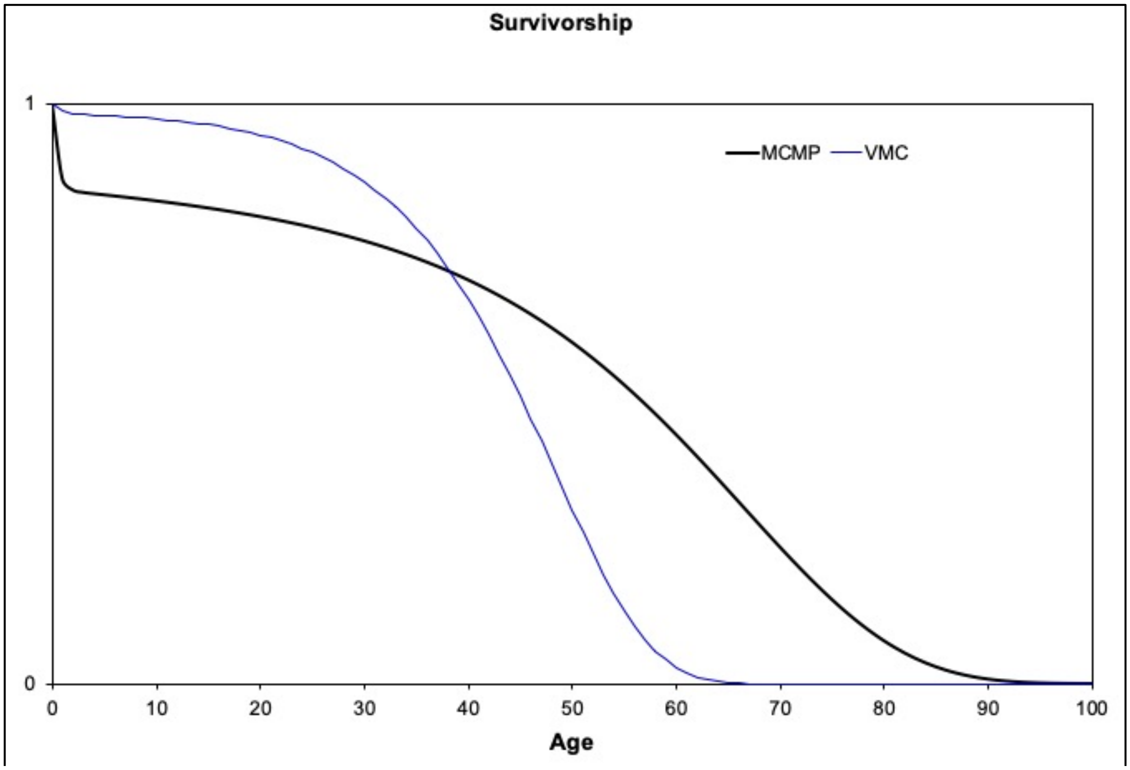


Figure 67. Survivorship VMC and MCMP.

There is a statistically significant relationship between sex (χ^2= 77.5888, df = 1, p <0.00001), see Table 48.

Sample	Male	Female
VMC	720	75
MCMP	464	173

Table 48. Individuals by Sex at VMC and MCMP.

Alameda Stone

During the course of excavation and analysis at Alameda Stone the cemetery was divided into five areas (designated 1-5). With the exception of the military section (area 1) the divisions were mainly arbitrary. Cemetery areas 1 and 2 are the southern portion of the cemetery, while areas 3-5 are the northern portion of the cemetery. Section 2 was predominantly male (69%) and Euroamerican or Hispanic. This disproportionate sex ratio suggested that a recent migrant population was interred in this area (Trask 2010:372). Cemetery area 3 comprises the bulk of the civilian section with over half of the total individuals recovered during the project. This section has an equal distribution of males and females that were primarily young to middle age adults, however there is also a larger number of fetal and infant remains (Trask 2010:373). Cemetery area 4 is highly disturbed with a larger number of indeterminately sexed remains. Area 4 has a large number of individuals under the age of 2 (Trask 2010:373). Cemetery area 5 is the smallest with only 32 individuals. There is an even male to female ration, but the area is comprised of young adults and individuals less than 12 years old (90%) (Trask 2010:373-374). The southern portion of the cemetery (areas 1-2) is primarily composed of young to middle-aged adult males, with a lower number of young children and females. The northern portion of the cemetery (areas 3-5) is more diverse in regard to age, sex, and biological affinity when compared to the southern portion. Therefore for the comparisons to VMC the cemetery areas at Alameda Stone were condensed into areas 1 & 2, and areas 3-5.

Alameda Stone Sections 1-2

The overall age structure of sections 1 and 2 from Alameda stone closely resembles the age structure at VMC (see Figure 68). There is a noted lack of subadults, and a majority of individuals in sections 1-2 are adult males. VMC has a larger proportion of older adults over the age of 50 (n=154; 31%), while Alameda sections 1-2 is comprised mainly of young to middle aged adults aged 25-45 (n=121; 82%).

The hazard models indicate that there is a significant difference between VMC and Alameda Stone sections 1-2 regarding mortality and survivorship. The probability density (Figure 69) demonstrates that individuals interred at Alameda Stone section 1-2 faced a higher probability of dying younger than those interred at VMC. Alameda Stone section 1-2's highest probability begins at around age 35, while VMC's occurs at approximately age 50.

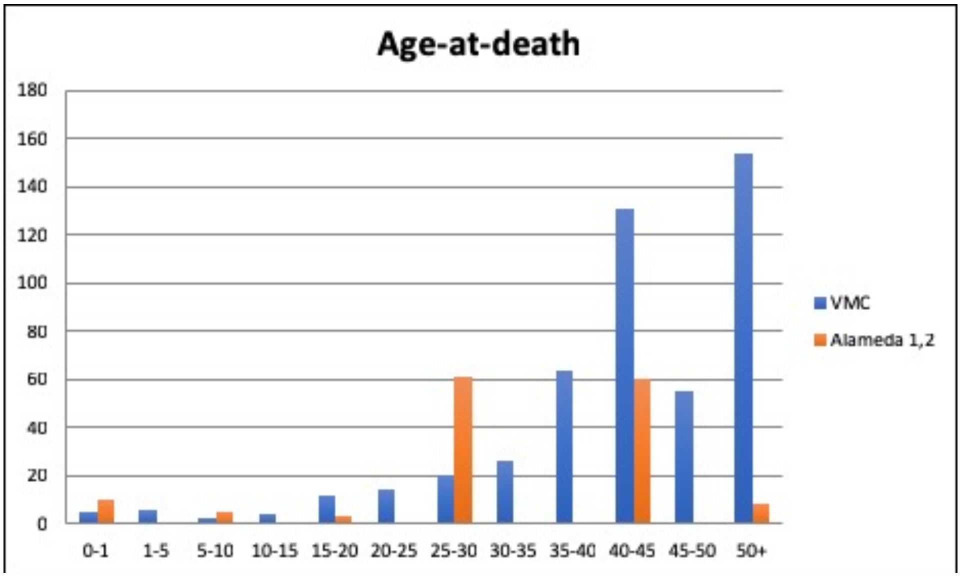


Figure 68. Age at death structure of VMC and Alameda Stone sections 1-2.

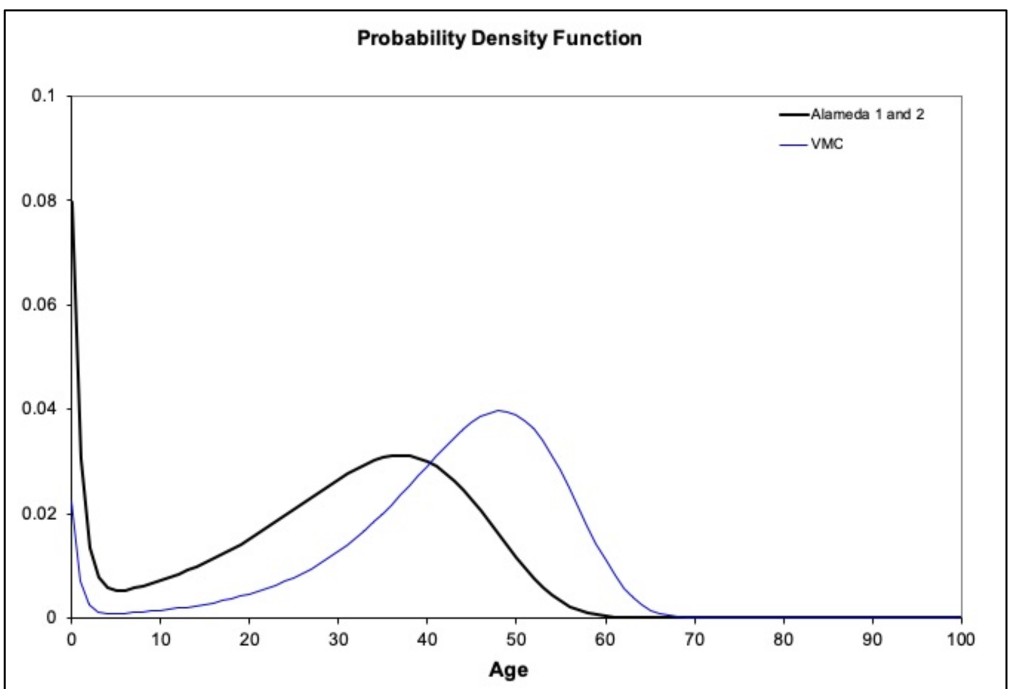


Figure 69. Probability Density Function VMC and Alameda Stone sections 1-2.

The probability of mortality (see Figure 70) is slightly different between the two samples. At VMC the probability of mortality rises dramatically after age 45, while the probability of mortality at Alameda Stone section 1-2 is slightly earlier, rising around age 35.

Similar to the mortality hazard, the probability of surviving to the next age interval (see Figure 71) is lower for individuals from Alameda Stone sections 1-2 than VMC. Survivorship declines at VMC at approximately age 35, while the survivorship declines at Alameda Stone sections 1-2 begins declining at approximately 20. By the age of 55, individuals at VMC have less than a 10% probability of surviving to the next age interval. The Alameda Stone sections 1-2 sample encounters a less than 10% probability of surviving even earlier at age 45.

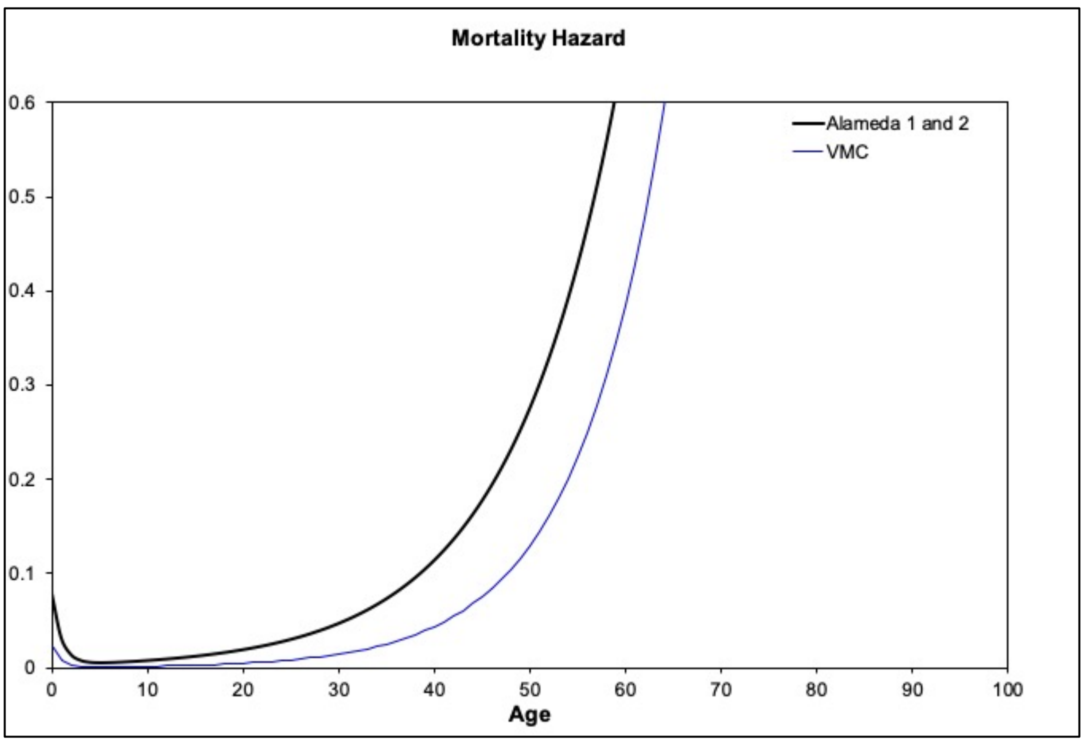


Figure 70. Mortality Hazard VMC and Alameda Stone sections 1-2.

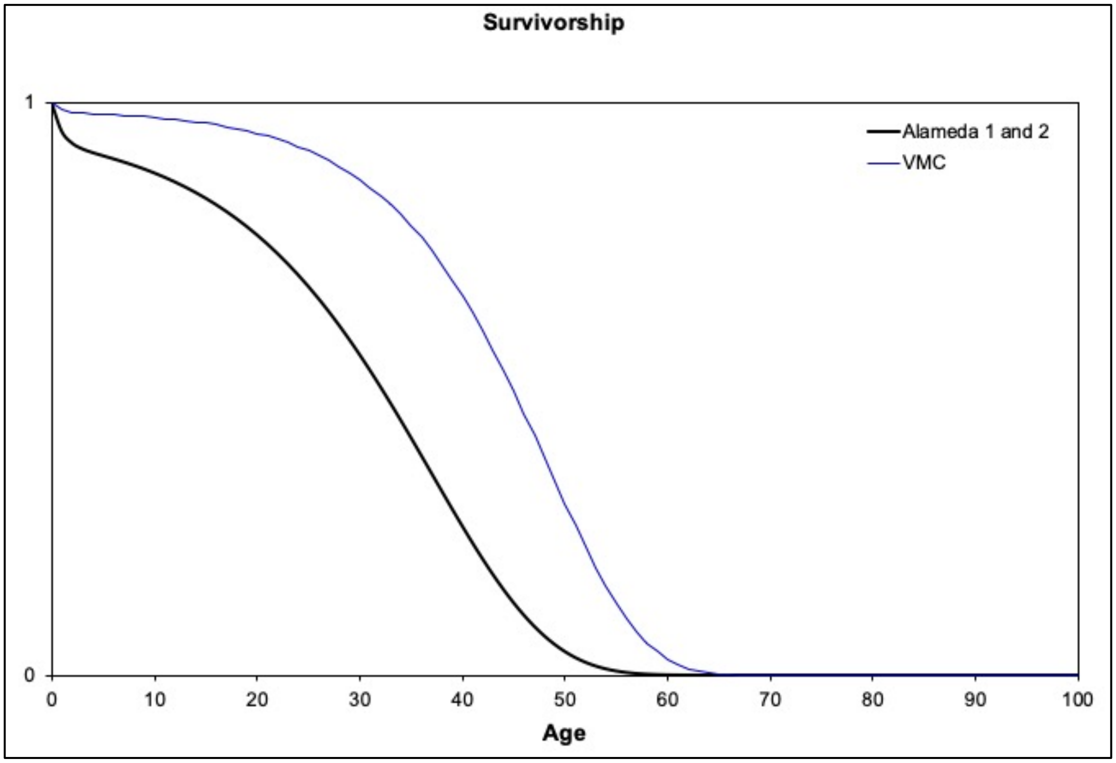


Figure 71. Survivorship VMC and Alameda Stone sections 1-2.

There is not a statistically significant relationship between sex (χ^2= 0.1088, df = 1, p = 0.74151), see Table 49.

Sample	Male	Female
VMC	720	75
Alameda Stone 1-2	77	7

Table 49. Individuals by Sex at VMC and Alameda Stone Sections 1-2.

Alameda Stone Sections 3-5

The age structure of sections 3-5 from Alameda Stone is very different from VMC (see Figure 72). Sections 3-5 has a large number of infants (n=356; 32%) and subadults (n=201; 18%) and a small number of older adults over the age of 50 (n=73; 6.5%). As previously stated VMC has a large proportion of older adults over the age of 50 (n=154; 31%), and very few subadults (n=43; 9%).

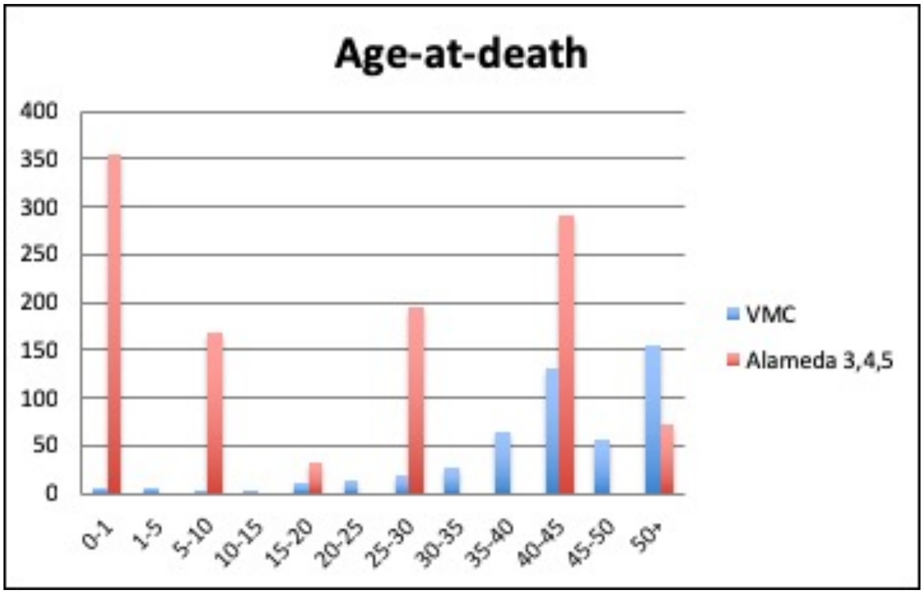


Figure 72. Age at death structure of VMC and Alameda Stone sections 3-5.

The hazard models indicate that there is a significant difference between VMC and Alameda Stone sections 3-5 regarding mortality and survivorship. The probability density (Figure 73) demonstrates that individuals interred at Alameda Stone section 3-5 faced a higher probability of dying younger, both in terms of infant mortality and early adulthood, than those interred at VMC. Alameda Stone section 3-5's highest probability in adulthood begins at around age 35, while VMC's occurs at approximately age 50.

The probability of mortality (see Figure 74) is similar between the two samples. At VMC the probability of mortality rises dramatically after age 45, while the probability of mortality at Alameda Stone section 3-5 is slightly earlier, rising around age 35.

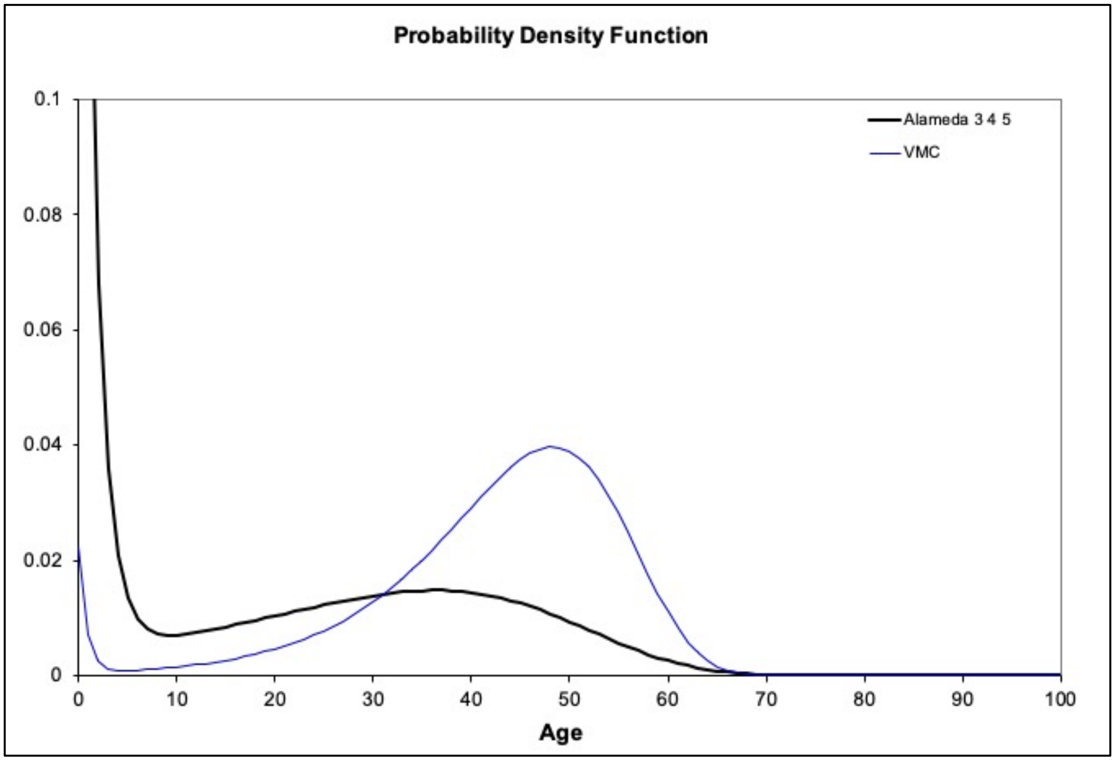


Figure 73. Probability density function of VMC and Alameda Stone sections 3-5.

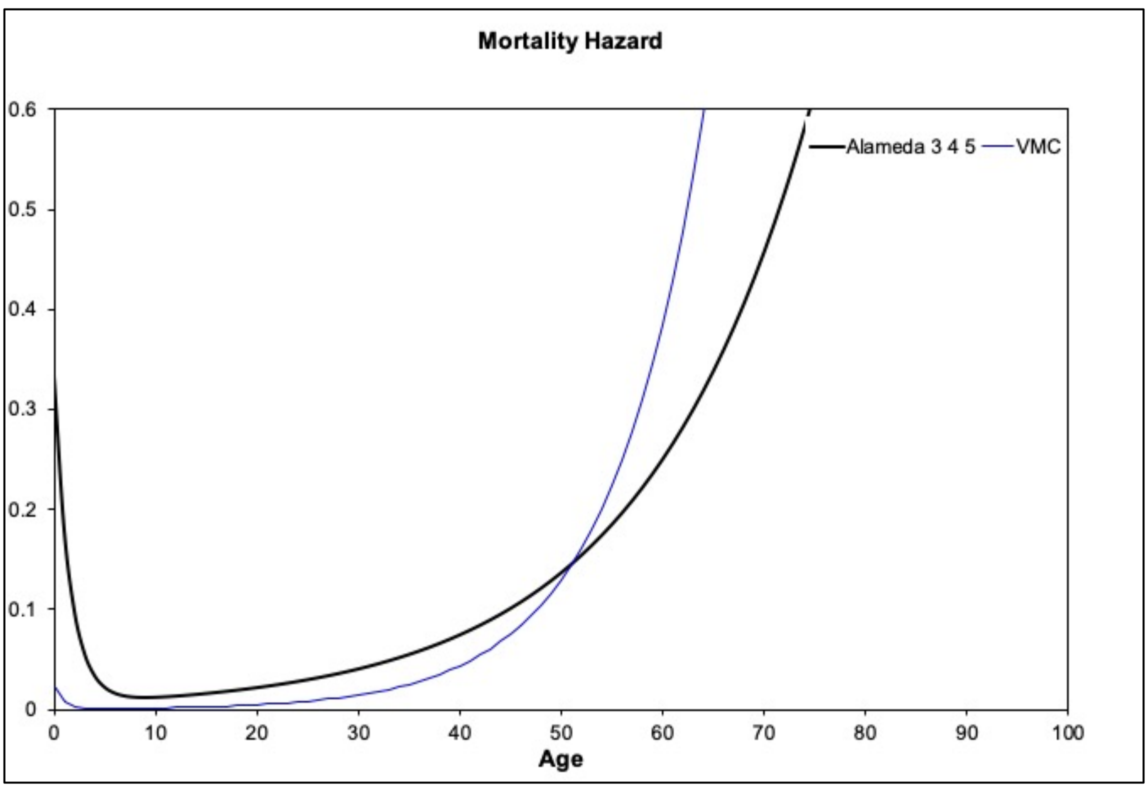


Figure 74. Mortality hazard of VMC and Alameda Stone sections 3-5.

Similar to mortality, the probability of survivorship in Alameda Stone sections 3-5 is generally lower than for VMC (Figure 75). Those interred in Alameda Stone sections 3-5 faced a heavy risk of infant mortality. Even at age five individuals in the Alameda Stone sections 3-5 only have a 60% probability of surviving into the next age interval, while VMC has a 98% probability of surviving into the next age interval.

There is a statistically significant relationship between sex (χ^2= 230.0568, df = 1, p <0.00001), see Table 50.

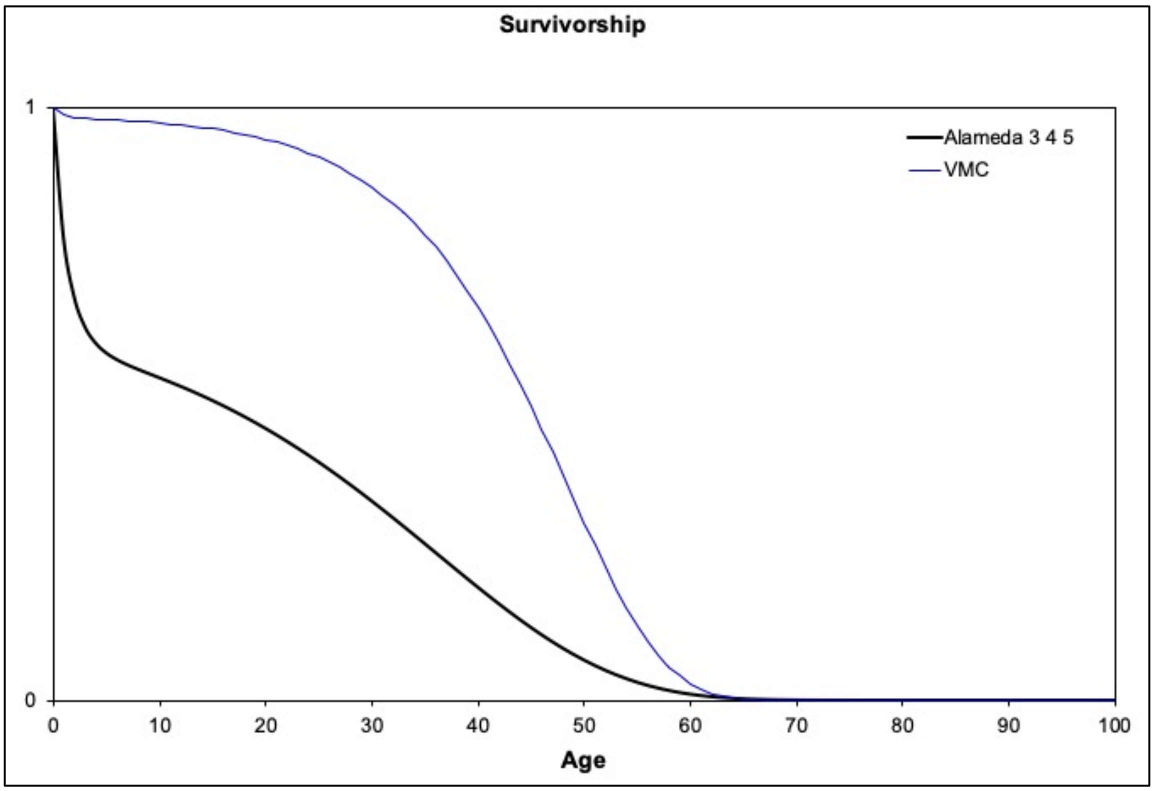


Figure 75. Survivorship VMC and Alameda Stone sections 3-5.

Sample	Male	Female
VMC	720	75
Alameda Stone 3-5	217	199

Table 50 Individuals by Sex at VMC and Alameda Stone sections 3-5.

Milwaukee County Institution Ground

The age structure of MCIG is very different from VMC (see Figure 76). MCIG has a large number of infants (n=346; 40%) and adults (n=394; 46%), as well as a smaller portion of older adults over the age of 50 (n=154; 18%). As previously stated VMC has very few subadults (n=43; 9%), a majority of adult individuals (n=296; 60%), and a large proportion of older adults over the age of 50 (n=154; 31%).

The hazard models indicate that there is a significant difference between VMC and MCIG regarding mortality and survivorship. Similar to Alameda Stone sections 3-5 the probability density (Figure 77) demonstrates that individuals interred at MCIG faced a higher

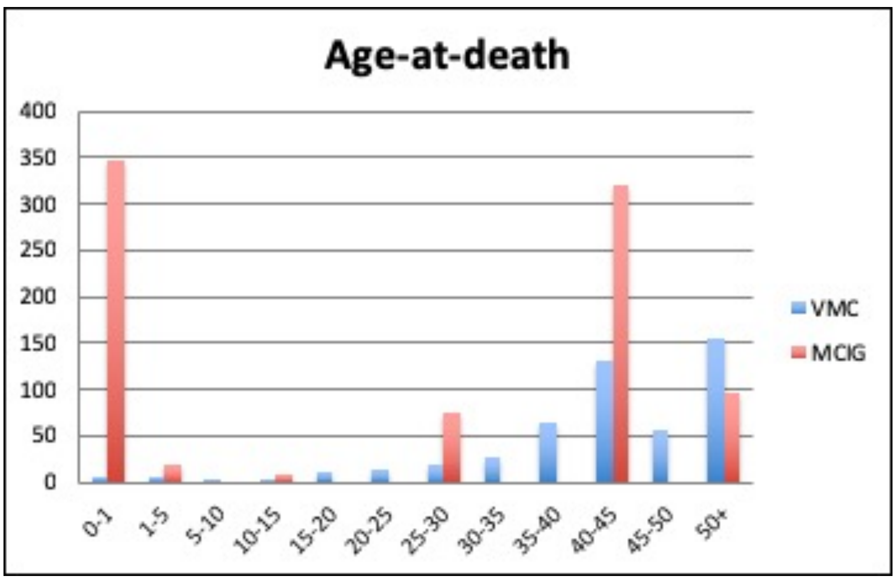


Figure 76. Age at death structure of VMC and MCIG.

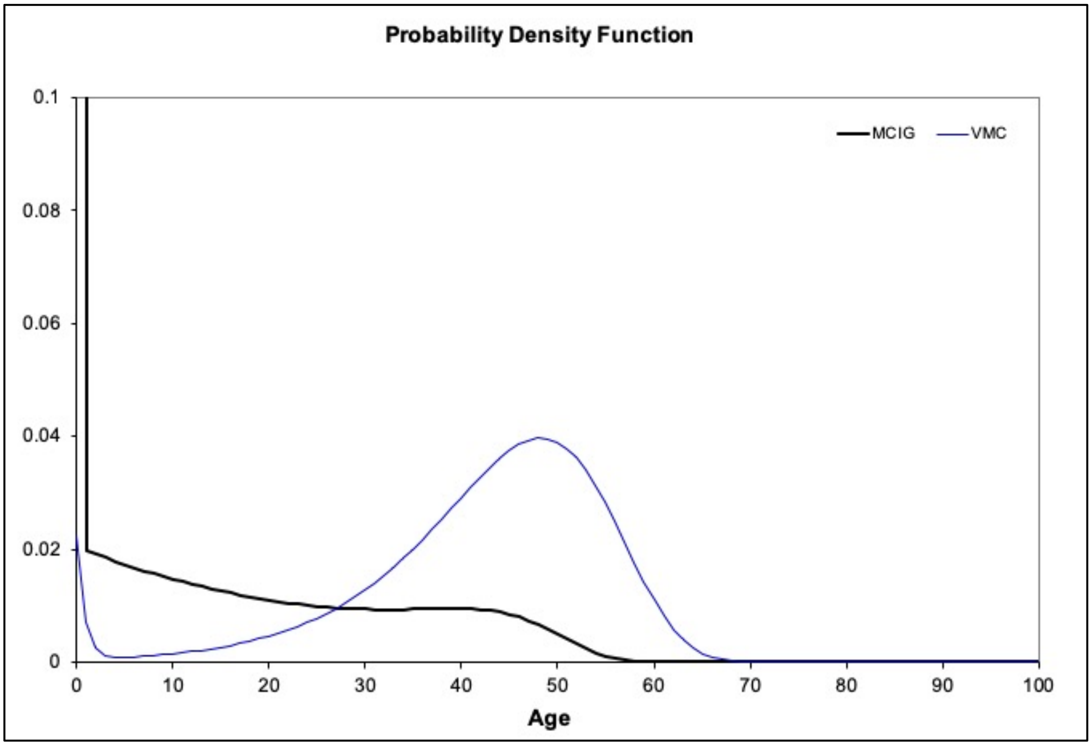


Figure 77. Probability density function VMC and MCIG.

probability of dying younger, both in terms of infant mortality and early adulthood, than those interred at VMC.

The probability of mortality (see Figure 78) is similar between the two samples after the risk of infant mortality. At VMC the probability of mortality rises dramatically after age 45, while the probability of mortality at MCIG is slightly earlier, rising around age 35. Similar to mortality, the probability of survivorship at MCIG is lower than for VMC (Figure 79). Those interred in MCIG faced a heightened risk of infant mortality. Even at age one individuals at MCIG have a 60% probability of surviving into the next age interval, while VMC has a 98% probability of surviving into the next age interval.

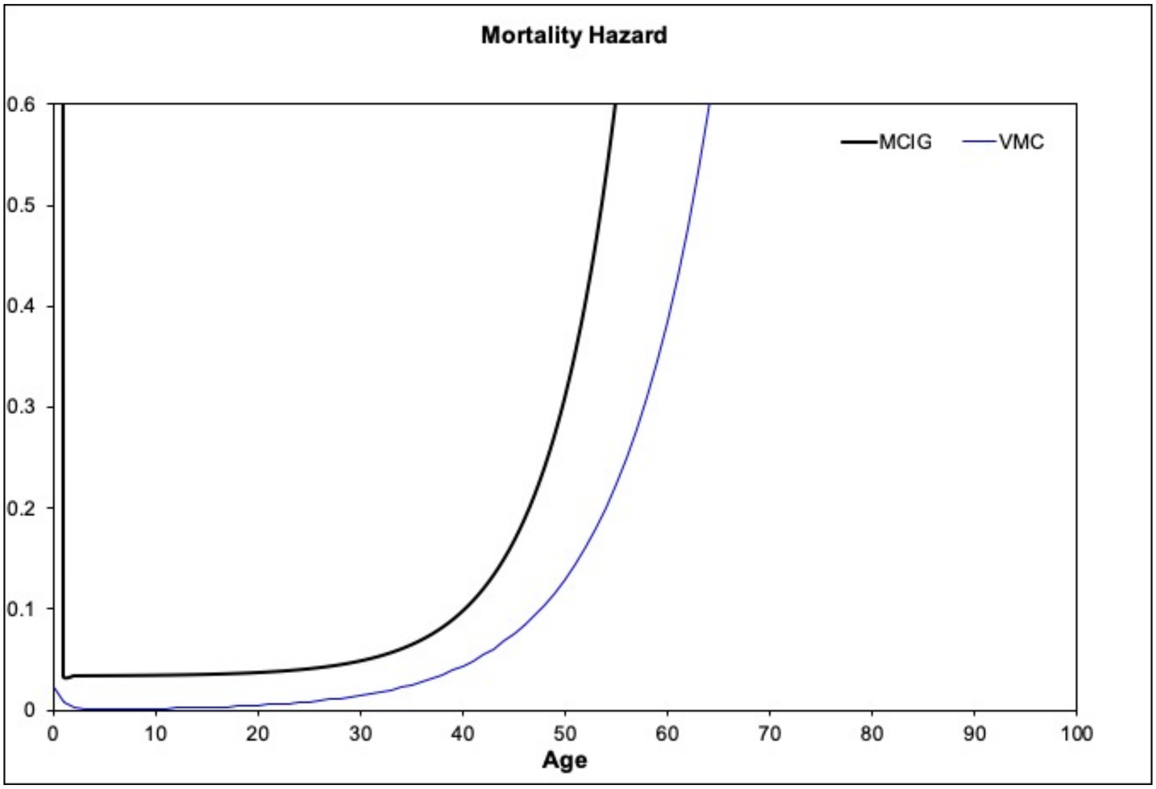


Figure 78. Mortality Hazard of VMC and MCIG.

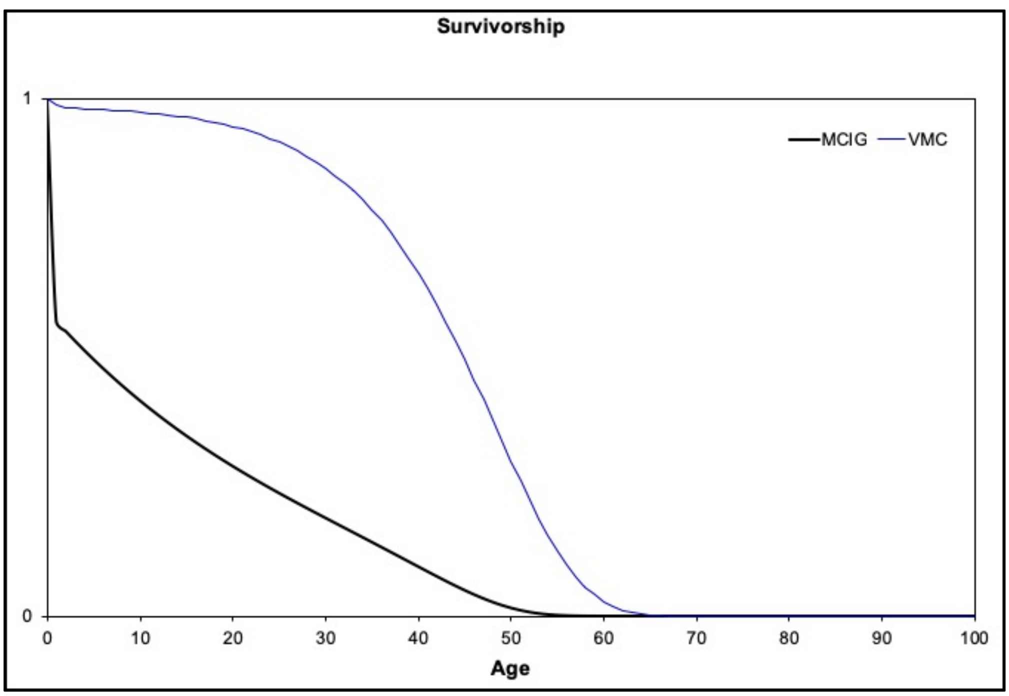


Figure 79. Survivorship VMC and MCIG.

There is not a statistically significant relationship between sex (χ^2= 2.5788, df = 1, p= 0.108306, see Table 51.

Sample	Male	Female
VMC	720	75
MCIG	406	57

Table 51. Individuals by Sex at VMC and MCIG.

Voegtly

The age structure of Voegtly is very different from VMC (see Figure 80). The Voegtly cemetery has as a large number of infants (n=249; 36%) and subadults (n=273; 40%) with a very small number of older adults age 50+ (n=34; 5%). As previously stated VMC has very few subadults (n=43; 9%), a majority of adult individuals (n=296; 60%), and a large proportion of older adults over the age of 50 (n=154; 31%).

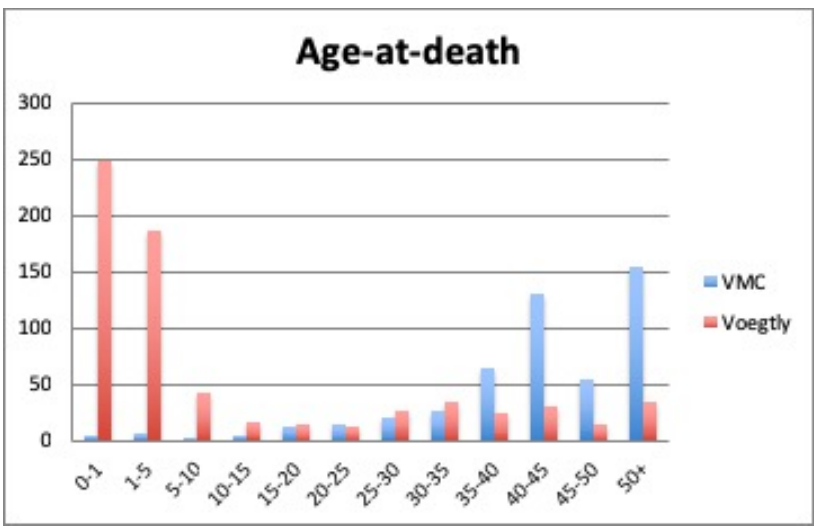


Figure 80. Age at death structure of VMC and Voegtly.

The hazard models indicate that there is a significant difference between VMC and Voegtly regarding mortality and survivorship. The probability density (Figure 81) demonstrates that individuals interred at Voegtly faced a higher mortality risk earlier in life.

The probability of mortality (see Figure 82) is drastically different. At VMC the probability of mortality rises dramatically after age 45, while the probability of mortality at Voegtly is consistent after age 5. This may be a result of the large number of individuals under the age of 5 at Voegtly.

Similar to mortality, the probability of survivorship at Voegtly is much lower than for VMC (Figure 83). Those interred in Voegtly faced an extreme risk of subadult mortality. By age five individuals at Voegtly have a 50% probability of surviving to the next age interval, while at that same age individuals at VMC have a 98% probability of surviving to the next age interval.

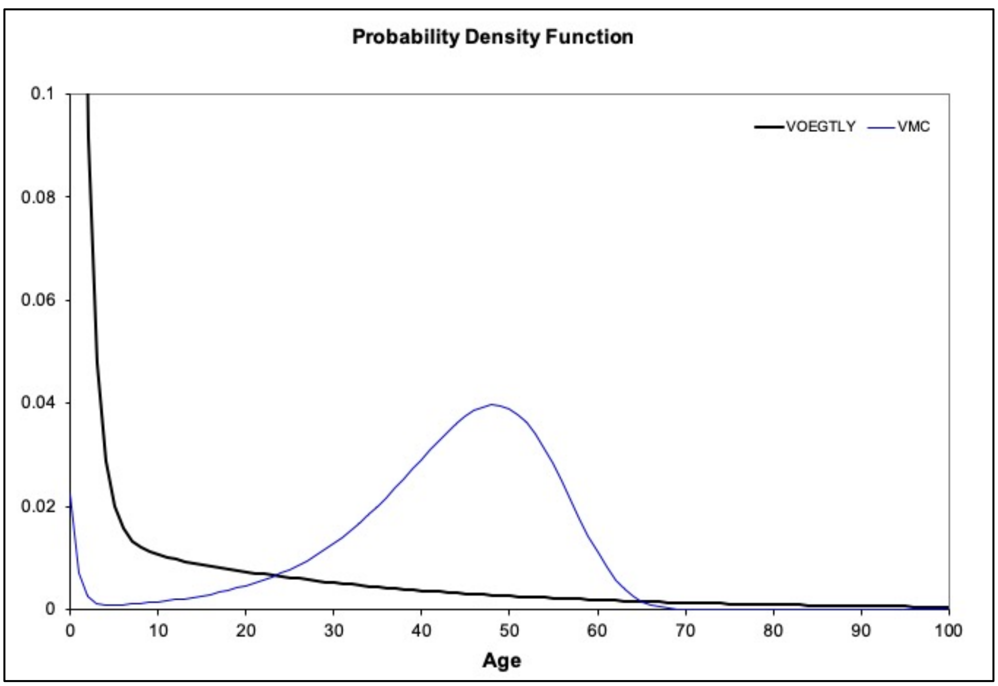


Figure 81. Probability density function VMC and Voegtly.

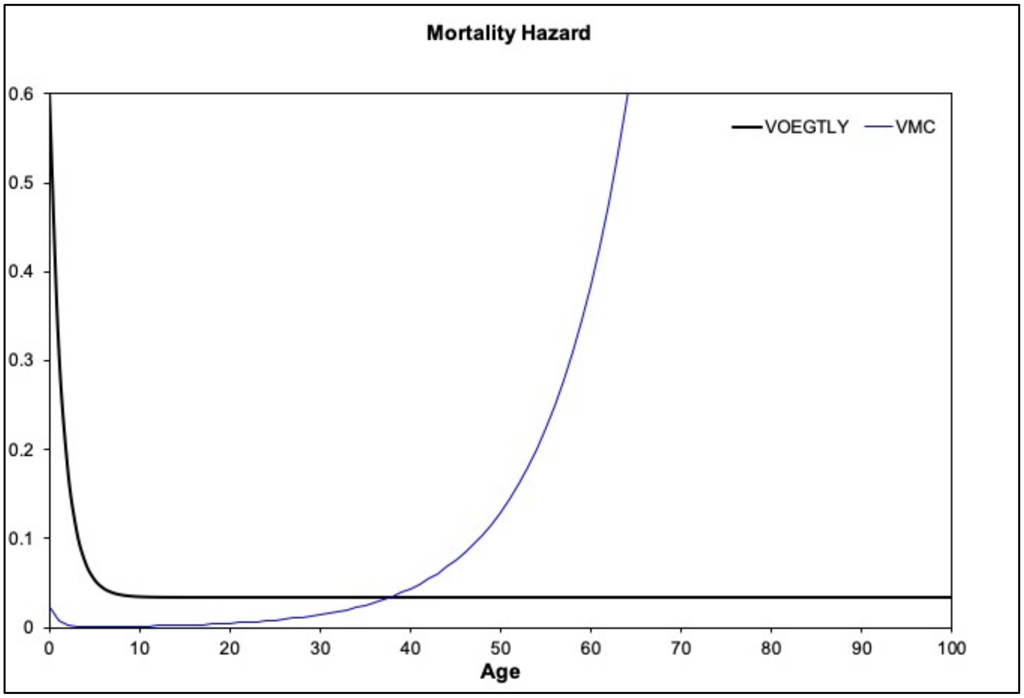


Figure 82. Mortality Hazard of VMC and Voegtly.

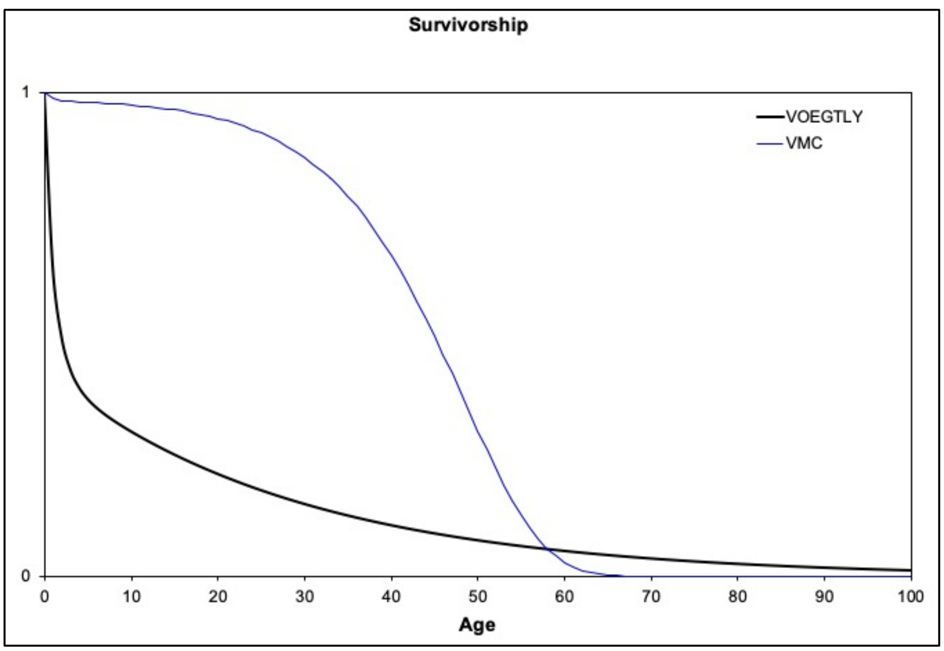


Figure 83. Survivorship of VMC and Voegtly.

There is a statistically significant relationship between sex (χ^2= 108.5387, df = 1, p <0.00001), see Table 52.

Sample	Male	Female
VMC	720	75
Voegtly	95	67

Table 52. Individuals by Sex at VMC and Voegtly.

Health

Each of the comparative samples required a slightly different approach in order to make the data comparable to VMC. The Mission City Memorial Park is not included in the health comparison because causes of death are not available for those individuals. Data for the Milwaukee County Institution Ground is derived from Dr. Colleen Milligan's 2010 dissertation. Data for Alameda-Stone cemetery was provided by Dr. Joseph Hefner as well as the project's site report (Heilen et al 2010). Data from the Voegtly cemetery was derived from the report published by the Smithsonian Institution Press (2003). Due to the lack of subadults in the VMC sample only adult results are discussed in detail. Presence and absence data for periosteal reactions, tuberculosis, and syphilis was tabulated for each sample only from the adult population (see tables 52-55).

Sample	Present	Absent
VMC	394	520
Alameda Stone	164	526
MCIG	31	482
Voegtly	8	156

Table 53. Presence and absence of periosteal reactions in adults at each cemetery.

Sample	Present	Absent
VMC	10	904
Alameda Stone	5	685
MCIG	6	525
Voegtly	3	161

Table 54. Presence and absence of tuberculosis in adults at each cemetery.

Sample	Present	Absent
VMC	10	904
Alameda Stone	3	687
MCIG	1	530
Voegtly	0	164

Table 55. Presence and absence of syphilis in adults at each cemetery.

The prevalence rates for periosteal reactions (43%), tuberculosis (11%), and syphilis (11%) were higher at VMC than each of the comparative samples (Alameda Stone 24%, <1%, <1%; MCIG 6%, 1%, <1%; Voegtly 5%, 2%, n/a). The chi-square rates for each comparison can be seen in Table 56. The only statistically significant pathology was periosteal reactions, which was significant for each comparison.

Summary

This chapter provides the comparative results between the VMC skeletal sample and both associated historical documents and other comparative skeletal samples. Looking first at the comparison between the VMC skeletal sample and the historical record, the skeletal sample and

Comparison	Periosteal Reactions	Tuberculosis	Syphilis
VMC v. Alameda Stone	χ^2= 64.8196; p <0.0001	χ^2= 0.249; Yates Correction p = .6177	χ^2= 1.385; Yates Correction p = 0.2393
VMC v. MCIG	χ^2= 215.8457; p <0.00001	χ^2= 0.0004; Yates Correction p = 0.9499	χ^2= 2.547; Yates Correction p = 0.1105
VMC v. Voegtly	χ^2= 85.274; Yates Correction p <0.00001	χ^2= 0.165; Yates Correction p = .6849	n/a

Table 56. Chi-squared results for pathological comparisons between samples.

historic death register shows an identical prevalence of infectious pathologies. However, the historic record has a much higher prevalence of tuberculosis, which suggests that the prevalence of tuberculosis diagnoses in the skeletal record is underrepresented. This is likely a twofold issue of poor preservation, and the nature of skeletal involvement in tuberculosis disease progression. The age structure of the historic record is also very different from the skeletal sample, with many infants represented in the death register. Similarly, the headstone data from county burials at Mission City Memorial Park also has a larger number of infant burials, unlike VMC. As previously mentioned, the lack of subadults in the skeletal sample may indicate differential burial treatment of subadults with them being buried elsewhere, or that there was a dedicated baby land where subadult burials were segmented into an unexcavated portion of the cemetery. Comparing the historic county burial deaths with nationwide cause of death prevalence also highlighted stark differences within the county burial population. Individuals receiving county burials died from tuberculosis and premature birth at much higher rates that the nationwide average, indicating larger issues with communicable disease and maternal health.

The comparisons between the VMC sample and other similar skeletal samples provide a better context for assessing the overall health and demographic structure of VMC. VMC is most similar to Alameda Stone sections 1-2, the sections interpreted as military and recent migrants. The prevalence of non-specific infections, tuberculosis, and syphilis is significantly higher in the VMC sample than MCIG, Alameda Stone, or Voegtly.

The concluding chapter for this study will discuss the research questions and trends drawn from the results of the analysis of VMC provided in chapter 6, as well as the comparative analysis from this chapter.

Chapter 8: Discussion

Introduction

This dissertation sought to examine the health and nutritional status of individuals interred in the Santa Clara Valley Medical Center historic cemetery. This research concentrated on the interpretation of pathological characteristics, biological profile, and mortuary analysis within a framework of public health and structural violence. The results reported in the two previous chapters (Chapter 6: VMC Results and Chapter 7: Comparative Results) provide data in these areas. The following sections specifically address the goals and research questions of the current study using the results from the VMC sample and comparison with historical records and other skeletal samples.

Question 1: Does institutionalization and or structural violence lead to identifiable biological impacts?

Structural violence can also be viewed as inequality expressed through unfairness of distribution whose exchange is a political process. The bodies of the individuals interred at VMC became unentangled objects. There is a minimal amount of commodification of the body, not necessarily the same as those individuals used as medical and anatomical specimens (see Figure 84), but a small amount of social exchange has occurred with the transformative act of becoming a pauper burial. Individual identities have been removed, yet there is still a level of social reciprocity that has occurred in providing a "proper" burial for these individuals. This is done not to benefit the dead, but to benefit the social capital of the living associated with this task.

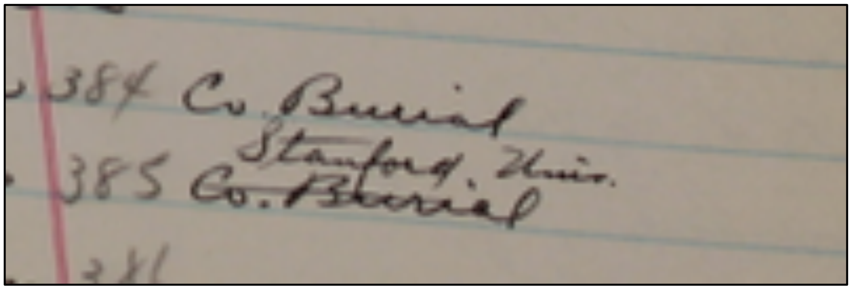


Figure 84. Record of Baby Warren, stillborn. Cause of death Eclampsia. Date of death December 23rd, 1931. Originally recorded as a county burial, but ultimately given to Stanford University. Image source: County hospital death register Volume 5: 72-73.

Santa Clara County, as early as 1855, was creating policies to aid the destitute, but these policies were just a stop-gap. They cared for the destitute at the hospital, almshouse, and through outdoor relief, but did not appear to take measures to prevent the situations that precepted the illnesses. Thus, the county created structural violence, or perhaps a better term is structural health inequalities. Structural violence is the translation of large-scale social forces into biological reactions. It is the embodiment of social mechanisms in the individual social experience (Farmer 2004, 2006).

Immigrants and low socioeconomic migrants entering the Santa Clara Valley faced structured risk created by the prevalent social forces of the time. Gender, ethnicity, and socioeconomic status play a role in creating the time and place specific vulnerability that leads to health inequality. Even today there are significant mortality differentials based on these variables. However, cultural differences do not automatically equal structural violence. Both social and biological distinguishing characteristics can serve as a pretext for discrimination, however no single axis can fully define and predict an increased risk for suffering. Poverty effaces the protective status conferred by specific genders, ethnicities, and religions.

> "Poverty wields its destructive influence at every stage of human life, from the moment of conception to the grave. It conspires with the most deadly and painful disease to bring a wretched existence to all those who suffer from it" – World Health Organization 1995:5.

"Understanding that the body is deeply historicized and socialized enables a cross-cultural framework for understanding how social relations condition disease patterns and, more broadly, states of individual and collective affliction" (Nguyen and Peschard 2003:448). The patterns of pathologies at VMC is related to these individuals' lack of local social relations, which in turn, condition the disease patterns within this population. The relationship between inequality and health disparity and disease processes is a form of structural violence enacted through cultural and governmental policies and rationalities (Nguyen and Peschard 2003). This ritualized pattern of social violence leaves observable, and quantifiable, biological impacts on the body. The cultural of inequality facilitates a "pathogenic biosocial spiral of socioeconomic exclusion and deteriorating health" (Nguyen and Peschard 2003:448).

Social inequality contributes to ill health independently of income level. But social class is too blunt of a ranking to capture the fine grain differences that occur within groups, just as low socioeconomic status does not account for variability within that group. Social circumstances are important in shaping quality of life. Social connectedness is well established as an important component of health and well-being. Social capital is composed of support networks, economic and social inequality, and access to resources (Szreter and Woolcock 2004; Wilkinson 1996). As connected to health outcomes, it is some variation of the presence or absence of a direct social support mechanism. In groups where social capital is low, there are higher levels of stress and isolation, children's welfare decreases, there is a reduced capacity to respond to environmental health risks, and a reduced capacity to receive effective public health service interventions (Szreter and Woolcock 2004:78-84).

To apply structural violence to a past population Klaus (2014) recommends specific requirements including: (1) historically contingent of specific trajectories of Western European capitalist style political economics; (2) Rigidly hierarchical society; (3) Consider its relationship to other forms of violence and power (4) Remember while agency is constrained, people should be expected to exercise as much agency as possible;(5)Thoroughly and deeply embedded engagement with archaeological and historical contexts.

The pathological conditions and prevalence are VMC allows for an analysis of the embodiment of inequality. The embodiment of inequality requires an epidemiological framework that relies on quantitative understandings of health. This framework can work under a Foucaultian thesis that in modernity violence is sublimated, transformed in historic (and modern) times into a more insidious and pervasive ordering of bodies through institutional practices (Nguyen and Peschard 2003:457). Medical systems in different cultures, and at different times in history, differ in knowledge, methods, and the technologies used to diagnose and treat medical ailments. However, medical therapy has always had a political dimension, and these therapeutic politics play an important role in creating and maintaining the social inequalities of health (Young and Leslie 1992; Burchell et al. 1991; Nguygen and Peschard 2003).

Structural violence translates into affliction, or as Nguyen and Peschard (1003) referred to as the "pathogenic social spiral" from which it is exceedingly difficult to emerge. Migration remains an important element of the equation, because it not only contributes to the erosion of extant forms of solidarity as people move further away, but it also facilitates the spread of infectious disease (p.464). Migrant labor was often housed in insalubrious conditions, fulfilling the prophecy of the diseased native (Packard 1989). As the poor get sicker, and poorer, the cost of migrating and the social consequences rise. This triggers a defensive reaction on the part of the rich who do not want to shoulder the medical cost of inequality. As a result, the pathogenic social spiral is often greeted with compliancy. The lack of a social system removed previously available cultural buffers.

Poverty is created structurally through interrelated power dynamics among "culturally constructed social classes, ethnic groups, genders, and other social groups, often through their interactions with institutions" (Spencer-Wood and Matthews 2011:2). By examining disease prevalence rates, differences in health between social groups, and governmental/social policies we can begin to explore the biological consequences of structural violence.

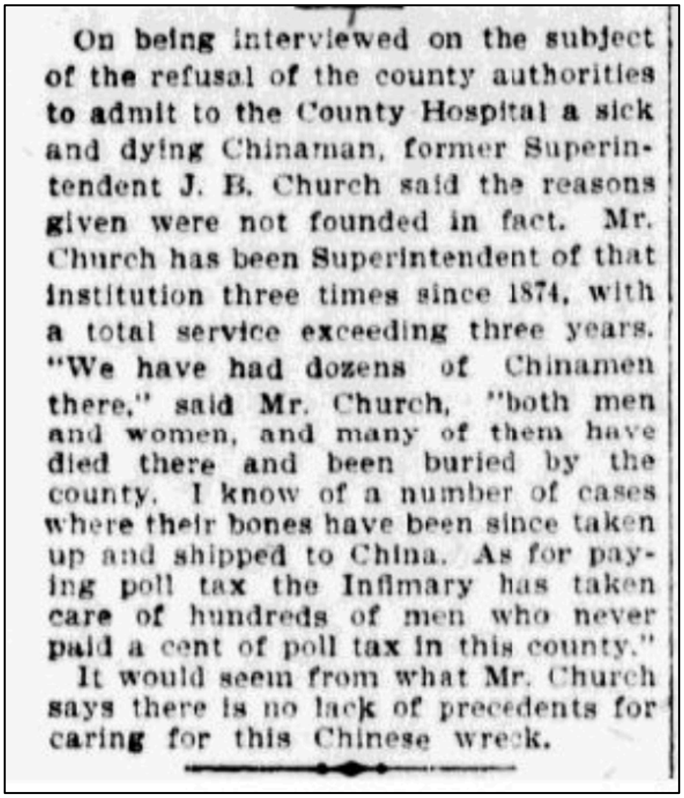
There are two ways to measure effects of structural violence in bioarchaeology: first by comparing prevalence differences between members of two groups – in this case it would be comparing the low socioeconomic sample (VMC) with an upper-class sample. Since there is not an upper-class skeletal ample from this area, the second approach must be used: an analysis of well contextualized health outcomes by comparing the skeletal sample to the historical record.

California's rapid population growth coupled with the unique demographic profile of the burgeoning population resulted in an immediate and intense need for government welfare, specifically the rise of the county hospital. In 1855 the state legislature passed a Poor Law, pushing responsibility for the destitute sick to the county (Cahn and Bary 1936), leading to the formation of hospitals and almshouses in several counties, including Santa Clara. "This growth of county hospitals was caused primarily by the acute need for a substitute for home life. Of the adult population in 1860, approximately one-fourth were women, and therefore more than half of the adult population consisted of men single or living apart from normal family groups. Any form of disability or destitution threw them upon the community and, although the kindness and mutual aid of the period were open-handed, the actual need of shelter and care was far greater than among a normally constituted population" (Cahn and Bary 1936:144).

The 1901 Indigent or Pauper Act provided that every county shall relieve and support all pauper, incompetent, poor, indigent persons and those incapacitated by age, disease, or accident provided that they were not supported and relieved by their relatives or friends, or by their own means. If the pauper had a spouse, children, parents, siblings, grandchildren, or grandparents living in the state the family was legally obligated to pay back the county for that individuals care (Cal. States 1901 CHAP CCX in Welfare Activities in California 1850-1934).

In order to be admitted to the county hospital you had to prove you were a resident of the state for one year, a resident of the county for three months, had no family that could take care of you, no friends or family that could pay for your care, and that you didn't own any assets that could be sold to pay for your care. The hospital, specifically the superintendent and later a board, determined if the petitioner meet the criteria and if they had a condition that necessitated treatment. In 1903 the State Board of Charities and Corrections was formed, and the supervision of county hospitals was placed under this jurisdiction. The board sought to establish standards with respect to medical treatment and social policy.

Not all individuals and ailments were treated the same at the Santa Clara county hospital. In 1903 the city passed a motion that no person shall be admitted to the County Hospital who is afflicted with any venereal disease, and the Superintendent was directed to refuse admission (Evening News April 21, 1903). Though the presence of individuals with venereal syphilis (n=10) in the VMC skeletal sample indicates that this city ordinance may have been short lived, or not fully enforced. In 1901 the county was also accused of refusing care to Chinese individuals at the county infirmary (Figure 85). Claims by the Superintendent that the hospital treated "dozens" of Chinese since 1874, may be more supportive of the refusal of admission claim than it is defensive, as individuals of Chinese origin were a major fraction of Santa Clara County during the late 19th century.



On being interviewed on the subject of the refusal of the county authorities to admit to the County Hospital a sick and dying Chinaman, former Superintendent J. B. Church said the reasons given were not founded in fact. Mr. Church has been Superintendent of that institution three times since 1874, with a total service exceeding three years. "We have had dozens of Chinamen there," said Mr. Church, "both men and women, and many of them have died there and been buried by the county. I know of a number of cases where their bones have been since taken up and shipped to China. As for paying poll tax the Infimary has taken care of hundreds of men who never paid a cent of poll tax in this county."

It would seem from what Mr. Church says there is no lack of precedents for caring for this Chinese wreck.

Figure 85. San Jose Mercury News October 20th, 1901.

By carefully examining and reconstructing the prevailing social systems individuals interred in this cemetery encountered, it is possible to explore issues of structural violence and its relationship to disease. Even in the absence of specific burial records, these methods can still be applied. Expanding the theoretical framework of structural violence not just to highlight the traditional bioarchaeological pathology categories, but the contextualization of them using historical documentation allows for the consideration of the differential application of the forces that affect health. A structural violence framework allows me to contextualize the disease prevalence rates and patterns at VMC within the social and political atmosphere the individuals lived in. Therefore, issues such as the 43.5% of individuals with non-specific infections, is understood not just as “poor health”, but also as a consequence of both social, institutional and government policy and decision-making processes.

The hospital direct internment burial category showed signed of increased biological stressors compared to other burials at VMC (Table 57). Although many patients at the infirmary had short stays, a large proportion of the hospital population were long term custodial patients (Figure 86). The 1914 state wide survey of county hospitals estimated that nearly 70% of all

Category	X^2	df	p-value	ϕ
Sex	1.02	1	0.31	0.04
Age	2.24	2	0.32	0.05
Periosteal Reaction	22.01	1	<.0001	0.15
Fracture	4.49	1	0.05	-0.07

Table 57. χ^2 Non-hospital internment v. hospital direct internment sample.

Probable Length of Stay.

	No.	Per cent
2 weeks or less	.6	---
2 weeks to 1 month	7.5	---
1 to 2 months	17.0	30.5
3 to 6 months	4.5	---
6 months to 1 year	12.0	---
1 to 5 years	26.0	---
Over 5 years	27.0	69.5
		100.0

Figure 86. Probable Length of Stay based on hospital patients statewide in 1914. State Board of Charities and Corrections 1916:60.

hospital stays could be considered custodial having been patients for more than 6 months. A majority of the hospital population, 53% has stayed for over a year. This would allow ample time for the long-term time frames necessary for the pathological conditions seen in the hospital patient population to be connected to the institution, and the treatment of the patients. The 1880 Federal Census of Defective, Dependent, and Delinquent Classes lists not only the name, occupation, and age/sex data for individuals residing at the hospital, but also lists the cause of their disability and the date that they entered the care of the hospital. Although some of the individuals had been residents for only a few months, a majority had been there for 1-4 years. Those with longer residents list their chronic issues as kidney disease, gout, rheumatism, syphilis, tuberculosis, and old age to name a few (U.S. Census 1880). This supports the assumption that the individuals in the hospital's care were struggling with long-term illness that would impact the stress indicators skeletally.

Although the historical record sheds light on some of the structural inequality in Santa Clara County, the skeletons provide direct evidence of the biological consequences of this inequality. VMC represents the poorest of the poor of Santa Clara County. These are not just the individuals that needed medical aid and were treated at the hospital. These are people so socioeconomically disadvantaged that they, or their close social group, lacked the economic means for a private burial. The health of low socioeconomic individuals in Santa Clara County appears to have suffered as a result of the action of the government and prevailing social systems, or phrased another way, structural violence has significant impacts on the health of these low socioeconomic individuals.

Question 2: At this time, we know that major issues such as the second epidemiological transition, public health reform, immigration, and socioeconomic status impact the health and nutrition of people. Given the nature and historical context of VMC how did these events effect people at VMC?

Epidemiologic transition theory has been a guiding principle for examining the impact of economic, social, and environmental transformations in recent human history (Barrett et al. 1998; Zuckerman 2014). The second epidemiologic transition is characterized by a decrease in infant mortality, a decrease in maternal death, a decrease in infectious disease deaths, and an increased life span (Barrett et al. 1998; Orman 1971). There is also a shift from acute infectious diseases, like whooping cough or measles, to chronic non-communicable disease such as cardiovascular disease or cancer (Zuckerman et al. 2014). In the United States and Europe, the second epidemiologic transition typically begins in the mid 19th century. The timing of the transition is attributed to public health initiatives, the germ theory of disease, and improved hygiene (Cutler and Miller 2005; Gage 2005, Reinhard and Pucu de Araujo 2014).

Although this framework emphasizes the impact of socioeconomic and ecological factors on disease mortality transition, the trend has unfortunately been to apply the transition uniformly across populations as large as countries or even continents. This data conflation minimizes the differential experiences based on location, race, gender, and class (Barrett et al. 1998; McKeown 2009; Fleischer and McKeown 2014). It has been previously suggested that socioeconomic and local conditions, such as degree of urbanization, seem to influence the extent, nature, and timing of the transition (Dobson 1997; Woods 2000; Zuckerman 2014). The transition status of the VMC skeletal sample can be interpreted from the infant mortality rate, number of infectious pathologies, and mortality curve.

Infant Mortality

In the VMC skeletal sample, the near absence of infants (n=5/1004) would suggest that either the infant mortality rate is either shockingly low, or infants simply were not buried within the excavated section. Newspaper articles such as the one seen in Figure 87 indicate that more subadults are likely elsewhere in the cemetery as no 7-week old infant was recovered.

A low infant mortality rate is unlikely, especially once historical records are examined. Newspaper articles were routinely highlighting the dichotomy of California's overall low infant mortality rate and San Jose's higher infant mortality rate. Headlines like "Infant Death Rate Apparently High Here" (Evening News February 6, 1917), and "Babes Dying Needlessly in San


Child Buried Without Health Board Permit

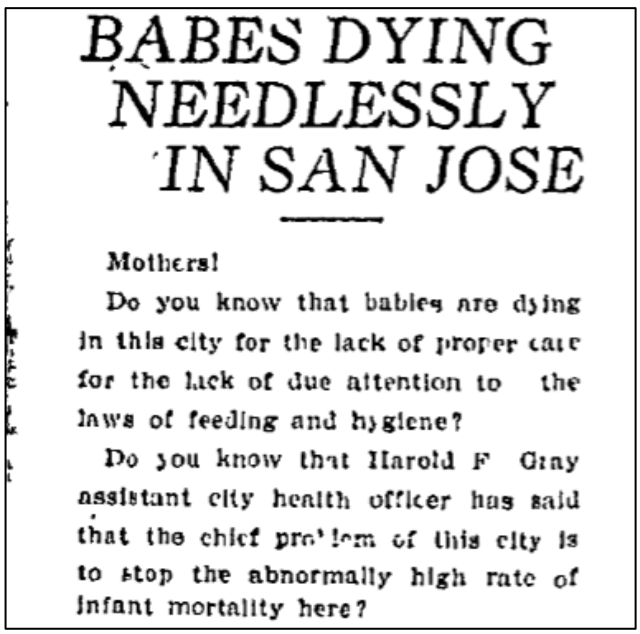
Body of Baby Born at County Hospital Is Returned to Potter's Field There.

Mary Melefeore, the seven-weeks'-old infant, who died last Sunday morning at the home of its mother, Mrs. Angela Melefeore, 712 State street, was buried yesterday in the potter's field of the county hospital.

Figure 87. Child buried without Health Board Permit. Evening News April 7, 1916 page 9.

Jose" (Evening News March 31, 1917), see figure 88, juxtaposed with "Infant Mortality is at Minimum In State. California Given Honors for Having Lowest Rate in the Entire Country" (Evening News July 21, 1921). For example in 1916 the mortality rate for children under the age of two state wide was 23 per 100,000, but in San Jose the rate was more than double at 47 per 100,000 (Evening News June 15 1917).

The hospital death register shows that infant, and neonate mortality, continued to be high into the late 1920s-early 1930s. Infant (<1 year old) deaths are 8.5% (n=206/2427) of private burials, and 27% (n=170/629) of the county burials. Unfortunately, without knowing the number of live births and individuals surviving past 1 year, the mortality rate (per 1,000 live births) cannot be calculated.



BABES DYING NEEDLESSLY IN SAN JOSE

Mothers!

Do you know that babies are dying in this city for the lack of proper care for the lack of due attention to the laws of feeding and hygiene?

Do you know that Harold F Gray assistant city health officer has said that the chief problem of this city is to stop the abnormally high rate of infant mortality here?

Figure 88. Excerpt from article blaming San Jose's high infant mortality rate on mothers not knowing how to give proper care to their babies. Image source: The Evening News, March 31st 1917 68(78):6.

Disease

In a ten year retrospective published in 1916, the California State Board of Health notes decreases in the death rate for tuberculosis (218.0 per hundred through to 194.5 per hundred thousand) and epidemic diseases (68.5 per hundred thousand to 33.1 per hundred thousand) while noting death rate increases for diseases of the circulatory system, Bright's disease (a kidney disease), nephritis, and cancer. The death rate for "young persons" was decreasing, while the death rate for the middle ages and beyond was steadily increasing. Infant mortality has also decreased during this ten-year period – ascribed to a drastic reduction in children under the age of two dying from diarrhea and enteritis (45.7 per hundred thousand to 27.8 per hundred thousand) (California State Board of Health July 1916:7)

However, infectious disease rates are high (45%) in the VMC skeletal sample and the county burial portion of the death register (45%). The VMC skeletal sample had the higher prevalence rates of periosteal reactions, tuberculosis, and syphilis than any of the comparative skeletal samples. The county burials from the death register have high rates of tuberculosis (16%) and pneumonia/influenza (12%). This is directly contrary to the larger state wide health state provided by the California State Board of Health. Death from non-communicable diseases (aside from heart disease which can be due to both acute and chronic issues) are relatively low in the county burial portion of the death register. Cancer (6.63%) and diabetes (0.24%) are relatively minor contributors to the overall causes of death.

Mortality

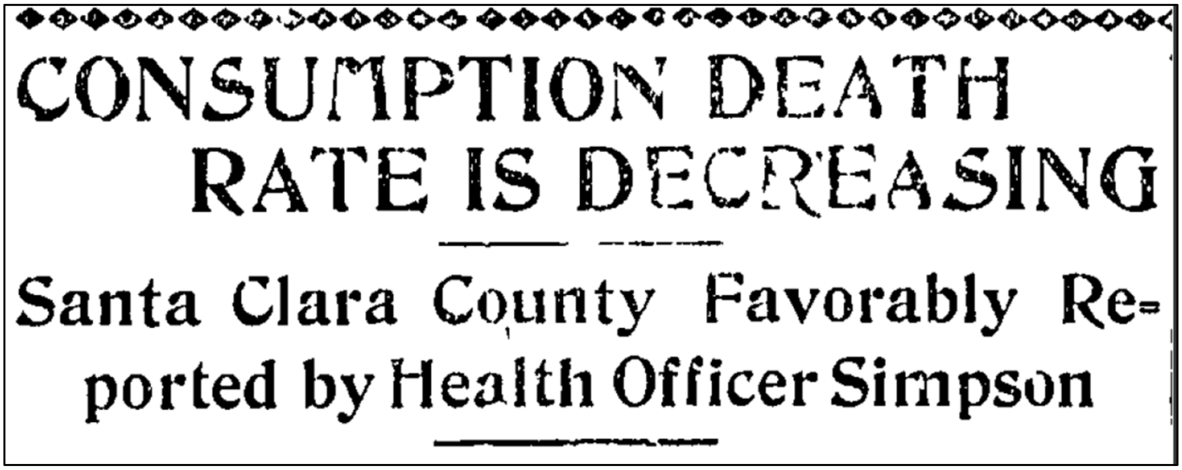
The VMC skeletal samples probability of mortality rises sharply at age 40. The Mission City Memorial Park and county burials from the death register does not see a rise in their mortality hazard until age 70. It is necessary to consider how the lack of infants in the VMC sample may be impacting the hazard models, and the differences in comparing skeletal age at death data with recorded age at death. However, all of the hazard modeling indicates that individuals from the VMC skeletal sample faced a higher risk of death earlier in life than the other samples. When compared to the other skeletal samples only Alameda Stone sections 1-2, the military and migrant sections, had an earlier mortality spike.

The high rates of infant mortality provided by the historical record, high rates of infectious disease in both the skeletal sample and historic record, and higher risk of earlier mortality seen in both the skeletal sample and historic record of county hospital deaths indicates that this population had not yet reached the second epidemiologic transition. This is another example of epidemiologic transitions occurring at different rates between populations, even at the same time and geographic location.

Public Health

Santa Clara County was an early adoptee of public health campaigns.   The department of Health of the city of San Jose began formal reporting in 1890, following an August 1889 ordinance mandating health reports on the city (Curnow 1896:1). In 1896 the City of San Jose general municipal ordinance No. 1654 An Ordinance in Relation to the Preservation of the Public Health included sections covering the privileges of the board of health; penalty for failure to abate nuisance; adulterated swill milk ; diseased or unsound meats, game, poultry, fish or other market products; articles exposed for sale shall be deemed for sale; police shall seize and removal articles unfit for human food; stalls where animals are kept to be cleaned – no swine allowed near dwellings; births must be reported; burial permits - how granted; dead bodies – removal permits; physicians must report contagious and infectious diseases; hotel keepers and house holders must report scarlet fever, diphtheria and small pox; quarantine regulations – persons not to enter or depart from houses quarantined; penalty (General Municipal Ordinance).

As early as 1902 (Figure 89) the decreased deaths rates from tuberculosis in Santa Clara County are being attributed to "…improved methods of treatment…inspection of food



CONSUMPTION DEATH RATE IS DECREASING

Santa Clara County Favorably Reported by Health Officer Simpson

Figure 89. Consumption Death Rate is Decreasing. Santa Clara County Favorably Reported by Health Officer Simpson Evening News (Published as The Evening News) - April 16, 1902 Volume XLI Issue 99 Page 3.

products…improved sanitary methods and conditions [and enforcements of] sanitary precaution" (Evening News April 16 1902), i.e. public health initiatives. However, as discussed in the next section, not all individuals benefited equally from public health policies.

Immigration

As discussed in the Question 1 section, foreign born individuals and recent migrants into the area faced animosity and discrimination in many aspects of their lives. Public health initiatives often focused on the dangerous and ignorant "others" as the root cause of public nuisances and epidemics. Health officials routinely pointed to the "willful ignorance of foreigners "and low socioeconomic individuals as the root cause of high infant mortality and high epidemic disease loads. Assistant Health Office Harold F. Gray is quoted as stating that "…need of instruction in the care of infants among the poorer classes of our citizens … who do not realize the condition of affairs" (The Evening News June 15 1917). "Beginning with the agitation against foreigners in the gold fields, there has been virtually no period in California history without a campaign against some unpopular minority group: Latin Americans, Native

Americans [Indians], African Americans [Negros], Chinese, Japanese, Filipinos, and distressed Southern Whites “Oakies” have all been involved in this kind of conflict” (Cahn and Bary 1936:135-136).

It’s likely that the poor and indigent whites in Santa Clara County were more likely to be admitted and treated at the hospital, while those of other ethnicities may have only been admitted to the infirmary in critical situations, or just to be buried in the adjacent potter’s field. Many of the indigent “white” individuals (noted in the historical record) may have been buried as the two other, nicer potter’s fields. As mentioned previously, there were specific requirements for being admitted to a county hospital. To be treated you had to submit a formal petition, prove that you had been a resident of the state for at least one year, a resident of the county for three months, had no property you could sell to pay for medical care, and no relatives that could support you. Thus, very recent migrants to the area would not have qualified for county medical care, even if they lacked the personal property and social network aspects of the requirements.

The disease prevalence rates suggest that this, along with other prevailing social issues, may have prevented many from seeking medical care. The hospital, even though it was created to care for the areas indigent sick, seemed to be doing everything it could to only treat the “types” of people they found suitable. For example, in 1889 the county board of supervisors sought to have new maps of the county produced. But they noted that it would be advisable to leave the county infirmary off of the maps because the maps were going to be highly visible and showing that the county had the infirmary (and almshouse) might encourage “undesirable immigration” (Evening News May 8 1889).

Unfortunately, ancestry assessment was not possible on a majority of the sample. Of the 411 individuals with ancestry assessments 24% (n=106) were of European ancestry while the remaining 76% (n=305) were of non-European ancestry (Asian/Latino or African American). The use of different ancestry assessments methods during the on-going analysis at CSU, Chico may provide additional degrees of specificity with regards to the ancestry assessments.

The 1914 survey of statewide county hospitals also noted that individuals of "White European" descent are a majority of the hospital population (Figure 90). Although individuals of non-European descent are only 7.5% of the total hospital population they are specifically called out as a "foreign problem". The survey of hospital patients showed that 42% of patients had been in the county over five years, 22% 1-5 years, 3 months – 1 year 14.6%, and 3 months of less 21.2%. Interestingly of the 4,214 foreign born patients documented only 156 (3.7%) had been residents for less than a year. Only 591 (14%) has been residents in the United States for less than 5 years before admission to a county hospital. This indicates one of two things, (1) the counties may have refused admission to individuals that had been residents for less lengths of time, or (2) the demographic profile of California was changing. Although individuals, or their parents, were foreign born by the 20th century migration trends were changing, and many Californians, though foreign born, were not new to the state or county (see Figure 91 and 90). However, length of residence does not seem to negate the larger negative health impacts of systemic racism and inequality.

Race and Nationality.

The following tables show that the great burden is the care of native born persons of European descent. At the same time, there *is* a "foreign problem" and notably a "Mexican problem."

Special Racial and National Groups.

	No.	Per cent
Mexican	595	4.8
Negro	167	1.4
Chinese	83	.6
Japanese	39	---
Hindu	15	---
Indian	55	.4
Miscellaneous	10	---
Total of above	964	7.5
White of European descent	11,523	92.5
Total known	12,457	100.0

Figure 90. Breakdown of "racial and national groups" among county hospital patients statewide in 1914. Source: State Board of Charities and Corrections 1916:56.

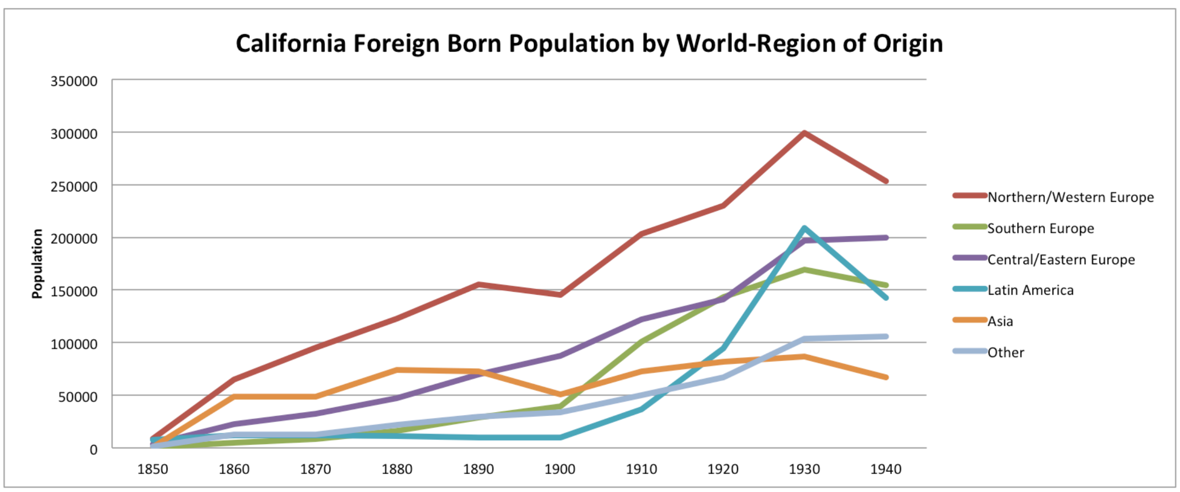


Figure 91. California foreign born population by world-region of origin. Data source: The Population of California, 1946.

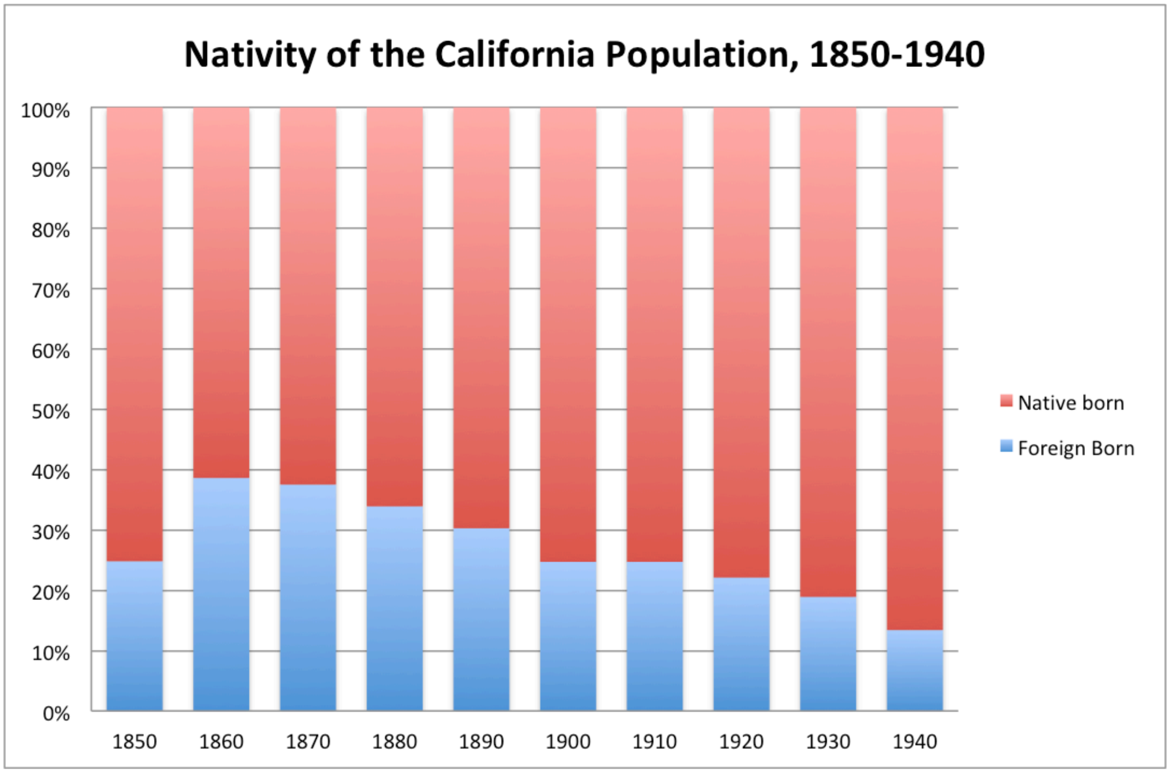


Figure 92. Native born v. foreign born. Data Source Population of California 1946.

Question 3: Putting the cemetery in context with the historical record suggests a set of expectations of particular kinds of pathologies. How do these expectations compare with the pathologies documented in the skeletal remains?

As illustrated above in the discussion of questions 1 and 2, an in-depth analysis of the historical record reveals stark health disparities in Santa Clara county during the late 19th and early 20th century. In California as a whole, the death rate for infectious diseases, such as tuberculosis, was much higher for every non-white racial group than for whites (ex. TB for Mexicans 5x higher, flu and pneumonia deaths 3x higher). Infant mortality rates were also higher among every non-white group (4x higher among Mexicans and 3x higher among Native Americans). The high rates of infectious disease and high infant mortality rates are tied to poverty, unsuitable living conditions, and lack of medical care (Cahn and Bary 1936:224). The skeletal data conforms well to the historical, contextual data revealing unhealthy living conditions. There is high nonspecific periosteal inflammation, high rates of infectious disease, and high rates of enamel defects. The nature of these skeletal responses points to long term, chronic health issues.

As discussed in Chapter 6, the VMC skeletal sample has a high prevalence rates of non-specific infections (45%), documented tuberculosis (n=10), Valley Fever (n=2), and syphilis (n=10), amongst other pathological issues. The low socioeconomic status of individuals given pauper burials, combined with the higher rates of individuals of non-European ancestry (70% of the assessable sample) indicates that the disease prevalence's rates confirm to the expectations from the historical record. The only component of the historical record that the skeletal sample does not meet is the high infant mortality rate. The lack of infants within the skeletal sample does not mean that this population did not have a higher neonate and infant mortality rate, rather that they are just not present within the portion of the cemetery exhumed.

Question 4: How does VMC compare to similar cemeteries in terms of the consequences of structural and institutional behavior?

As discussed earlier in this chapter, issues stemming from structural violence and institutionalization may have produced the high rates of infectious disease documented in the VMC skeletal sample. The prevalence rates of every pathological category examined was higher at VMC than of each comparative sample (Alameda Stone, MCIG, and Voegtly). The prevalence rates for periosteal reactions was double (43%) the next closest sample Alameda Stone (23%). The high rates of non-specific infections are a proxy for viewing larger issues of systemic infection within the living population.

Admittingly there are theoretical issues that arrive when attempting to measure the consequences of structural and institutional behaviors based on the health of a population from skeletal data. Wood et al. (1992) highlighted the issues of demographic nonstationary, selective mortality, and hidden heterogeneity. As pointed out in Chapter 2, the VMC population, and in fact most of the population of California at this time, was demographically nonstationary. Migration and immigration were fundamental components of this population, similar to Alameda Stone (Leher et al. 2010:511). With regards to selective mortality, the VMC skeletal sample is not representative of the entire population of Santa Clara County (i.e. they represent only individuals that received pauper burials), thus the skeletal data does not represent the entire population at risk for a specific hazard. The skeletal data may overestimate the prevalence of a particular pathology when compared to the entire population (Wood et al. 1992). Hidden heterogeneity, the different levels of susceptibility to health risks within a population (Wood et al. 1992), can be due to factors such as socioeconomic status, environmental variation, or genetics. The unifying low socioeconomic status of the individuals interred at VMC reduces some of the potential hidden heterogeneity. Even if, based on some of the issues put forth in the Osteological Paradox and subsequent critiques, individuals with the infectious responses were the "healthier" portion of the population, the high rates of periosteal reactions, tuberculosis, and syphilis still point to a population under undue biological stress.

The Voegtly Cemetery is populated by middle/upper class individuals and has a very low rate of infectious disease, though high infant mortality. The higher socioeconomic status of the individuals buried there, as well as the Swiss-German nature of the church population (Ubelaker and Jones 2003) may have sheltered these individuals from the consequences of structural violence and institutionalization. Thus, in terms of this research question is not a comparable sample.

VMC is more similar to MCIG in terms of pathologies, likely due to the institutional nature of the cemetery and the higher immigrant basis of the population. However, the prevalence rates for all pathological categories investigated were much higher at VMC. Demographically VMC and MCIG have very different age structures, due mostly to the lack of subadults in the VMC population. The lack of infants in the VMC sample is also likely what produces the drastic differences between the two samples hazard analysis. The distribution of sex is, however, similar between the two samples with a majority being males (VMC = 90.5%, MCIG = 88%).

What may account for the differences in pathology and demography seen between the two samples? Although Milwaukee was a city with a heavy immigrant component, it was mainly comprised of immigrants from northern and western Europe (Milligan 2010:15). The population of Santa Clara County was heavily European, but more ethnically diverse in terms of county of origin, especially for individuals from outside of Europe. Additionally, Milwaukee's immigration patterns were more family based, while California attracted a higher rate of single males, or males away from families elsewhere. Milwaukee's economy was focused on industrial manufacturing and shipping (Leavitt 1982) compared to the agricultural focus of Santa Clara's economy. Milwaukee may have had better implementation of their public health programs and policies. These factors created very different contexts, though both samples are institutional potter's fields, within which structural violence and institutionalization were bounded and played out.

VMC has higher rates of pathologies than either Alameda Stone sections 1-2 or 3-5. Demographically VMC is more similar to Alameda Stone sections 1-2, which is comprised of the military and recent migration sections of the cemetery. The differences in both the pathologies and demography highlights the impact of structural violence and institutionalization at VMC. Alameda Stone was selected as a comparative sample due to its rural western context and 19th century timeframe. Though Alameda Stone is temporally earlier than VMC, having a sample with a similar rural western nature was important.

Question 5: Are there changes in the cemetery in terms of the spatial organization, and might these be attributed to change over time or differential treatment of health?

Neither coffin construction nor grave goods provided enough temporally diagnostic features to differentiate time periods within the cemetery.

In terms of spatial organization several trends emerged. Geo-spatial clustering was statistically significant for males, subadults, rectangular coffins, and the hospital button burial category. Burials of subadults are concentrated in the southern and northwest portions of the cemetery. This may suggest differential spatial patterning dependent on decedent age. However, the lack of younger subadults, especially infants <1 year of age, as previously mentioned is not consistent with the historical record. This suggests that the youngest individuals within the total cemetery may be buried in a segregated baby land. Rehor and Beck (2015) estimated that 35% of the total cemetery was exhumed, thus it is possible that larger burial trends are being obscured by only having the northern most portion of the cemetery to examine.

Rectangular coffins comprise 15% (n=149) of the coffins (see Figure 93). They are found throughout the sample, and also cluster with other rectangular coffins. Their presence across the cemetery suggests that their use is likely not temporally diagnostic. The individual undertaking companies hired by the county for the one-year burial contracts may have used several coffin suppliers, or purchased whichever style was the cheapest at the time. The less the burial cost for the undertaker, the more profit there was to be made. Specific coffin shapes or dimensions are not typically mentioned in the historic record. Although the use of redwood as the material is frequently mentioned.

The only glimpse into specific coffin style choices is the Monahan funeral records. Hocking, Arnold and Monahan Undertakers were routinely paid by the country for indigent burials and the burial of soldiers as evident in warrants published monthly by the county for individuals owed payment. The funeral records available for three individuals interred at the County hospital note three different styles of burial container: homemade coffin lined with white silk (for a 4 hour old infant charged $10 for burial), redwood box (3 years old charged $7.50 for the coffin and burial), and no casket (75 years old, charged $15 for embalming and $12.50 for services). The homemade coffin was produced by Bill Hanser Sr., the redwood box was manufactured by "J.M.", and the "no casket" is noted to be manufactured by the county hospital so perhaps there was still some form of burial container (Monahan Funeral Records 1914-1936; source Santa Clara Central Library). The initials J.M. are also present as the individual that received the undertaker's payment for the burials, so J.M. likely works for the company, suggesting in-house production of coffins. These burials each took place at the County Hospital Cemetery in 1917 from the same funeral home, yet each received a different coffin. This highlights the amount of potential variation in burial containers. They also note a coffin style of "hospital case" for a private burial in the Chinese section of Oak Hill cemetery but do not note the manufacturer, so it is possible that there was a standardized size and style of coffins utilized for some hospital internments.

The clustering of the hospital button burial category may indicate that individuals in charge of the burials waited until several hospital direct internments needed to occur before burial. It also could simply suggest that multiple people died in close succession.

Dispersion was statistically significant for adults, hexagonal coffins, and community members. However, each of these categories represents the largest single variable within the larger categories of age, coffin shape, and burial category. The statistical significant may be a product of the overall sample size of each of these categories. Individuals with non-specific infections (Figure 94) and syphilis (Figure 95) appear across the cemetery. The burials with tuberculosis (Figure 96) are concentrated in the southwestern quadrant of the cemetery. The placement of these individuals does not suggest any differential burial patterning based on illness.

Conclusion

The results of this research suggest that the social and health inequalities seen in the VMC skeletal sample can be understood by examining the county's efforts towards public health initiatives, public policy toward the destitute, and the components of structural violence and institutionalization that intertwine with these factors. The time and place specific vulnerability encountered by these individuals in life are shown to have specific biological consequences. The individuals interred at VMC grappled with higher rates of infectious communicable disease and higher infant and neonate mortality rates than their middle- and upper-class counter parts. The reformation of social welfare in the 19th century led to increases in structural inequality. These conditions experienced by inmates of the hospital, and the larger lower socioeconomic community only reinforced social and health inequalities. These institutionalized social inequalities resulted in physiological consequences observable skeletally in the high rates of pathological reactions. The lack of social capital removed cultural buffers that were previously available to these individuals before moving to the Santa Clara Valley. The interplay of migration, lack of social capital, a low socioeconomic status, ill health, and government health care created a pathogenic social spiral (Nguyen et al. 2003) that was exceedingly difficult to emerge from.

The incorporation of a structural violence as an interpretative framework promotes the balanced integration of empirical bioarchaeological studies and social theory to interpret the skeletal data. A thoroughly and deeply embedded engagement, with both the archaeological and historic contexts in conjunction with the skeletal data, allows for a more nuanced analysis of pathological responses.

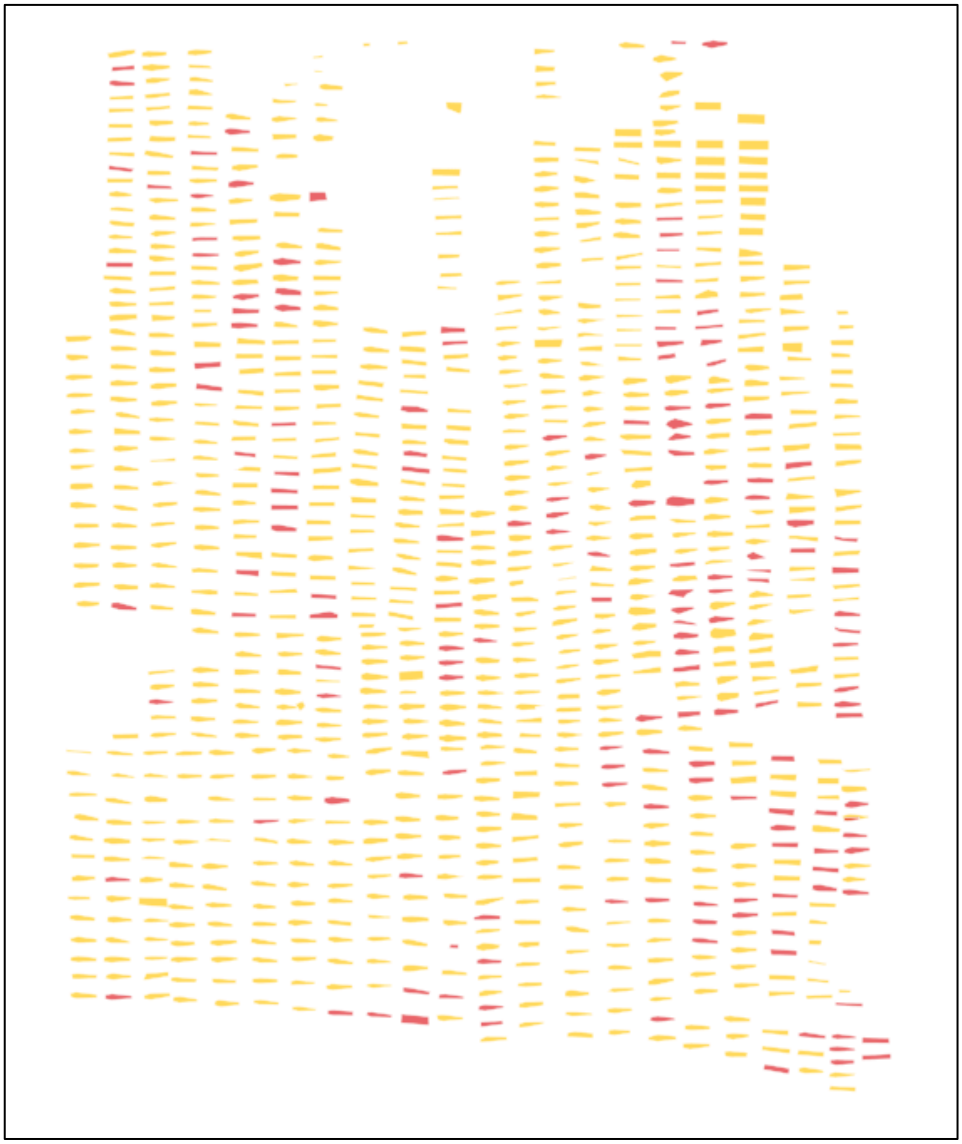


Figure 93. Burials by coffin shape. Rectangular coffins are red, all other shapes are yellow.

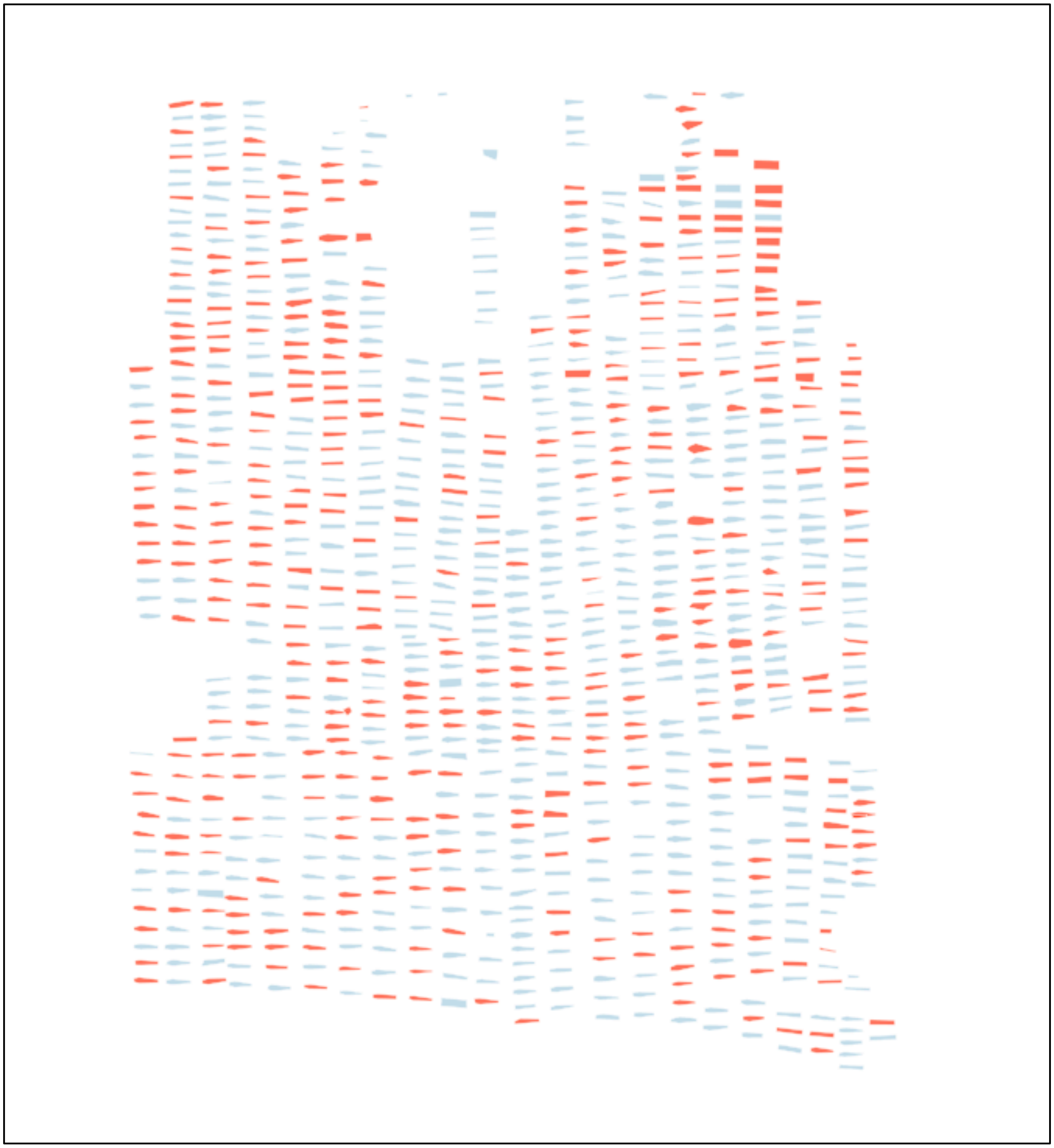


Figure 94. Burials with non-specific infections in red.

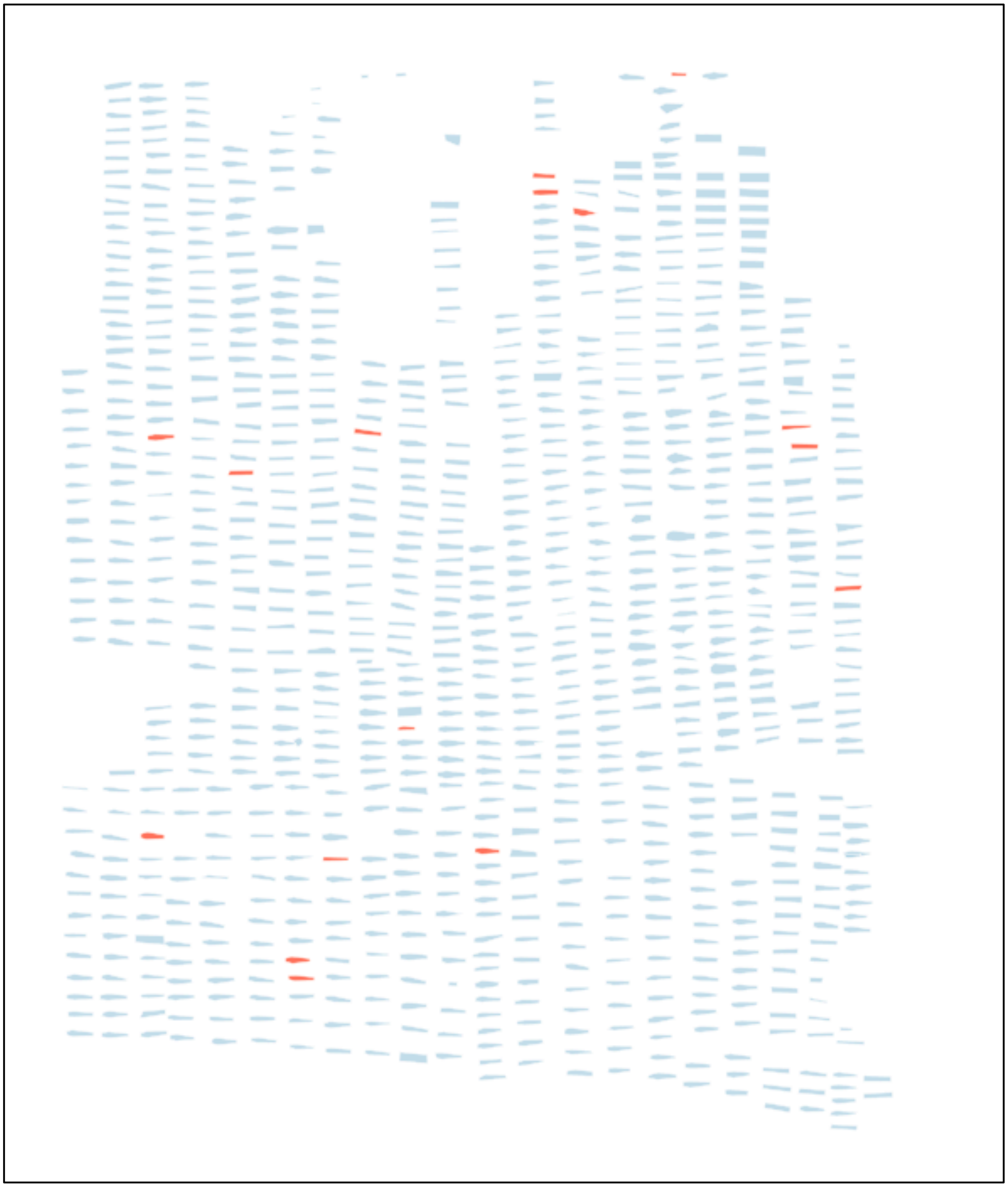


Figure 95. Burials with syphilis shown in red.

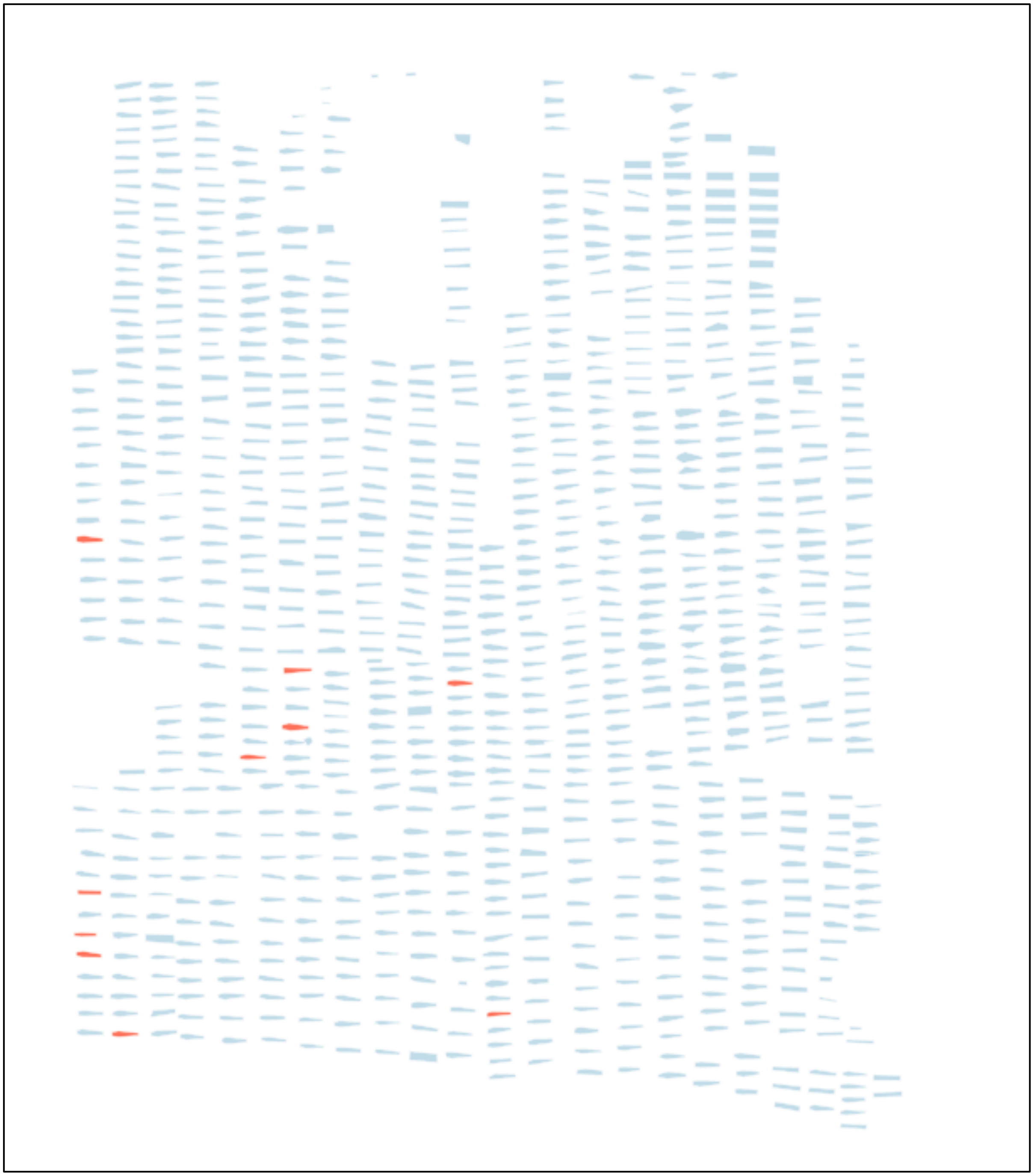


Figure 96. Burials with tuberculosis shown in red.

REFERENCES

REFERENCES

Abel, Emily K
2007 Introduction. In *Tuberculosis and Politics of Exclusion: A History of Public Health and Migration to Los Angeles*. Pp. 1-4. Rutgers University Press: New Brunswick.

Anderson, Bruce
2008 Identifying the dead: Methods utilized by the Pima County (Arizona) Office of the Medical Examiner for undocumented border crossers: 2001-2006. *Journal of Forensic Sciences* 53:8-15.

Anthropological Studies Center
2008 The How-To Manual. In *SHARD: Sonoma Historic Artifact Research Database*. Sonoma State University, Rohnert Park.

Appadurai, A.
1986 Introduction: Commodities and the Politics of Value. In *The Social Life of things: Commodities in Cultural Perspective*. Edited by A. Appadurai, pp.3-63. Cambridge University Press, Cambridge.

Aries, Philippe
1974 The Reversal of Death: Changes in Attitudes Toward Death in Western Societies. *American Quarterly* 26(5):536-560.

Armelagos, George
2003 Bioarchaeology as Anthropology. *Archaeological Papers of the American Anthropological Association* 13(1):27-40.

Armelagos, George with KC Barnes and J Lin
1996 Disease in human evolution: the re-emergence of infectious disease in the third epidemiological transition. *Anthro Notes* 18(3):1-7.

Armelagos, George with Peter Brown and Bethany Turner
2005 Evolutionary, historical and political economic perspectives on health and disease. *Social Science & Medicine* 61:755-765.

Ashmore, W. and P.I. Geller
2005 Social Dimensions of Mortuary Spaces. In *Interacting with the Dead: Perspectives on Mortuary Archaeology for the New Millennium*. Edited by Gordon Rakita, Jane Buikstra, Lane Beck, and Sloan William, pp. 107-123. University Press of Florida, Gainesville.

Aufderheide, Arthur and Conrado Rodriguez-Martin
1998 *The Cambridge Encyclopedia of Human Paleopathology*. Cambridge University Press, New York.

Baker, Brenda J., Tosha L. Dupras, and Matthew W. Tocheri.
2005 *The osteology of infants and children*. Texas A&M University Press, College Station.

Barrett, Ronald with Christopher Kuzawa, Thomas McDade and George Armelagos
1998 Emerging and Re-emerging Infectious Diseases: The Third Epidemiologic Transition. *Annual Review of Anthropology* 27:247-271.

Bass, William M.
2005 *Human Osteology: A Laboratory and Field Manual*. 5th ed. Missouri Archaeological Society, Inc., Columbia.

Bernstein, Nancy
1972 *The First One Hundred Years: Essays on the History of the American Public Health Association.* American Public Health Association.

Binford, Lewis R.
1971 Mortuary Practices: Their Study and Potential. In *Approaches to the Social Dimensions of Mortuary Practices*. Edited by J.A. Brown, pp. 6-29. Society for American Archaeology No 25, Washington D.C.

Birkby, WH with Todd Fenton and Bruce Anderson
2008 Identifying Southwest Hispanics Using Non-Metric Traits and the Cultural Profile. *Journal of Forensic Science* 53(1):29-33.

Blanchard, Brenna Kay
2010 A Study of the Accuracy and Reliability of Sex Estimation Methods of the Human Pelvis. Master's thesis, Department of Anthropology, California State University Chico.

Bloch, Maurice and Jonathan Parry
1982 Introduction. In *Death and the Regeneration of Life*. Edibed by Maurice Bloch and Jonathan Parry, pp. 1-44. Cambridge University Press, Cambridge.

Bocquet-Appel, Jean-Pierre and Claude Masset
1982 Farewell to Paleodemography. *Journal of Human Evolution* 11:321-333.

Boldsen, Jesper and George Milner
2012 An Epidemiological Approach to Paleopathology. In *A Companion to Paleopathology*. Edited by Anne Grauer, pp. 114-132. Blackwell: New York.

Brooks, Sheilagh, and Judy M. Suchey.
1990 Skeletal age determination based on the os pubis: a comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods. *Human Evolution* 5 (3): 227-238.

Brown, James
1995 On Mortuary Analysis – With Special Reference to the Saxe-Binford Research Program. In *Regional Approaches to Mortuary Analysis*. Edited by L.A. Beck, pp. 3-26. Springer Science & Business Media, New York.

Brown, Jennifer with Kaitlin Benedict, Benjamin Park, and George Thompson III
2013 Coccidioidomycosis: Epidemiology. *Clinical Epidemiology* 5:185-197.

Bruzek, Jaroslav
2002 A Method for Visual Determination of Sex, Using the Human Hip Bone. *American Journal of Physical Anthropology* 111:157-168.

Budja, Mihael
2010 The Archaeology of Death: From 'Social Personae' to 'Relational Personhood'. *Documenta Praehistorica* 37:43-54.

Buikstra, Jane and Douglas Ubelaker
1994 *Standards for Data Collections from Human Skeletal Remains*. Arkanasas Archaeological Survey Research Series No. 44. Arkansas Archaeological Survey, Fayetteville.

Buikstra, Jane
1977 Biocultural Dimensions of Archaeological Study: A Regional Perspective. In *Biocultural Adaptation in Prehistoric America*. Edited by Robert Blakely, pp. 67-84 University of Georgia Press, Atlanta.

2006 A Historical Introduction. In *Bioarchaeology: The Contextual Analysis of Human Remains*. Edited by J.E. Buikstra and L.A. Beck, pp. 7-25. Academic Press, Burlington.

Bush, H.
1991 Concepts of Health and Stress. In *Health in Past Societies. Biocultural Interpretations of Human Skeletal Remains in Archaeological Contexts*. Edited by H. Bush and M. Zvelebil, pp. 11-21. British Archaeology Reports, International Series 567. Tempus Reparatum, Oxford.

Buzon, Michele R.
2012 The Bioarchaeological Approach to Paleopathology. In *A Companion to Paleopathology*. Edited by Anne Grauer, pp. 58-75. Blackwell, New York.

Cahn, Frances and Helen Bary
1937 *Welfare activities of federal, state, and local governments in California, 1850-1934*. University of California Press: Berkeley.

Campbell, Gibson and Kay Jung
2002 *Historical census statistics on population totals by race, 1790-1990, and by Hispanic origin, 1970 to 1990, for the united states, regions, divisions, and states.* Population Division Working Paper No. 65. U.S. Census Bureau, Washington D.C.

Cannon, Aubrey
1989 The Historical Dimension in Mortuary Expressions of Status and Sentiment. *Current Anthropology* 30(4):437-458.

2005 Gender and Agency in Mortuary Fashion. In Interacting with the Dead Perspectives on Mortuary Archaeology for the New Millennium. Edited by Gordon Rakita, Jane Buikstra, Lane Beck and Sloan Williams, pp. 41-65. University Press of Florida: Gainesville.

Carr, C.
1984 The nature of organization of intrasite archaeological records and spatial analytic approaches to their investigation. In *Advances in archaeological method and theory*. Edited by Michael Schiffer, pp. 103-222. Academic Press, New York.

1995 Mortuary Practices: Their Social, Philosophical-Religious, Circumstantial, and Physical Determinants. *Journal of Archaeological Method and Theory* 2(2):105-200.

Chamberlain, Andrew T.
2006 *Demography in archaeology*. Cambridge University Press, Cambridge.

Charles, D.K. and J.E. Buikstra
2002 Siting, Sighting, and Citing the Dead. In *The Spaces and Place of Death*. Edited by H. Silverman and D. Small, pp. 13-25. Archaeological Papers of the American Anthropology Association. Vol 11. Arlington, Virginia.

Chicago Dry Goods Reported
1900 W.L. & Co. Rings advertisement. August 11th, 1900. 30: 34. Source: https://books.google.com/books?id=jKE7AQAAMAAJ&pg=RA7-PA34&dq. Accessed April 1, 2019.

Christianson, Eric
1997 Medicine in New England. In *Sickness and Health in America: Readings in the History of Medicine and Public Health*. Edited by Judith Leavitt and Ronald Numbers, pp. 47-71. University of Wisconsin Press, Madison.

Coffin, Margaret M.
1976 *Death in Early America: The History and Folklore of customs and Superstitions of Early Medicine, Funerals, Burials, and Mourning*. Thomas Nelson Inc Publisher, New York.

Cohen, Mark and George Armelagos editors
1984 *Paleopathology at the origins of agriculture*. Academic Press, New York.

Collins, Erika.
2009 An Osteological and Mortuary Analysis of the Insane Asylum of California Cemetery 1851-1854. Master's Thesis, Department of Anthropology, California State University, Chico.

Commonwealth Club of California
1946 *The population of California, a report of a research study made by authorization of the board of governors of the commonwealth club of California*. Parker Printing Co, San Francisco.

Conkey, M.W. and J.D. Spector
1984 Archaeology and the Study of Gender. In *Advances in Archaeological Method and Theory Vol 7.* Edited by M.B. Schiffer, pp. 10-38. Academic Press, Orlando.

Coolidge, Mary.
1909 *Chinese Immigration*. Henry Holt and Company: New York.

Cutler, David, and Grant Miller.
2005 The role of public health improvements in health advances: the twentieth-century United States. *Demography* 42: 1-22.

Curl, James Stevens.
1972 The Victorian Celebration of Death. Sutton, London.

Curnow, J.R.
1896 *Sixth Annual Report of the Department of Health of the City of San Jose for year ending April 30, 1896*. City of San Jose.

De Cunzo, Lu Ann
2006 Exploring the Institution: Reform, Confinement, Social Change. In *Historical Archaeology*. Edited by Martin Hall and Stephen Silliman, pp. 167-189. Blackwell Publishing, Malden.

Defo, Barthelemy Kuate
2014 Beyond the 'transition' frameworks: the cross-continuum of health, disease and mortality framework. In *Global Health Action* 7:1-16.

DeWitte, Sharon and Christopher Stojanowski
2015 The Osteological Paradox 20 Years Late: Past Perspectives, Future Directions. In *Journal of Archaeological Research* 23(4):397-450.

de la Cova, Carlina
2008 *Silent Voices of the Destitute: An Analysis of African American and Euro- American Health During the Nineteenth Century.* PhD Dissertation, Department of Anthropology, Indiana University, Indianapolis.

2011 Race, Health, and Disease in 19th Century Born Males. *American Journal of Physical Anthropology* 144(4)526-537.

2012 Trauma Patterns in 19th-Century-Born African American and Euro-American Females. *International Journal of Paleopathology* 2(2-3):61-68.

2014 The biological effects of urbanization and in-migration on 19th-century-born African Americans and Euro-Americans of low socioeconomic status: an anthropological and historical approach. In *Modern Environments and Human Health. Revisiting the Second Epidemiological Transition*. Edited by M. Zuckerman, pp. 243-266. John Wiley & Sons, Hoboken.

Dobson, MJ
1997 *Contours of death and disease in early modern England*. New York: Cambridge University Press.

Dougherty, Sean
2011 Broken Bones, Broken Lives: Injury-Related Morbidity and Mortality in a Turn of the Century Pauper Cemetery. PhD Dissertation, Department of Anthropology, Indiana University, Indianapolis.

Duffy, John
1978 Social Impact of Disease in the Late 19th Century. In *Sickness and Health in America: Readings in the History of Medicine and Public Health*. Edited by Judith Leavitt and Ronald Numbers, pp. 418-425. The University of Wisconsin Press, Madison.

1990a *The Sanitarians: A History of American Public Health.* University of Illinois Press: Urbana.

1990b The Institutionalization of Public Health. In *The Sanitarians: A History of American Public Health*. University of Illinois Press: Urbana. Pp. 126-137.

Farmer, Paul
2004 An Anthropology of Structural Violence. *Current Anthropology* 45(3):305-325.

Farmer, Paul with Bruce Nizeye, Sara Stulac, and Salmaan Keshavjee
1996 Social Inequalities and Emerging Infectious Diseases. *Emerging Infectious Diseases* 2:259-269.

2006 Structural Violence and Clinical Medicine. *PLoS Medicine* 3(10):1686-1691.

Fleischer, Nancy and Robert McKeown
2014 The Second Epidemiologic Transition from an Epidemiologist Perspective. In *Modern Environments and Human Health: Revisiting the Second Epidemiological Transition*. Edited by Molly Zuckerman, pp. 353-368. John Wiley & Sons, Hoboken.

Foote, Horace
1888 *Pen Pictures from the Garden of the World or Santa Clara County, California*. Lewis Publishing Company: Chicago.

Fox, DM
1978 Social Policy and City Politics: Tuberculosis Reporting in New York, 1889-1900. *Bulletin of the History of Medicine*. 49(2):169-195.

Frankenberg, Susan R. and Lyle Konigsberg
2006 A Brief History of Paleodemography from Hooton to Hazards Analysis. In *Bioarchaeology: The Contextual Analysis of Human Remains*. Edited by Buikstra and Beck, pp. 227-261. Routledge, London.

Galtung, J.
1969 Violence, Peace, and Peace Research. *Journal of Peace Research 6(3):167-191.*

Gage, Timothy
1991 Causes of Death and the Components of Mortality: Testing the Biological Interpretations of a Competing Hazards Model. *American Journal of Human Biology* 3:289-300.

1993 The decline of mortality in England and Wales 1861 to 1964: decomposition by cause of death and component of mortality. *Population Studies* 47:47-66.

1994 Population variation in cause of death: level, gender, and period effects. *Demography* 31:271-296.

2005 Are Modern Environments Really Bad for Us?: Revisiting the Demographic and Epidemiologic Transitions. *Yearbook of Physical Anthropology* 41s:96-117.

2014 The current state of knowledge on the industrial epidemiologic transition: where do we go from here? In *Modern Environments and Human Health: Revisiting the Second Epidemiological Transition.* Edited by Molly Zuckerman, pp. 377-392. John Wiley & Sons: Hoboken.

Garcia, Lorie
1997 *Santa Clara: From Mission to Municipality*. Beyond Buildings: Santa Clara.

Geber, J.
2015 Comparative Study of Perimortem Weapon Trauma in Two Early Medieval Skeletal Populations (AD 400-1200) from Ireland. *International Journal of Osteoarchaeology* 25(3):253-264.

Gerber, David A.
2011 *American immigration: a very short introduction*. Oxford University Press.

Gill, George W.
1998 Craniofacial criteria in the skeletal attribution of race. *In* Forensic osteology: Advances in the identification of human remains. Edited by Kathy Reichs, pp. 293-317. Charles C Thomas Publisher, Springfield.

Gill, George W., and Stanley Rhine (editors)
1990 Skeletal attribution of race. No. 4. Maxwell Museum of Anthropology, Albuquerque.

Goldstein, Lynne
1981 One-dimensional archaeology and multi-dimensional people: spatial organization and mortuary analysis. In *The Archaeology of Death*. Edited by C.J. Becker and Jan Chapman, pp. 53-70. Cambridge University Press: Cambridge.

1995 Landscapes and Mortuary Practices: A Case for Regional Perspectives. In *Regional Approaches to Mortuary Analysis.* Edited by L.A. Beck, pp. 101-121. Plenum Press: New York.

2000 Mississippian Ritual as Viewed Through the Practice of Secondary Disposal of the Dead. In *Mounds, Modoc, and Mesoamerica: Papers in Honor of Melvin L. Fowler*. Edited by Ahler, pp. 193-295.Scientific Paper Series Vol 28. Illinois State Museum, Springfield.

2006 Mortuary Analysis and Bioarchaeology. In *Bioarchaeology: The Contextual Analysis of Human Remains*. Edited by Jane Buikstra and Lane Beck, pp. 375-388. Elsiver: Burlington MA.

Goldstein, Lynne with Joseph Hefner, Kristin Sewell, and Michael Hielen
2012a Cultural affinity, identity, and relatedness: distinguishing individuals and cultural groups. In *Uncovering Identity in Mortuary Analysis: Community-Sensitive Methods for Identifying Group Affiliation in Historical Cemeteries*. Edited by Michael Hielen, pp. 91-104. SRI, Tucson.

Goldstein, Lynne with Kristin Sewell, Michael Heilen, and Joseph Hefner
2012b Mortuary Synthesis. In Uncovering Identity. In *Mortuary Analysis: Community-Sensitive Methods for Identifying Group Affiliation in Historical Cemeteries*. Edited by Michael Hielen, op. 185-226. SRI, Tucson.

Goodman, A.H. and T. L. Leatherman (editors)
1998 *Building a New Biocultural Synthesis: Political-Economic Perspectives on Human Biology*. University of Michigan Press: Ann Arbor.

Goodman, Alan with R. Thomas, Alan Swedlund, and George Armelagos
1988 Biocultural Perspective on Stress in Prehistoric, Historical, and Contemporary Population Research. *Yearbook of Physical Anthropology* 31:169-202.

Grauer, Anne
2012 Introduction: The Scope of Paleopathology. In *A Companion to Paleopathology*. Edited by Anne Grauer, pp. 1-14. Blackwell, New York.

Grauer, Anne and EM McNamara
1995 A Piece of Chicago's Past: Exploring Childhood Mortality in the Dunning Poorhouse Cemetery. In *Bodies of Evidence*. Edited by Anne Grauer, pp. 91-104. John Wiley & Sons, New York.

Grauer, Anne with EM McNamara and DV Houdek
1998 A History of Their Own: Patterns of death in a nineteenth-century poorhouse. In *Sex and Gender in Paleopathological Perspective*. Edited by AL Grauer and P Stuart-Macdam, pp. 149-164. Cambridge University Press, Cambridge.

Halverson, Wilton
1949 History of Public Health in California. *Bulletin of the Medical Library Association* 37(1):59-61.

Harper, Kristin with Molly Zuckerman, Megan Harper, John Kingston, and George Armelagos
2011 The Origin and Antiquity of Syphilis Revisited: An Appraisal of Old World Pre-Columbian Evidence for Treponemal Infection. *Yearbook of Physical Anthropology* 55:99-133.

Harper, Kristin and George Armelagos
2010 The Changing Disease-Scape in the Third Epidemiological Transition. *International Journal of Environmental Research and Public Health*. 7:675-697.

Hall, Frederic.
1871 *The History of San Jose and Surroundings: With Biographical Sketches of Early Settlers*. A.L. Bancroft and Company, San Francisco.

Heilen, Michael (editor)
2012 *Uncovering Identity in Mortuary Analysis: Community-Sensitive Methods for Identifying Group Affiliation in Historical Cemeteries*. SRI, Tucson:Arizona.

Heilen, Michael and Marlesa Gray (editors)
2010 *Deathways and Lifeways in the American Southwest: Tucson's Historic Alameda-Stone Cemetery. The Transformation of a Remote Outpost into an Urban City*. Volume 1 Context and Synthesis from the Joint Courts Complex Archaeological Project Tucson, Arizona. Pima County Cultural Resources and Historic Presentation Office.

Heilen, Michael with Joseph Hefner and Mitchell Keur
2010 *Deathways and Lifeways in the American Southwest: Tucson's Historic Alameda-Stone Cemetery. The Transformation of a Remote Outpost into an Urban City.* Volume 2 The History, Archaeology, and Skeletal Biology of the Alameda-Stone Cemetery. Pima County Cultural Resources and Historic Presentation Office.

Heilen, Michael with Joseph Hefner and Mitchell Keur
2012 Life, Death, and Dying in Southeastern Arizona, 1860-1880: Historical Accounts and Bioarchaeological Evidence. In *Uncovering Identity in Mortuary Analysis: Community-Sensitive Methods for Identifying Group Affiliation in Historical Cemeteries*. Edited by Michael Heilen, pp. 105-164. SRI, Tucson,

Heilen, Michael and Kristin Sewell
2012 Historic and Archaeological Overview for The Alameda-Stone Cemetery. In *Uncovering Identity in Mortuary Analysis: Community-Sensitive Methods for Identifying Group Affiliation in Historical Cemeteries*. Edited by Michael Heilen, pp. 53-90. SRI, Tucson,

Hefner, Joseph T.
2007 *The statistical determination of ancestry using cranial nonmetric traits*. PhD Dissertation, Department of Anthropology., University of Florida, Gainsville.

2009 Cranial nonmetric variation and estimating ancestry. *Journal of Forensic Sciences* 54 (5): 985-995.

Hertz, Robert
1960 A Contribution to the Study of the Collective Representation of Death. In *Death and the Right Hand*. Translated by R. Needham and C. Needham, pp. 27-86. Free Press, New York.

Higgs, Robert.
1979 Cycles and trends of mortality in 18 large American cities, 1871-1900. *Explorations in Economic History* 16:381-408.

Higgins, RL and JE Sirianni
1995 An Assessment of Health and Mortality of Nineteenth Century Rochester, New York Using Historic Records and The Highland Park Skeletal Collection. In *Bodies of Evidence*. Edited by Anne Gauer, ed. Pp. 121-138. John Wiley & Sons, New York.

Higgins RL, MR Haines, L Walsh, and JE Sirianni
2002 The Poor in Mid-Nineteenth Century Northeastern United States: Evidence from the Monroe County Almshouse, Rochester, New York. In *The Backbone of History: Health and Nutrition in the Western Hemisphere*. Edited by RH Steckel and JC Rose, pp. 162-184. Cambridge University Press, Cambridge.

Hillson, Simon
1996 *Dental Anthropology*. Cambridge University Press, Cambridge.

Hillson, Simon with Caroline Grigson and Sandra Bond
1998 Dental defects of congenital syphilis. *American Journal of Physical Anthropology* 107:25-40.

Hoffman, F L
1919 *Pauper Burials and the Internment of the Dead in Large Cities*. Prudential Press, Newark.

Holman, DJ.
2003 mle: A Programming Language for Building Likelihood Models. Version 2.1. Vol. 1: User's Manual. Retrieved from http://faculty.washington.edu/~djholman/mle.

Irvine, Leigh Hadley.
1914 *Santa Clara County, California: California Lands for Wealth, California Fruit for Health*. Produced under the direction of the Board of Supervisors of Santa Clara County. No publisher.

Işcan, M. Yaşar, Susan R. Loth, and Ronald K. Wright.
1984a Age estimation from the rib by phase analysis: white males. *Journal of Forensic Science* 29(4): 1094-1104.

1984b Metamorphosis at the sternal rib end: a new method to estimate age at death in white males. *American Journal of Physical Anthropology* 65(2):147-156.

İşcan, M. Yaşar, Susan R. Loth, and Ronald K. Wright.
1985 Age estimation from the rib by phase analysis: white females. *Journal of Forensic Science* 30(3): 853-863.

James, Bryce
1891 *The American Commonwealth Vol II: The party system, public opinion, illustrations and reflections, social institutions*. American Edition. Charles H Sergel & Co: Chicago

Jamieson, Ross W
1995 Material Cultural and Social Death: African American Burial Practices. *Historical Archaeology* 29(4):39-58.

Jones, Terry and Kathryn Klar (editors)
2007 *California Prehistory Colonization, Culture, and Complexity*. AltaMira Press:Lanham

Kadushin, Charles
1964 Social Class and the Experience of Ill Health. *Sociological Inquiry* 34(1):67-80.

Kalish, Richard and David Reynolds
1981 Mexican American. In *Death and Ethnicity: A Psychocultural Study*. University of California Press: Berkeley. Pp 155-184

Katz, Michael
1986a *In the Shadow of the Poorhouse A Social History of Welfare in America*. HarperCollins Publishing: New York.

1986b The Origins and Failure of the Poorhouse. In *In the Shadow of the Poorhouse, A Social History of Welfare in America*. BasicBooks: New York. Pp. 1-36.

1986c Outdoor Relief. In *In the Shadow of the Poorhouse, A Social History of Welfare in America*. BasicBooks: New York. Pp. 37-59.

Kircher, Tobias and Robert Anderson
1989 Cause of Death Proper Completion of the Death Certificate. *JAMA* 258(3):349-352.

Klaus, Haagen
2014a The Bioarchaeology of Structural Violence: A Theoretical Model and a Case Study. In *Bioarchaeological Interpretations of the human Past: Bioarchaeology of Violence.* Edited by Debra Martin, Ryan Harrod and Ventura Perez, pp. 29-62. University Press of Florida: Tallahassee.

2014b Frontiers in the Bioarchaeology of Stress and Disease: Cross-Disciplinary Perspective from Pathophysiology, Human Biology, and Epidemiology. *American Journal of Physical Anthropology* 155:294-308.

Klaus, Haagen and Amanda Harvey, Mark Cohen editors
2017 *Bones of Complexity: bioarchaeological case studies of social organization and skeletal biology*. University Press of Florida: Gainesville Florida

Kleinberg, S J
1977 Death and the Working Class. *The Journal of Popular Culture* XI(1): 193–209.

Kitson, Peter
2014 Industrialization and the changing mortality environment in an English community during the industrial revolution. In *Modern Environments and Human Health: Revisiting the Second Epidemiological Transition*. Edited by Molly Zuckerman, pp. 179-200. John Wiley & Sons: Hoboken.

Konigsberg, Lyle and Susan Frankenberg
1994 Paleodemography: "Not Quite Dead". *Evolutionary Anthropology* 3(3):92-105.

Kopytoff, K.
1986 The Cultural Biography of Things: Commoditization as Process. In *The Social Life of Things: Commodities in Cultural Perspective*. Edited by A. Appadurai, pp. 64-91. Cambridge University Press: Cambridge.

Kruger-Kahloula, Angelika
1994 On the wrong side of the fence racial segregation in American cemeteries. In *History and memory in African-American culture*. Edited by Genevieve Fabre and Robert O'Meally, pp. 130-150. Oxford University Press: New York.

Kuijt, I.
1996 Negotiating Equality through Ritual: A Consideration of Late Natufian and Prepottery Neolithic A Period Mortuary Practices. *Journal of Anthropological Archaeology* 15:313-336.

Laderman, Gary
1996 From the Place of Death to the Space of Burial. In *The Sacred Remains: American Attitudes Towards Death, 1799-1883*. Yale University Press: New Haven. Pp. 27-38.

Lanphear, Kim
1988 Health and Mortality in a Nineteenth-Century Poorhouse Skeletal Sample. Ph.D. Dissertation, Department of Anthropology. State University of New York:Albany.

1990 Frequency and distribution of enamel hypoplasias in a historic skeletal sample. *American Journal of Physical Anthropology* 81(1):35-43.

Laqueur, Thomas
1983 Bodies, Death, and Pauper Funerals. *Representations* 1:109-131.

Larsen, Clark Spencer
1997 *Bioarchaeology: Interpreting Behavior from the Human Skeleton*. Cambridge University Press: Cambridge.

2006 The Changing Face of Bioarchaeology: An Interdisciplinary Science. In *Bioarchaeology: The Contextual Analysis of Human Remains*. Edited by JE Buikstra and LA Beck, pp. 359-374. Elsevier: Boston.

Lawler, D.F.
2016 Differential diagnosis in archaeology. International Journal of Paleopathology. 19:119-123.

Leavitt, Judith
1982 *The Healthiest City: Milwaukee and the Politics of Health Reform*. University of Wisconsin Press: Madison.

1997 "Typhoid Mary" Strikes Back: Bacteriological Theory and Practice in Early 20th-Century Public Health. In *Sickness and Health in America: Readings in the History of Medicine and Public Health*. Edited by Judith Leavitt and Ronald Numbers, pp. 555-574. University of Wisconsin Press: Madison.

Leavitt-Reynolds, Alissa
2011 A Biocultural Examination of Trauma From the Colorado State Insane Asylum Skeletal Collection, 1879-1899. Master's Thesis, Department of Anthropology, Colorado State University, Denver.

Lee Decker, Charles H.
2009 Preparing for an Afterlife on Earth: Transformation of Mortuary Behavior in Nineteenth-Century North America. In *International Handbook of Historical Archaeology*. Edited by David Gaimster and Teresita Majewski, pp. 141-157.

Leher, Tamara with Shannon Black and Patrick Stanton
2010 Pathological Conditions. In Deathways and Lifeways in the American Southwest: Tucson's Historic Alameda-Stone Cemetery. The Transformation of a Remote Outpost into an Urban City. Volume 2 The History, Archaeology, and Skeletal Biology of the Alameda-Stone Cemetery. Edited by Michael Heilen, Joseph Hefner, and Mitchell Keur.. Pima County Cultural Resources and Historic Presentation Office.

Lewis, Mary and Charlotte Roberts
1997 Growing Pains: the Interpretation of Stress Indicators. *International Journal of Osteoarchaeology* 7:581-586.

Lichtenstein, Bea
2004 *Images of America Santa Clara*. Arcadia Press: Boston.

Lightfoot, Ken
2005 *Indians, Missionaries, and Merchants. The Legacy of Colonial Encounters on the California Frontiers*. University of California Press: Berkeley

Lightfoot, Kent and Otis Parrish
2009 *California Indians and Their Environment An Introduction*. University of California Press: Berkeley.

Lincoln-Baab, Lorrir and John McClelland
2010 Dental Health in Late-Nineteenth-Century Tucson. In Deathways and Lifeways in the American Southwest: Tucson's Historic Alameda-Stone Cemetery. The Transformation of a Remote Outpost into an Urban City. Volume 2 The History, Archaeology, and Skeletal Biology of the Alameda-Stone Cemetery. Edited byMichael Heilen, Joseph Hefner, and Mitchell Keur,pp. 611-676. Pima County Cultural Resources and Historic Presentation Office.

Lovell, Katherine D.
1943 Migrant Aid in California, 1849-1939: A Comparison of the Social Services for Transients during the Gold Rush and the Great Depression. *The American Journal of Economics and Sociology* 3(1):69-87.

Lovejoy, C. Owen, Richard S. Meindl, Thomas R. Pryzbeck, and Robert P. Mensforth.
1985 Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death. *American Journal of Physical Anthropology* 68(1): 15-28.

Lynnerup, Niels and Jesper Boldsen
2012 Leprosy (Hansen's disease). In A Companion to Paleopathology. Edited byAnne Grauer, pp. 458-471.Wiley-Blackwell:Oxford UK.

The Louis Berger Group, Inc.
2005 *Potter's Field Disinternment/Reinterment, Secaucus Interchange Project*. Louis Berger Group, Morristown, New Jersey. Submitted to the New Jersey Turnpike Authority, Woodbridge, New Jersey.

Maggi, Franklin with Diana Wirt, Robin Veder, and Kara Oosterhous
2002 *Historical and Architectural Evaluation for Oak Hill Memorial Park for SCI California Funeral Services Inc*. City of San Jose, California.

Mann, Robert W., and David R. Hunt.
2013 Photographic regional atlas of bone disease: a guide to pathologic and normal variation in the human skeleton. Charles C Thomas Publisher: Springfield.

Markel, Howard and Alexandra Minna Stern
1999 Which face? Whose nation?: Immigration, Public Health, and the Construction of Disease at America's Ports and borders, 1891-1928. *The American Behavioral Scientist* 42(9):1314-1331.

2002 The Foreignness of Germs: The Persistent Association of Immigrants and Disease In American Society. *The Milbank Quarterly* 80(4):757-788.

Marino, Daniela
1997 Prayer for a Sleeping Child: Iconography of the funeral ritual of little angels in Mexico. *Journal of American Culture* 20(2):37-44.

Mars, Amaury
1901 *Reminiscences of Santa Clara Valley and San Jose*. Artistic Publishing Company: San Francisco.

Martin, Debra
1998 Owning the Sins of the Past: Historical Trends, Missed Opportunities, and New Directions in the Study of Human Remains. In *Building a New Biocultural Synthesis Political-Economic Perspective on Human Biology*. Edited by Alan Goodman and Thomas Leatherman, pp. 170-190. University of Michigan Press: Ann Arbor.

Martin, Debra with Ryan Harrod and Misty Fields
2010 Beaten Down and Worked to the Bone: Bioarchaeological Investigations of Women and violence in the Ancient Southwest. In *Landscapes of Violence* 1(1):1-19.

Martin, Debra with Ryan Harrod and Ventura Perez
2013 *Bioarchaeology An Integrated Approach to Working with Human Remains*. Springer: New York.

Mast, Nicholas H and Daniel Horwitz
2002 Osteomyelitis: A Review of current literature and concepts. *Operative Techniques in Orthopedics*, 12(4):232-241.

McGloin, Cashel
2012 Crazy Bones: Evidence of Insanity in the Skeletal Collection of the Colorado State Insane Asylum. Master's Thesis, Department of Anthropology, Colorado State University, Colorado.

McKeown, Robert
2009 The Epidemiologic Transition: Changing Patterns of Mortality and Population Dynamics. *American Journal of Lifestyle Medicine* 3:19S-26S.

Meindl, Richard S., and C. Owen Lovejoy.
1985 Ectocranial suture closure: a revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology* 68(1): 57-66.

Meindel, Richard and Katherine Russell
1998 Recent Advances in Method and Theory in Paleodemography. *Annual Review of Anthropology* 27:375-399.

Melosi, Martin
2000a *The Sanity city: Urban Infrastructure in America from Colonial Times to the Present.* The John Hopkins University Press: Baltimore.

2000b Bringing the Serpent's Tail into the Serpent's Mouth Edwin Chadwick and the "Sanitary Idea" in England. In *The Sanity City: Urban Infrastructure in America from Colonial Times to the Present*. The John Hopkins University Press: Baltimore. Pp. 43-57

2000c On the Cusp of the New Public Health Bacteriology, Environmental Sanitation, and the Quest for Permanence 1880-1920. In *The Sanity City: Urban Infrastructure in America from Colonial Times to the Present*. The John Hopkins University Press: Baltimore. Pp. 103-116

Metcalf, Peter and Richard Huntington
1991 Death Rituals and Life Values: Rites of Passage Reconsidered. In *Celebrations of Death The Anthropology of Mortuary Ritual*. Cambridge University Press: Cambridge. Pp.108-132.

Mikkelsen L, Cohen L, Bhattacharyya K, Valenzuela I, Davis R, Gantz T.
2002. *Eliminating Health Disparities: The Role of Primary Prevention*. Prevention Institute: Oakland, California.

Milligan, Colleen
2010 Paleopathology and Public Health in "America's Healthiest City": A Comparative Study of Health from the Milwaukee County Institution Grounds Cemetery. PhD. Dissertation, Department of Anthropology, Michigan State University, East Lansing.

Milner, George with James Wood and Jesper Boldsen
2008 Advances in Paleodemography. In *Biological Anthropology of the Human Skeleton*. Edited by Katzenberg and Saunders, pp. 561-600. John Wiley & Sons: New York.

Mitford, Jessica.
1963 The American way of death. Simon and Schuster: New York.

Molina, Natalia
2016 Fear and Loathing in the US-Mexico Borderlands: The History of Mexicans as Medical Menaces, 1848 to the Present. *Azlan: A Journal of Chicano Studies* 41(2):87-112.

Monahan Mortuary
n.d. Death & Funeral Records, December 2, 1914 through January 8, 1938. Santa Clara Central Park Library Central Geneology GS Collection.

Moratto, Michael
2014 *California Archaeology*. Academic Press: Orlando.

Morris, Ian
1992 The Anthropology of a Dead World. In *Death-Ritual and Social Structure in Classical Antiquity*. Cambridge University Press: Cambridge. Pp.1-30.

Munro-Fraser, J.P.
1881 *The History of Santa Clara California*. Alley Bowen & Co, Publisher: San Francisco.

Nawrocki, S.P.
1990 Reflections of Social Status in a Late-19th Century Almshouse Cemetery Population Near Rome, New York. Paper presented at the 30th Northeastern Anthropological Association Meetings, Burlington, VT.

Netter, Frank
2003 *Atlas of Human Anatomy*, 3rd edition Icon Learning Systems LLC Teterboro: Trenton

Nguyen, Vinh-Kim and Karine Peschard
2003 Anthropology, Inequality, and Disease: A Review. *Annual Review of Anthropology* 32:447-474.

Numbers, R L, J W Leavitt
1997 Sickness and Health: An Overview. In *Sickness and Health in America: Readings in the History of Medicine and Public Health*. Edited by R Numbers and J Leavitt, pp. 3-10. University of Wisconsin Press: Madison.

Nystrom, Kenneth
2014 The Bioarchaeology of Structural Violence and Dissection in the 19th Century United States. *American Anthropologist* 116(4):765-779.

Nystrom, Kenneth with Joyce Sirianni, Roseanne Higgins, Douglas Perrelli, and Jennifer Liber Raines
2016 Structural Inequality and Postmortem Examination at the Erie County Poorhouse. In *The Bioarchaeology of Dissection and Autopsy in the United States.* Edited by Kenneth Nystrom, pp. 279-300. Springer: London.

Omran, Abdel
1971 The Epidemiologic Transition: A Theory of the Epidemiology of Population Change. *The Milbank Quarterly* 83(4):731-757.

1977 A Century of Epidemiologic Transition in the United States. *Preventive Medicine* 6:30-51.

1983 The Epidemiologic Transition Theory. A Preliminary Update. *Journal of Tropical Pediatrics* 29(6):305-316.

Ortner, Donald
2003 *Identification of Pathological Conditions in Human Skeletal Remains*. Academic Press: Boston.

2003a Theoretical Issues in Paleopathology. In *Identification of Pathological Conditions in Human Skeletal Remains*. Academic Press: San Diego. Pp. 109-118.

2003c Metabolic Disorders. In *Identification of Pathological Conditions in Human Skeletal Remains*. Academic Press: San Diego. Pp. 383-418.

2008 Differential diagnosis of skeletal lesions in infectious disease. In *Advances in human Palaeopathology.* Edited by Ron Pinhasi and Simon Mays, pp.189-214. Wiley & Sons: New York

2009 Issues in paleopathology and possible strategies for dealing with them. In *Anthropologischer Anzeiger* 67(4):323-340.

O'Shea, J.M.
1981 Social Configuration and the Archaeological Study of Mortuary Practices: A Case Study. In *The Archaeology of Death*. Edited by R. Chapman, I. Kinnes, and K. Randsborg, pp. 39-52. Cambridge University Press: Cambridge.

1984 The development of an archaeological theory of mortuary behavior. In *Mortuary Variability: An Archaeological Investigation.* Academic Press: New York. Pp.1-12.

Palkovich, A.M.
1996 Historic Depopulation in the American Southwest: Issues of Interpretation and Context-Embedded Analyses. In Bioarchaeology of Native American Adaptation In *The Spanish Borderlands.* Brenda Baker and L. Kealhofer editors, pp. 179-197. University Press of Florida: Gainesville.

Parker Pearson, Mike
1999 Learning from the dead. In *The Archaeology of Death and Burial*. Texas A&M University Press: College Station. Pp.1-20.

Peebles, C.S. and S.M. Kus
1977 Some Archaeological Correlates of Ranked Societies. American Antiquity 42:421-448.

Perez, Ventura
2014 The Politicization of the Dead, Violence as Performance, Politics as Usual. In *Bioarchaeological Interpretations of the Human Past: Bioarchaeology of Violence*. Edited by Debra Martin, Ryan Harrod and Ventura Perez, pp. 13-29. University Press of Florida: Tallahassee.

Perry, Megan
2007 Is bioarchaeology a handmaiden to history? Developing a historical bioarchaeology. *Journal of Anthropological Archaeology* 26(3): 486-515.

Pfaelzer, Jean
2007 *Driven Out The Forgotten War Against Chinese Americans*. Random House: New York.

Pinhasi, Ron and Simon Mays editors
2008 *Advances in Human Palaeopathology*. Wiley & Sons: New York

Phillips, Shawn
2001A Inmate Life in the Oneida County Asylum, 1860-1895: A Biocultural Study of the Skeletal and Documentary Records. Ph.D. Dissertation, Department of Anthropology, University at Albany State University of New York, New York.

2001B County Institutions as Crucibles of Social Judgment: Bioarchaeological Evidence of the Consequences of Disease and Social Stigma. *Northeast Anthropology* 61(Spring):27-47.

Pinder, David, Izumi Shimada, and David Gregory.
1979 The nearest-neighbor statistic: archaeological application and new developments. *American Antiquity* 44(3): 430-445.

Pitt, Leonard
1966 *The Decline of the Californios A Social History of the Spanish-speaking Californians, 1846-1890*. University of California Press: Berkeley.

Pitti, Stephen
2003 *The Devil in Silicon Valley Northern California, Race, and Mexican Americans*. Princeton University Press: Princeton.

Quesada, James with Laurie Kain and Philippe Bourgois
2011 Structural Vulnerability and Health: Latino Migrant Laborers in the United States. In *Medical Anthropology Cross-Cultural Studies in Health and Illness* 30(4):339- 362.

Rakita, Gordon and Jane Buikstra
2005 Introduction. In *Interacting with the Dead Perspectives on Mortuary Archaeology for the New Millennium*. Edited by Rakita, Buikstra, Beck, and Williams, pp. 1-12.. University Press of Florida: Gainsville

Rangel, Jim
2016. December 28th, 2016. Personal Communication.

Reimers, Eva
1999 Death and Identity: Graves and Funerals as Cultural Communication. *Mortality* 4(2):147-166.

Rehor, Jay and Karin Goetter Beck
2015 Excavation Of The County Infirmary Cemetery At Santa Clara Valley Medical Center, Santa Clara County, California. URS. Submitted to Alex Gallego, Director of Facilities Santa Clara Valley Medical Center, San Jose California.

Reinhard, Karl and Elisa Pucu de Araujo
2014 Comparative Parasitological Perspectives on Epidemiologic Transitions: The Americas and Europe. In *Modern Environments and Human Health: Revisiting the Second Epidemiological Transition*. Edited Molly Zuckerman, pp. 321-338. John Wiley & Sons: New York.

Reitsema, Laure and Britney McIlvaine
2014 Reconciling “stress” and “health” in physical anthropology: What can bioarchaeologists learn from other subdisciplines? *American Journal of Physical Anthropology* 155(2):181-185.

Resnick Donald. and Niwayama G
1995 Osteomyelitis, septic arthritis and soft tissue infections: Organisms. In *Diagnosis of Bone and Joint Disorders*. Edited by D Resnick, 2012-2075. 3rd edition. Saunders: Philadelphia.

Rhine, Stanley
1990 *Non-Metric Skull Racing. Skeletal Attribution of Race*, edited by George W. Gill and Stanley Rhine, 9-20. Maxwell Museum of Anthropology, Anthropological Papers No. 4 University of New Mexico, Albuquerque, New Mexico.

Richards, Patricia
1997 Unknown Man NO. 198 The Archaeology of the Milwaukee County Poor Farm. Ph.D. Dissertation., Department of Anthropology, The University of Wisconsin-Milwaukee.

Richards, Patricia and M Kastell
1993 Archaeological Excavations at the Almshouse Burial Ground, Milwaukee County Poorhouse, Wauwatosa, Wisconsin. Reports of Investigation No. 333, Great Lakes Archaeological Research Center, Inc.

Robbins, Grew with Kelsey Gray, V. Mushrif-Tripathy, and A.R. Sankhyan
2012 A peaceful realm? Trauma and social differentiation at Harappa. In *International Journal of Paleopathology* 2:136-147.

Roberts, Charlotte
2012 Re-Emerging Infectious: Development in Bioarchaeological Contributions to Understanding Tuberculosis Today. In *A Companion to Paleopathology*. Edited by Anne Grauer, pp. 434-457. Blackwell:New York.

Rosenberg, Charles
1997 Social Class and Medical Care in 19th-Century America: The Rise and Fall of the Dispensary. In *Sickness and Health in America: Readings in the History of Medicine and Public Health*. Edited by Judith Leavitt and Ronald Numbers, pp. 309-322. University of Wisconsin Press: Madison.

Rosenberg, Charles E.
1987 Expanding a Traditional Institution: Social Sources of Hospital Growth, 1850-1875. In *The Care of Strangers – The Rise of America's Hospital System*. Basic Books: New York. Pp. 97-121.

Rosenow, Michael K.
2015 *Death and Dying in the Working Class, 1865-1920*. University of Illinois Press: Chicago.

Rothschild, Bruce M.
2005 History of Syphilis. *Clinical Infectious Diseases* 40:1454-63.

Rouse, Wendy L.
2005 "What We Didn't Understand": A History of Chinese Death Ritual in China and California. In *Chinese American Death Rituals: Respecting the Ancestors.* Edited by Sue Chung and Priscilla Wegars, pp. 19-46. Alta Mira Press: Lanham.

Ruffin, Herbert G
2014a Origins of Santa Clara Valley's Black Community 1769-1900. In *Uninvited Neighbors African Americas in Silicon Valley 1769-1990.*. University of Oklahoma Press: Norman. Pp. 15-47

2014b African Americans in the Valley of Heart's Delight, 1900-1941. In *Uninvited Neighbors African Americas in Silicon Valley 1769-1990*. University of Oklahoma Press: Norman. Pp. 48-72.

Sattenspiel, Lisa and Rebecca Lander
2014 The timing of the second epidemiologic transition in small US towns and cities: evidence from local cemeteries. In Modern Environments and Human Health: Revisiting the Second Epidemiological Transition. Edited by Molly Zuckerman, pp. 163-177. John Wiley & Sons: Hoboken.

Saxe, A.A.
1970 Social Dimensions of Mortuary Practices. Ph.D. Dissertation, Department of Anthropology, University of Michigan Ann Arbor.

Schaefer, Maureen with Sue Black and Louise Scheuer
2009 *Juvenile Osteology: A Laboratory and Field Manual*. Academic Press, San Diego California.

Schell, Lawrence
1997 Culture as a Stressor: A Revised Model of Biocultural Interaction. In *American Journal of Physical Anthropology* 102:67-77.

Schofield R. and D. Reher.
1991 The decline of mortality in Europe. In *The Decline of Mortality in Europe*. Edited by Schofield, Reher and Bideau, pp. 1-17. Oxford University Press: Oxford

Scheper-Hughes, Nancy
1992 Death without weeping: the violence of everyday life in Brazil. University of California Press, Berkeley.

Schug, Gwen Robbins with K. Elaine Blevins, Brett Cox, Kelsey Gray, and V. Mushrif-Tripathy
2013 Infection, Disease, and Biosocial Processes at the End of the Indus Civilization. *PloS One 8*(12):e84814.

Scott, G. Richard, and Christy G. Turner.
1997 *Anthropology of modern human teeth*. Cambridge University Press: Cambridge.

Sewell, Kristin with Michael Heilen, Lynne Goldstein
2012 Deathways and Tucson's Living Population 1860-1880. In *Uncovering Identity in Mortuary Analysis: Community-Sensitive Methods for Identifying Group Affiliation in Historical Cemeteries*. Edited by Michael Heilen, pp. 165-184. SRI, Tucson.

Shanks, M. and C. Tilley
1987 Material Culture. In *Social Theory and Archaeology*. Edited by Michael Shanks and Christopher Tilley, pp. 79-117. University of New Mexico Press: Albuquerque.

Shah, Nayan
2001a Introduction: Public Health, Race, and Citizenship. In *Contagious Divides: Epidemics and Race in San Francisco's Chinatown.* University of California Press: Berkeley. Pp. 1-16.

2001b Regulating bodies and space. In *Contagious Divides: Epidemics and Race in San Francisco's Chinatown*. University of California Press: Berkeley. Pp. 17-44.

Shortridge, C.M.
1896 *Santa Clara County and it's Resources, Historical, Descriptive, Statistical*. Eton: San Jose.

Singer, Merrill
2009 *Introduction to Syndemics a critical systems approach to public and community health*. Jossey-Bass: San Francisco California.

Singer, Merill and Scott Clair
2003 Syndemics and Public Health: Reconceptualizing Disease in Bio-social Context. *Medical Anthropology Quarterly* 17(4):423-441

Smits, Nicholas
2008 The Archaeology of an urban Chinese American cemetery. *Historical Archaeology* 42(3):111-122.

South, Stanley
1977 *Method and Theory in Historical Archaeology*. Academic Press: New York.

Spencer-Wood, Suzanne M., and Christopher N. Matthews.
2011 Impoverishment, criminalization, and the culture of poverty. Historical Archaeology 45(3): 1-10.

State Board of Control of California
1978 [1920] *California and the Oriental*. Arno Press: New York.

Steiner, Michael J.
2003 Creating Immortality: Death and Material Culture. In *A Study of the Intellectual and Material Culture of Death in Nineteenth Century America*. Studies in American History, vol. 45. Edited by Edwin Mellen, pp. 59-109. Lewiston: New York.

State Board of Charities and Corrections
1905 *First Biennial Report of the State Board of Charities and Corrections of the State of California from July 1, 1903 to June 30, 1904*. Superintendent State Printing: Sacramento.

1906 Second Biennial Report of the State Board of Charities and Corrections of the State of California from July 1, 1904 to June 30, 1906. Superintendent State Printing: Sacramento.

1908 Third Biennial Report of the State Board of Charities and Corrections of the State of California from July 1, 1906 to June 30, 1908. Superintendent State Printing: Sacramento.

1915 Sixth Biennial Report of the State Board of Charities and Corrections of the State of California from July 1, 1912 to June 30, 1914. California State Printing Office: Sacramento

1921 Ninth Biennial Report of the State Board of Charities and Corrections of the State of California from July 1, 1918 to June 30, 1920. California State Printing Office: Sacramento

Strange, Julie-Marie
2003 'Tho' lost to sight, to memory dear': pragmatism, sentimentality and working-class attitudes towards the grave, c.1875-1914. *Mortality* 8(2):144-159.

Sweeney, Kate.
2014 American Afterlife: Encounters in the Customs of Mourning. The University of Georgia Press: Athens

Swensen, Edward
2015 The Archaeology of Ritual. *Annual Review of Anthropology* 44:329-45.

Szreter, Simon, and Michael Woolcock.
2004 Health by association? Social capital, social theory, and the political economy of public health. *International Journal of Epidemiology 33*(4): 650-667.

Tainter, J.A.
1978 Mortuary Practices and the Study of Prehistoric Social Systems. In *Advances in Archaeological Method and Theory*. Edited by M.B. Schiffer, pp. 105-141. Academic Press: New York.

Temple, Daniel and Alan Goodman
2014 Bioarchaeology has a "health" problem: conceptualizing "stress" and "health" in bioarchaeological research. *American Journal of Physical Anthropology* 155(2):186-191.

tenBroek, Jacobus.
1957 California's Welfare Law--Origins and Development. California Legal Review. 45(3):241-303.

Thompson and West
1876 New Historical Atlas of Santa Clara County California Compiled, Drawn and Published from Personal Examinations and Surveys. San Francisco: California.

Trask, Willa
2010 Paleodemography. In *Deathways and Lifeways in the American Southwest: Tucson's Historic Alameda-Stone Cemetery. The Transformation of a Remote Outpost into an Urban City. Volume 2 The History, Archaeology, and Skeletal Biology of the Alameda-Stone Cemetery*. Edited by Michael Heilen, Joseph Hefner, and Mitchell Keur, pp. 365-398. Pima County Cultural Resources and Historic Presentation Office.

Tsu, Cecilia M.
2013 *Garden of the World Asian Immigrants and the Making of Agriculture in California's Santa Clara Valley*. New York: Oxford University Press

The Evening News
1896 Duration of Life: The Average Age in Santa Clara County is 45 Years of Age. October 9th, Volume XXX Issue 90 Page 2. San Jose, California

1889 The supervisors. New Maps of the County Are to be furnished. May 8 Volume XIV issue 106 page 3. San Jose, California.

1903 County business of special importance April 21, Volume LXIII Issue 103 Page 11. San Jose, California.

1906 Two reports are filed by grand jury little work accomplished owing to lack of time. January 2 Volume 46 issue 7 Page 5. San Jose, California.

1916 Child buried without health board permit. April 7 Volume XC Issue 98 Page 9. San Jose, California.

1917 Death Rate is high for city. June 15 Volume 168 Issue 142 Page 6. San Jose, California.

1919 San Jose has low infant mortality. July 25 Volume 72 issue 22 Page 2. San Jose, California

Todd, T. Wingate.
1920 Age changes in the pubic bone. I. The male white pubis. *American Journal of Physical Anthropology* 3(3): 285-334

Tomes, Nancy
1997 The Private Side of Public Health: Sanitary Science, Domestic Hygiene, and the Germ Theory, 1870-1900. In *Sickness and Health in America: Readings in the History of Medicine and Public Health*. Edited by Leavitt and Numbers, pp. 506-528. University of Wisconsin Press: Madison.

Ubelaker, Douglas and Erica Jones (editors)
2003 *Humans Remains from Voegtly Cemetery, Pittsburg, Pennsylvania. Smithsonian Contributions to Anthropology No. 46.* Smithsonian Institution Press: Washington, D.C.

U.S. Census (United States Bureau of the Census)
1880 Santa Clara County, Manuscript census, population schedule

1880 Santa Clara County, Manuscript census, supplemental schedules

1910 Santa Clara County, Manuscript census, population schedule

van Gennep, A.
1960 [1908] *The Rites of Passage*. University of Chicago Press, Chicago

Van Gerven, Dennis P and George Armelagos
1983 Farewell to Paleodemography?" Rumors of Its Death Have Been Greatly Exaggerated. *Journal of Human Evolution* 12:353-360.

Wagner, D
2005 Poorhouse, Almshouse, Poor Farm: Buried American History. In *The Poorhouse: America's Forgotten Institution*. Rowman and Littlefield Publishers: New York. Pp. 1-18.

Waldron, T
2009 Paleopathology. Cambridge University Press: Cambridge.

Walker, Phillip with Rhonda Bathurst, Rebecca Richman, Thor Gjerdrum, and Valerie Andrushko
2009 Perspectives: The Causes of Porotic Hyperostosis and Cribra Orbitalia: A reappraisal of the Iron-Deficiency-Anemia Hypothesis. *American Journal of Physical Anthropology* 139:109-125.

Wallace, Sarah Isabel
2017 "The Public Health Must Prevail" Enforcing Exclusion. In *Not Fit to Stay Public Health Panics and south Asian Exclusion.* UBC Press: Vancouver. Pp. 66-95.

Waller, John C.
2014 Institutional Facilities. In *Health and Wellness in 19th-Century America*. Greenwood: Santa Barbara. Pp. 225-240.

Weston, Darlene
2012 Nonspecific Infection in Paleopathology: interpreting periosteal reactions. In *A Companion to paleopathology*. Edited by Anne L. Grauer, pp. 492-512. John Wiley & Sons: New York.

Weiner, Annette
1983 Inalienable Wealth. *American Ethnologist* 12:210-227.

Wesolowsky, Al B. and Ricardo Elia eds.
1991 *Archaeological Excavations at the Uxbridge Almshouse Burial Ground in Uxbridge Massachusetts*. BAR International Series 564. Oxford: England.

Weston, Darlene
2012 Nonspecific Infection in Paleopathology: interpreting periosteal reactions. In *A Companion to paleopathology*. Edited by Anne L. Grauer, pp. 492-512. John Wiley & Sons: New York.

White, Tim with Michael Black and Piete Folkens
2011 *Human Osteology* 3rd edition. Academic Press San Diego California

Wilkinson, Richard
1976 *Unhealthy Societies The Afflictions of Inequality*. Routeledge:London

Wood J.W., G.R. Milner, H.C. Harpending, and K.M Weiss
1992 The Osteological Paradox. *Current Anthropology* 33(4):343-370.

Wood JE, Holman DH, O'Connor KA and Ferrell RJ.
2002 Mortality Models for Paleodemography. In *Paleodemography: Age Distribution from Skeletal Samples*. Edited by Hoppa RD, and Vaupel JW, pp. 129-168. Cambridge University Press: Cambridge.

Wood KW, Holman DJ, Weiss KM, and Buchana AE.
1992a Hazard Models for Human Population Biology. *Yearbook of Physical Anthropology* 35:43-87.

Woods, R
2000 *The demography of Victorian England and Wale*s. Cambridge: Cambridge University Press.

World Health Organization
1995 Bridging the Gaps. World Health organization: Geneva.

Wright, Doris
1940 The Making of Cosmopolitan California: An Analysis of Immigration, 1848-1870 Part 1. *California Historical Society Quarterly* 19(4):323-343.

Wright, Lori and Cassady Yoder
2003 Recent Progress in Bioarchaeology: Approaches to the Osteological Paradox. *Journal of Archaeological Research* 11(1):43-70.

Yang, Ying with Duc Vugia, Farzaneh Tabnak, Kenneth Komatsu, Clarisse Tsang, Laura Erhart, Orion McCotter, Shoana Anderson, George Rutherford, John Galgiani, and Richard Hector.
2011 The Public Health Impact of Coccidioidomycosis in Arizona and California. *International Journal of Environmental Research and Public Health*. 8(4):1150-1173.

Younoszai, Barbara
1990 Mexican American Perspectives Related to Death. In *Ethnic Variation in Dying, Death, and Grief. Diversity in Universality*. Edited by Donald Irish, Kathleen Lundquist, and Vivian Jenkins Nelsen, pp. 67-78. Taylor & Francis: Philadelphia.

Zuckerman, Molly with Bethany Turner and George Armelagos
2012 Evolutionary Thought in Paleopathology and the Rise of the Biocultural Approach. In *A Companion to Paleopathology*. Edited by Anne Grauer, pp. 34-57. Blackwell:New York.

Zuckerman, Molly editor
2014 *Modern Environments and Human Health? Revisiting the Second Epidemiological Transition*. Wiley & Sons: New York.

Zuckerman, Molly with Kristina Harper, Ronald Barrett, and George Armelagos
2014 The evolution of disease: anthropological perspectives on epidemiologic transitions. *Global Health Action* 7(1):23303-23309.