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The overall biological profile of anatomized remains from the Winchester site

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Thesis

THE OVERALL BIOLOGICAL PROFILE OF ANATOMIZED REMAINS FROM THE WINCHESTER SITE

by

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ABSTRACT

The following research examined the overall biological profile of an anatomized human skeletal assemblage discovered in Winchester, Massachusetts (Middlesex County) in 2020. This assemblage was discovered during construction of a private house in a suburban neighborhood. In addition, this project examined the history of medical teaching specimens and how this new collection connected to the anthropological understanding of this history. For centuries, marginalized individuals, including Black people, poor people, and criminals, were utilized as the cadaver supply for medical schools. The author examined the general biological profile, including sex, age, population affinity, and stature, of the Winchester assemblage. Since none of the fragmented postcranial bones were able to be matched to particular individuals, these estimations served as a profile for the general population of the Winchester assemblage. The skulls were the only parts of the sample that could be treated as specific individuals. Craniofacial nonmetric traits were observed as well as postcranial aspects of the skeleton. The total number (NISP) of adult remains was 14,469. The MNI of the adult remains was 35 based on the left femora.

The author hypothesized that the majority of the remains would consist of male individuals, and the age profile would reflect the average age at death during the mid-1800s, which was about 20-40 years old. In addition, it was hypothesized that the

majority of individuals would be of Black population affinity, which might indicate that the remains were robbed from Black cemeteries.

The majority of the assemblage was indeed comprised of males. Specifically, 60.5% of the pubic symphyses and 58.8% of the greater sciatic notches analyzed were determined to be male. The general average age at death of the sample was 23 to 45 years old. Estimation of population affinity of the sample was attempted; however, the results were not compelling due to the fragmentation of the remains and limited ability to reconstruct crania.

The stature of the remains was estimated to range from 58.1 to 69.9 inches or 4 feet 10 inches to 5 feet 10 inches. This biological profile was compared to the demographics of Middlesex County, Massachusetts, and the United States presented by the 1850 U.S. Census and data from the military during that time. The Winchester adult remains had more males than females, similar to the sex representation in Massachusetts' poorhouses, penitentiaries, jails, and houses of correction during 1850. Unlike these institutions, the general population of Middlesex County had more females than males. The 1850 Census indicates that the majority of individuals in Massachusetts' poorhouses, penitentiaries, jails, and houses of correction were 24 years and older, which aligns with the estimated aged range for the Winchester adult remains. White and Black individuals were the only population affinities compared in the 1850 Census, and there were significantly more White individuals. The average height of a White male in the US military was 63.7 inches, which aligned with the general stature interval of 58.1 to 69.9 inches for the adult Winchester remains. Future research, including DNA and

isotope analyses, could provide further insights into the origins of these individuals discovered at this site.

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LIST OF ABBREVIATIONS

MHC.....Massachusetts Historical Commission

MNE..... Minimum Number of Elements

MNI..... Minimum Number of Individuals

NISP..... Number of Identified Specimens

OCME.....Office of the Chief Medical Examiner

INTRODUCTION

Site Background

In early November of 2020, a pit of largely fragmentary skeletal remains was unearthed after being hit with a backhoe at 25 Dartmouth Street, Winchester, Massachusetts during the excavation of a cellar hole in a suburban neighborhood (Pokines et al. n.d.). The burial feature was found at N 42˚ 27’ 17.9” W 71˚ 09’ 7.7” at 7 m a.m.s.l, and the burial (Feature 1) measured 2.0 m north to south and ≤ 2.1 m east to west. Within the site, adult and juvenile human skeletal remains, nonhuman skeletal remains, and various artifacts were present in the sandy, loose soil. Many of the human skeletal remains exhibited sharp force trauma (Mazza 2024). Personnel from the Office of the Chief Medical Examiner (OCME) and the Winchester Police Department examined the scene, and the former determined that it was likely an archaeological case, not recent forensic, due to artifact association, taphonomic state, and trauma profile (Pokines et al. n.d.). Because the site was likely archaeological, the Massachusetts Historical Commission (MHC) and the Winchester Archival Center investigated the history of the site. Based on the artifacts, including glass pipettes, glass bottles, and ceramic fragments, the site was estimated to have been created as early as the 1850s (Pokines et al. n.d.). The trauma on the human remains was congruent with trauma seen on cadaver remains that were used for medical training (i.e., anatomized) (Mazza 2024); however, it was still unknown if these remains once belonged to a medical school or a private physician. Anatomized remains are those that underwent the process of

dissection for educational purposes, while anatomical remains are those that have been preserved for study or research (Yucha et al. 2022). Because of the type of trauma exhibited on the remains and the associated laboratory artifacts found with the remains, the site being a Native American burial was ruled out (Pokines et al. n.d.). The hypotheses of the site belonging to a historical cemetery or being a modern forensic case were also eliminated. All human and nonhuman remains were accessioned by the OCME and given preliminary cleaning and analysis, with the artifacts analyzed by the MHC. The bones were returned to the MHC then loaned to Boston University for more extensive analysis.

Figure 1.1. Excavation of the burial located at the Winchester Site, Massachusetts.

History of Cadavers Used in Medicine

For centuries, particularly in the last 400 hundred years, knowledge of medicine and the human body has continuously and rapidly expanded. This can be attributed to the use and exploration of human cadavers, as they are the best alternative to studying live humans (Hayashi et al. 2016). Cadavers are dead human bodies that are sometimes embalmed and are used by medical students and professionals in surgical procedural training and other medical scenarios. This training involves dissection of the cadavers in order to learn basic anatomy and surgical procedures. Before being examined by medical students, these cadavers also may have undergone an autopsy to determine the cause of death. Both autopsies and dissections can create sharp force trauma on a skeleton. In an archaeological skeletal context, differentiating between autopsy and dissection trauma can be difficult (Dittmar and Mitchell 2015). Surgical procedures performed on the organs and other tissues of an individual are almost impossible to see due to the rapid decay of soft tissues after death. Some surgical procedures, however, like amputations and trephinations are evident in skeletal remains (Dittmar and Mitchell 2015).

Ancient Times

Before the utilization of human bodies for scientific exploration, ancient Egyptians, starting around 3000 BCE, practiced postmortem body modifications during the preservation and mummification of their dead for the afterlife (Burton 2005; Porter 1999). These modifications included the removal of internal organs, except for the heart. The organs that were removed were stored in Canopic jars (Burton 2005; Porter 1999).

Their dissection procedures were performed on a religious basis and not for scientific exploration. Even so, the Egyptians laid the foundation for the later anatomical studies conducted by civilization and institutions throughout history.

It was not until ancient Greece when dissection started being done for anatomical study; however, mostly nonhuman animals were used for this research (Burton 2005). Aristotle played a large role in promoting animal dissection during the 4th century BCE (Burton 2005). His work ultimately inspired the foundation of the Alexandria School of Medicine during the 3rd century BCE (Burton 2005; Hart 2019; Ghosh 2015). Two physicians, Herophilus and Erasistratus, achieved great recognition for their time at the school in Alexandria. They reportedly conducted vivisections (dissections on live humans) and dissections in public on human cadavers; both Herophilus and Erasistratus used criminals as the subjects of their research (Burton 2005; Hart 2019). Dissection of human remains disappeared from scientific exploration in Ancient Greece for a significant amount of time after Herophilus and Erasistratus (Ghosh 2015). Approximately four centuries later, Galen, who was originally from modern-day Turkey and moved to Rome, was a physician to the gladiators. He lived from 129-216 AD and made his mark on the medical field with his discoveries via dissections on nonhumans, particularly goats, pigs, apes, and sheep (Burton 2005).

The Middle Ages

In the West, religious belief that an intact body was sacred prohibited the study of human anatomy through dissection during the Middle Ages (Burton 2005; Daniell and

Thompson 1999; Hart 2019). However, there were some exceptions to this belief that were tolerated by the Catholic Church, particularly in England, France, and Germany (Burton 2005; Hart 2019). This was the "division of the corpses of Saints", which was the practice of dismembering a Saint's body and dispersing these relics to churches and other religious areas (Binski 1996; Burton 2005; Hart 2019). In addition, the division of a body, specifically those belonging to nobility, was tolerated if the individual had died away from home, and division was necessary for transport back to their resting place (Burton 2005; Hart 2019). During this time in the Eastern Roman Empire, Greeks performed autopsies and dissections occasionally, especially on criminals as a punishment (Burton 2005). Citizens of the East apparently did not have the same religious beliefs in the sanctity of a complete body. These dissections were normally performed to better understand disease, not anatomy (Burton 2005; King 1973).

Before and During the Renaissance

Autopsies as we know them today developed in Italy before and during the Renaissance. The earliest autopsy of this nature occurred in 1286 AD when an Italian doctor utilized autopsies to research an epidemic (Burton 2005; Park 1995). Another account discusses a physician who conducted autopsies on a chicken and a human male and found similar lesions on their hearts (Burton 2005). Shortly after, autopsies began to be applied in medicolegal contexts (Burton 2005). Pope Boniface VIII banned any and all dissection on human remains in the Roman Catholic Empire starting at the very end of the 13th century (Burton 2005; Ghosh 2015; Hart 2019; Park 1995). This included the

"division of the corpses of Saints" and the division of a body for easier transport. It was not until many popes later when rules on human dissection began to diminish (Burton 2005). For example, in Padua and Bologna, anatomy students were granted ability to practice human dissections by a law passed by Pope Sixtus IV during the late 15th century (Burton 2005; Hart 2019). In 1507, the first autopsy pathology textbook, *On Some Remarkable Hidden Causes of Diseases and of Cures* which was written by Antonio Benivieni, was published (Burton 2005). Andreas Vesalius, a Brussels-born anatomist who lived in Padua, Italy, challenged Galen's widespread ideas on anatomy and medicine. In 1543, Vesalius published *On the Fabric of the Human Body* based on findings from his substantial resource of executed criminals, upon which he used to perform autopsies and dissections (Burton 2005; Hart 2019). The Catholic Church ultimately accepted autopsies in 1556 after Emperor Charles V authorized forensic autopsies in 1532 (Burton 2005).

The 17th and 18th Centuries

During the 17th century, dissections on executed criminals to prevent entry into heaven became prevalent in Northern Europe (Burton 2005). Individuals who had committed the most atrocious crimes were put through public dissections (Burton 2005). Throughout the 17th and 18th centuries, autopsies on significant individuals, like royalty, produced a widespread acceptance of human autopsies and dissections in England (Baron 1998; Burton 2005; Harley 1994; Talbot 1978). At the University of Padua in the early 18th century, anatomist Giovanni Battista Morgagni spent his life teaching anatomy

through hundreds of autopsies and preaching the importance of autopsies and dissections for the continuing advancement of the field of medicine. The earliest documented autopsy in the territory of the US took place in 1661 and involved the examination of a juvenile girl (Anonymous 1999; Burton 2005).

Supply of Cadavers for Schools and Physicians

The use of human remains for the gain of anatomical knowledge has occurred for centuries. Anatomical body acquisition by medical institutions and private physicians started in Europe during the 1200s and in the colonial-era US during the 1600s (Hildebrandt 2010). Demand for cadavers typically outweighed the supply available. The source for this initial supply came from executed criminals (Burton 2005; Dittmar and Mitchell 2018; Flies et al. 2017; Hildebrandt 2010; Hodge 2013; Nystrom 2011). Statutes and laws were created in Europe and the US to ensure this supply.

Cadaver Acquisition Laws, Grave Robbing, and the Chosen

In 1641, Massachusetts implemented a statute that called for the dissection of some criminals as a way to give them postmortem punishment (Nystrom 2011). In 1790, a law was passed in the US that allowed federal judges to add dissection to a criminal's death sentence (Novak and Willoughby 2010). Similar laws were instigated in Scotland and England in 1506, 1540, and 1751 (Novak and Willoughby 2010). Although the US was founded on the separation of church and state, Christians took offense to this

punitive dissection and dissection in general due to their belief that it was an immoral act (Blakely and Harrington 1997; Breeden 1975; Wilf 1988).

Despite having these laws in place, students and physicians needed more cadavers partly due to the popularization of the "Paris method" (Blakely and Harrington 1997). This was the practice of hands-on dissection by anatomy students, who before just watched their professors perform dissections and autopsies (Blakely and Harrington 1997). This led to grave robbing by body snatchers, or "resurrectionists" to gain enough cadavers for students. The target of these body snatchers were marginalized peoples, like Black or poor White individuals, who could not afford "safe" burials (Blakely and Harrington 1997; Hildebrandt 2010; Hodge 2013; Novak and Willoughby 2010; Nystrom 2011; Owsley 1995). Types of "safe" burials included mortsafes, iron coffins, stone vaults with iron doors, and hired guards (Blakely and Harrington 1997). Between November and March were the ideal months to rob graves, because school was in session and cool temperatures outside preserved the bodies (Blakely and Harrington 1997). This grave robbing exacerbated the general public's disdain for human dissection.

From 1765 to 1884, citizens in Massachusetts and other parts of the country frequently incited "anatomy riots" when they would raid medical institutions and physicians' laboratories to show their contempt (Hodge 2013; Novak and Willoughby 2010; Nystrom 2011). In response to these riots and to put a stop to grave robbing, Massachusetts enacted the 1815 Act to Protect the Sepulchres of the Dead. This made it a felony to disturb and/or remove a body from a grave (Hodge 2013). Unfortunately, this legislation did not cease the grave robbing. In order to increase the cadaver supply, the

Massachusetts Anatomy Act was ratified in 1831. This allowed the dissection of unclaimed bodies from public hospitals and prisons (Hildebrandt 2010; Hodge 2013). Correspondingly, the UK passed their Anatomy Act in 1832 (Dittmar and Mitchell 2018). Although numerous laws were enacted in the US and Europe to increase cadaver supply and prevent the illegal acquisition of human bodies, this delinquency continued for many years. In fact, grave robbing occurred until the 1920s in some places, like Tennessee (Hildebrandt 2010). During the height of grave robbing, another tactic was used to acquire cadavers: murder. There were numerous instances where an individual would murder someone and then sell the remains for profit to medical schools or physicians to be utilized in anatomy courses. The most infamous of these murderers were William Burke and William Hare from Edinburgh, Scotland (Burton 2005; Hart 2019).

In the southern U.S. states, it was quite common for professors to teach their students that Black and White individuals differed anatomically (Blakely and Harrington 1997; Haller 1972). Despite their "differences", the bodies of Black individuals were frequently used for science in comparison to the bodies of White individuals (Blakely and Harrington 1997). Not only were Black individuals used as cadavers for teaching anatomy and surgical procedures, but they were also subjects of experiments while they were alive (Blakely and Harrington 1997; Savitt 1978 and 1972). Nearly all of this instruction and research was conducted to benefit White individuals.

Around the UK, the examination of excavated burial sites containing cadavers has resulted in the determination that the use of male cadaver bodies was more frequent than the utilization of female cadaver bodies (Dittmar and Mitchell 2018). For example, at the

Royal London Hospital, for every three males dissected, one female was dissected (Dittmar and Mitchell 2018). Furthermore, between 1842 and 1905, men were dissected twice as frequently as females were at St. Bartholomew's Hospital (Dittmar and Mitchell 2018). From 1855 to 1920, the University of Cambridge dissected men to women at a three to one ratio (Dittmar and Mitchell 2018). Male bodies from workhouses, which were institutions that housed individuals of lower socioeconomic status, were more likely to be taken as cadavers than the female bodies (Dittmar and Mitchell 2018). Not only was this disparity between male and female cadavers prevalent in the UK, but it also occurred in the US. This inequality may be due to the fact that males have more musculature than females do, so they may have been preferred for dissections for this reason (Dittmar and Mitchell 2018). However, the type of study being conducted played a role in what body types were utilized for the teaching. For instance, completely physically matured adult men who had died suddenly were favored for teaching about the muscular system, while young individuals were frequently used to study the nervous system (Dittmar and Mitchell 2018). When scientists desired to create an anatomical preparation, lean individuals were often preferred (Dittmar and Mitchell 2018). The common use of marginalized individuals, mentioned above, and male individuals as cadavers, also resulted in a skewness within the teaching of anatomy and the medical field as a whole. It was not until the enactment of the Anatomy Act of 1832 when unclaimed bodies from public hospitals and prisons were used for dissections and women started to be included more in the legal supply of cadavers (Burton 2005; Dittmar and

Mitchell 2018). It may be that availability of male cadavers over female was a factor if the sources such as deceased prisoners were skewed in favor of men.

After Dissection

Once dissection and examination of a body was complete, the cadaver was either turned into an anatomical preparation for future anatomy classes, or the body was sometimes buried. Anatomical preparation frequently involved applying a varnish coating to the bones and installing metal hardware into the remains for display purposes. If buried, these remains were often disposed as a commingled group along with nonhuman animal remains used in teaching and other laboratory waste, like glassware (Dittmar and Mitchell 2015; Hodge 2013). In addition to these individuals being viewed as inferior in a sociocultural context, the concept of personhood, which was frequently discussed among the public and anatomists alike, likely played a role in the treatment of these cadavers. It was a common belief that the personhood, or the status of being a human being with all associated rights and attributes, remained intact when a body was whole and fleshed; however, once dissected, a person became incomplete and therefore their personhood was gone (Hodge 2013). This theory may explain why many of these cadavers used by medical students and physicians were treated like nonhumans when being buried.

Hypotheses

In an effort to contribute to the history of medical training and understand what kind of individuals were used in this practice, the present research project focused on constructing the biological profile of the adult human remains from the Winchester site. This includes estimating the sex, age, stature, and population affinity represented among the remains. All data collected by the author were compared to past demographic studies of international and domestic populations. It was hypothesized that the majority of these remains were male individuals, much like the other sites that include anatomized remains (Dittmar and Mitchell 2018; Flies et al. 2017). It was also hypothesized that the age profile would reflect the average age at death during the 1850s in the broader US and specifically Middlesex County of the Commonwealth of Massachusetts. In addition, if the majority of the remains are believed to be from Black individuals, then it is likely that the individuals came from robbed Black cemeteries, as most of the cadavers used in Massachusetts during this period could be traced back to grave robbing (Hodge 2013). Other research projects focused on the juvenile remains (Hill et al. n.d.), nonhuman remains (Scialdone 2023), trauma of the entire sample (Mazza 2024), and pathology and taphonomy of the human remains (Swift 2024).

PREVIOUS RESEARCH

As long as cadavers have been utilized by private physicians and medical schools, there has been a need to discard the remains after they have been studied. This has created numerous burial sites containing anatomized remains (Table 2.1). Some of these sites have been located under university buildings, wells, private houses, and in sections of cemeteries. These discoveries have produced in-depth studies of these former anatomized specimens, the demographics of the individuals, and the history of autopsies and dissections for scientific exploration.

Past Anatomized Sites

Medical College of Georgia

One of the largest sites containing anatomical remains in the US was located at the Medical College of Georgia in Augusta (Table 2.1). During construction in 1989, 9,808 human bones or fragments thereof were discovered in the basement floor of the original building of the college (Blakely and Harrington 1997). It was determined that the MNI of adults in the sample was 62 individuals. Also found in this 1830s era building were approximately 300 nonhuman animal bones and 2,000 artifacts, which included items like laboratory equipment, clothing, and charcoal. The human skeletal remains consisted of Black and White individuals, both males and females, who ranged in age from fetus to elderly (Blakely and Harrington 1997). Analysis of 24 whole tibiae was performed to establish proportions of males and female in the sample. Out of these

79.2% were estimated to be male, and 20.8% were female. The tibiae were also examined to determine age of the sample, and 72.6% of 62 whole and fragmentary tibiae were from individuals over 20 years of age, while 27.4% were from individuals under 20 years of age. The remains exhibited a variety of pathological changes, postmortem amputation and dissection, and autopsy. Until 1887, dissection was illegal in the state of Georgia and therefore needed to be performed in secret. Grave robbing was the main source of cadavers for the school. The college hired a former slave, Grandison Harris, to steal bodies from cemeteries and bring them back to the school. Even after dissection was made legal, grave robbing persisted; however, bodies were also obtained from hospitals, funeral homes, and back alleys throughout Augusta. Like many of the anatomical sites from this period, majority of the remains from this site were from Black individuals. In fact, Black individuals made up 79% of this sample, even though the population of Black individuals in Augusta between 1840 and 1880 was 37% to 49% of the total population, respectively (Blakely and Harrington 1997). These remains exhibited pathological changes and postmortem trauma from autopsy, dissections, and amputations, which is the process of anatomization. The purpose of this research was to confirm that these individuals were once used as cadavers and to determine how these procedures were performed (Blakely and Harrington 1997).

Holden Chapel, Harvard, Massachusetts

In Massachusetts, a large anatomized collection was uncovered at Harvard University's Holden Chapel (Table 2.1). This building was built from 1742-1744 and

used as a place of worship, lecture space, barracks, storage facility, fire station, woodshop, and rehearsal space for the choir. Harvard Medical School was founded in 1783, and Holden Chapel became the program's sole home from 1801 to 1810. Until about 1850, this is where dissection, display, and some disposal of the cadavers took place. Much like the site at the Medical College of Georgia, these remains were found in the basement, specifically in a buried dry well. Within this dry well, excavators recovered fragmentary human remains, faunal remains, laboratory wares, personal artifacts, and chemical residues (Hodge 2013). The total number of artifacts and remains was 3,316, and they could be dated from the late 1700s to the mid-1800s (Hodge 2013). Although the human remains were commingled and fragmentary, the MNI could be calculated by tabulating the left tibia. It was determined that there were at least 11 individuals in the sample (Hodge 2013). This sample consisted of males and females, but the most of the remains were too fragmented to determine a sex. The majority of the individuals were adults. There were also at least two infants and one young adult. The population affinity of the individuals was unable to be determined (Hodge 2013). This collection of human remains was similar to those discussed in John Warren's, the founder of Harvard Medical School, lecture notes from October 1790. The faunal remains were used for comparative anatomy, which was standard in medical teaching by the early 1800s (Scialdone 2023).

Point San Jose, California

In the western US, approximately 4,000 fragments of anatomical human remains were discovered in San Francisco at the Point San Jose Site (Hart 2019; Table 2.1). Point San Jose was once known as Fort Mason, and the remains were discovered near the hospital building on the property. The MNI was estimated at 25 (Willey et al. 2018). Specifically, there were eight adult males, six adult females, two additional adults (sex unknown), one juvenile between 7-15 years old, one juvenile between 15-18 years old, three fetal, and four additional remains (sex and age unknown) (Hart 2019). Out of the skulls examined, five were deemed of Hispanic origin, and three skulls were estimated to be of Asian or Asian-related descent. The other two skulls were thought to be from White individuals. According to the 1870 California census, there was a large population of non-White individuals living in the state. Stable isotope analysis suggested that many of the individuals in the sample were from outside of Northern California, which had high proportions of immigrants and non-locals. Exhibition of skeletal and dental pathological changes within the remains were relatively low compared to other samples from the 1800s (Hart 2019). The purpose of this research was to examine the difference between autopsy, dissection, and other postmortem interventions (Hart 2019).

Dr. Thompson's Privy, Annapolis, Maryland

In Annapolis, Maryland, human remains of an MNI of two individuals were discovered in 1985 in an old outhouse, or privy, that once belonged to a physician, Dr. Frank Thompson (Table 2.1). Based on labeled ceramics found at the site, the

archaeologist dated the outhouse back to 1889. The human bones found, two partial femurs and a metacarpal, exhibited dissection marks and possible amputation marks (Mann et al. 1991). The femur fragments were likely from the same individual because of the similarity in size and morphology. Based on the muscle attachment sites on the femora, it is probable that the individual was female. In addition, the smooth surface, thickness, and size of the femora fragments suggested that they belonged to a young to middle-aged adult. The size of the metacarpal suggests that a second individual who was 9 to 12 years old was represented (Mann et al. 1991). The femora fragments exhibited antemortem inflammation along the surface. As seen in this instance, anatomized remains could be discarded in a highly informal way.

University of North Dakota

At the University of North Dakota, remains of an individual from the 19th or early 20th century were found near the president of the university's house in 2007 (Table 2.1). Much like the present project's sample, these remains were hit and fragmented by a backhoe (Stubblefield 2011). Rearticulation of the skeleton took place, and it was revealed that the pelvis, upper limbs, and shoulder girdles were missing. The skeleton also showed evidence of having gone through anatomization, including dissection marks, specifically those congruent with a sternotomy, craniotomy, and cutting of the temporal and frontal bones. In addition, a blue chalk substance, which most likely highlighted venous drainage locations, was discovered with the remains (Stubblefield 2011). Based on craniofacial traits, such as the nuchal area, mastoid process, brow ridge, and the size

of the postcranial bones, like the femoral heads, the individual was estimated to have been female. The age of the individual was estimated to be between 33 and 46 years old based on the fusing of the epiphyses and the sternal rib ends. The individual's stature was also estimated using the lengths of the left femur and tibia at 56.3-61.0 inches (Stubblefield 2011). *FORDISC* 3.1 (Jantz and Ousley 2005) was used to approximate the population affinity as Black. The Black population living in North Dakota was quite low; however, medical specimens were often created using the remains of targeted minorities. After the Civil War, shipping cadavers, mostly who were of Black descent, via the rail roads around the country to medical schools became common (Stubblefield 2011).

Newburgh Colored Burial Ground, New York

The 105 burials of the Newburgh Colored Burial Ground in New York, which dates back to 1830-1870, were rediscovered in 2008 during reconstruction of the Broadway School in Newburgh (Table 2.1). Nystrom (2011) performed a biological profile on one partially fragmented individual from the burial ground. To estimate age, the degree of epiphyseal fusion was analyzed, and it was concluded that the individual was a young adult. Sex was based on the cranial morphology and pelvic characteristics. This analysis revealed that the individual was most likely female. Population affinity was approximated by observing twelve craniofacial traits, and the results estimated Black population affinity (Nystrom 2011). The study did not mention if stature was determined. In addition, cut marks on the woman's calvaria were documented; however, it is uncertain whether they are from an autopsy to determine cause of death or a

dissection procedure for anatomical teaching (Nystrom 2011). There were no cut marks located on the post cranial elements. The individual had no signs of antemortem pathological changes besides several linear enamel hypoplasias and general poor dental health (Nystrom 2011).

Blockley Almshouse, Philadelphia, Pennsylvania

Across from the Blockley Almshouse in Philadelphia, Pennsylvania, there was a makeshift cemetery for human remains associated with the almshouse throughout the mid-to late 1800s (Crist et al. 2017; Table 2.1). Like the Winchester Site and the Medical College of Georgia Site, these remains, which were discovered in 2001 during construction, were also fragmented, commingled, and exhibited evidence of dissection. Crist et al. (2017) presented the demographic analysis of 248 of the individuals uncovered. The biological profile of these 248 individuals included 67% male, 30% female, and 3% indeterminate. Of these remains, 62% were estimated to be over 35 years old at death. Only 72 out of 248 individuals were able to be analyzed for population affinity, and 24% of this subset were estimated to have European population affinity. Four percent were deemed of being of African descent, and 2 individuals, or 1%, were estimated Asian or Native American population affinity (Crist et al. 2017). The remainder 71% of the sample were indeterminate. Forms of anatomization, including possible surgical procedures, dissection, and autopsy, were present on 67% of the 248 individuals of the Blockley Almshouse collection (Crist et al. 2017). These actions were seen essentially equally among both the males and females.

Somerville, Massachusetts

In Somerville, Massachusetts, remains of at least six individuals, who were anatomical cadavers, were discovered under a driveway, which was near an almshouse and several miles away from the Harvard main campus (Saul and Saul 1986; Table 2.1). Sawing trauma and trephinations exhibited on the bones indicated that these individuals were once used for anatomical teaching. These remains are thought to have dated back to the mid-1800s based on ceramic fragments and other laboratory glassware discovered alongside the remains. Two of these individuals was estimated as certain males, and the other four individuals were estimated to be ambiguous or probable females. The age at death of the sample ranged from late-stage fetus to 40+ years (Saul and Saul 1986). The population affinity or the stature of the individuals were not discussed by the authors. Several antemortem pathological changes, such as osteomyelitis, treponema, and Schmorl's nodes, could be seen on some of the elements (Saul and Saul 1986).

Medical College of Virginia

During the construction on the Medical College of Virginia campus at Virginia Commonwealth University in 1994, human remains, nonhuman remains, and other artifacts, such as medical and laboratory equipment, construction debris, and various fabrics, were discovered in a well (Owsley et al. 2017; Table 2.1). These remains and artifacts, which were dug out with a backhoe, date back to sometime between 1848 to 1860. Sources of these human remains included the nearby potter's field of Richmond, the Negro Burial Ground, the state penitentiary, and the medical school's infirmary. There was a minimum of 9 children under 14 years old and 44 adults found in this

commingled assemblage. Children were those who were estimated 14 years old and younger. Adults were those who were estimated 15 years old and older. These remains exhibited evidence of autopsy and dissection cuts from being used as teaching specimens in the VCU Medical School (Owsley et al. 2017). Sex was based on 26 complete and partial crania. Out of these crania, 65% were classified as male, 31% as female. and one (4%) as ambiguous. According to the population affinity estimation conducted on these crania, it was determined that 18 of them exhibited characteristics associated with an African population affinity. European population affinity was assigned to three of the crania, while the rest were indeterminate. Several of the crania had characteristics similar to those from continental Africa, not African Americans. Therefore, it was possible that these individuals were first generation Americans. The majority of the male crania were aged 35 years or older (Owsley et al. 2017). In addition to the remains being used for dissection and surgery practice, some of the remains exhibited metal hardware for anatomical display.

Albany County Almshouse Cemetery

The Albany County Almshouse cemetery, which was in operation from 1826 to 1926 was excavated in 2002 (Lowe 2017; Table 2.1). Grave robbing was evident on some of the coffins excavated in the cemetery. This excavation unearthed 1427 skeletons, of which 903 were subsequently examined for their biological profile. The interred individuals within the cemetery included residents from the almshouse, the nearby penitentiary, unclaimed bodies, like those from the rivers in the area, and people in the county who could not afford burial. Furthermore, many of these remains had been

used as cadavers by Albany Medical College before burial (Lowe 2017). These particular remains exhibited evidence of dissection saw marks. Pelvic characteristics and cranial morphology were examined to estimate sex of the remains. Out of 903 individuals, 441 were determined males, 283 were determined females, and 179 were determined ambiguous. Postmortem cuts, likely dissection marks from students of the Albany Medical College, were present on 30 out of 441 males, 15 out of 283 females, and 6 out of 179 ambiguous individuals (Lowe 2017). Dental eruption, tooth wear, and pelvis characteristics were analyzed to approximate age. Approximately 252 out of the 903 individuals studied could have been children under 13 years of age, while the rest were likely adults over 50. There were very few individuals in the sample between 13 and 19 years old. Population affinity and stature estimation of the assemblage were not discussed in the study (Lowe 2017).

Table 2.1. Comparison of the biological profiles of each anatomized site discussed in the text.

Site	Location	Date	MNI	Sex	Age	Population Affinity	Stature
Medical College of Georgia	Augusta, GA	Mid-1800s	62 adults; others not specified	Both men and women; 79.2% of 24 tibiae were males	Fetus to elderly	Mostly Black; some White	Not determined
Holden Chapel	Cambridge, MA	Late 1700s to mid-1800s	11	Both men and women	Infant to adult (majority being adult)	Not determined	Not determined
Point San Jose	San Francisco, CA	Early to mid-1870s	25	Both men and women	Fetal to Adult	5 Hispanic, 3 Asian/Asian related; 2 White	Not determined
Dr. Thompson's Privy	Annapolis, MD	Around 1889	2	1 individual likely female; other is unknown	One Young to middle aged-adult; one 9 to 12 years	Not determined	Not determined
University of North Dakota	Grand Forks, ND	19th or early 20th century	1	Female	33 to 46 years old	Black	56.3-61.0 inches
Newburgh Colored Burial Ground	Newburgh, NY	1830-1870	1	Female	Young adult	Black	Not determined

Site	Location	Date	MNI	Sex	Age	Population Affinity	Stature
Blockley Almshouse	Philadelphia, PA	Mid to late 1800s	248	67% were males; 30% were female; 3% were indeterminate	62% were older than about 35 years	24% of 72 people were European; 4% were African; and 1% were Asian/Native American population affinity	Not determined
Driveway in Somerville	Somerville, MA	Mid-1800s	6	2 male (33.3%); 4 ambiguous or prob. Female (66.7%)	Late stage fetus to 40s	Not determined	Not determined
Medical College of Virginia	Richmond, VA	1848 to 1860	53 (44 adults; 9 juvenile)	Out 26 crania, 65.0% were male and 31.0% were female; one individual was ambiguous	Majority of male crania were 35 years or older	18 out of 26 crania were African population affinity; 3 of the crania were European; the rest were indeterminate	Not determined
Albany County Almshouse Cemetery	Albany, NY	1826 to 1926	903	(441 (48.8% were males; 283 (31.3% were females; 179 (19.8%) were ambiguous)	Children to adults over 50 (about 252 out of 903 could have been children)	Not determined	Not determined

MATERIALS AND METHODS

The author analyzed only the adult human skeletal collection from the Winchester Site in Massachusetts (Figure 3.1). Some of these adult human remains had evidence of sawing trauma consistent with autopsy and dissection procedures and taphonomic and pathological changes (Mazza 2024; Swift 2024). For the purpose of this project, the author only focused on producing a biological profile of the adult remains found at the site, while other authors focused on trauma (Mazza 2024), taphonomy and pathology (Swift 2024), biological profile of the juveniles (Hill et al. n.d.), and nonhuman remains (Scialdone 2023). Initial inventory and organization began during January of 2022. During this organization, remains were separated and categorized as adult, juvenile, or nonhuman (Table 3.1). A more exhaustive inventory took place during May through August of 2022, in which remains were classified by element type. After reconstructing the fragments as much as possible using Duco ™ cement, the total amount of identified and unidentified adult remains is 14,469. Identified, or known, fragments are those that were able to be assigned to a particular bone type, while unidentified, or unknown, were not able to be assigned to a particular bone type, although they were determined to be from an adult individual based on bone formation characteristics, like porosity. Known whole and partial adult fragments make up 13,459, while unknown fragments of adult elements are 1,010. Besides the juvenile and nonhuman remains not discussed in this study, there was an estimated ~10,000 small fragments that were unable to be discerned between adult, juvenile, and possible unidentifiable nonhuman remains and are not included in the above counts.

Figure 3.1. A sample of remains, including those from the long bones, sterna, vertebrae, and crania, from the Winchester Site, Massachusetts.

NISP, MNI, and MNE

The number of identified specimens, or NISP, was calculated by totaling every complete bone and fragment together. The minimum number of individuals (MNI) was calculated for these commingled remains. The MNI is the minimum number of individuals present in an assemblage depending on the maximum minimum number of elements (MNE) of the most numerous bone taking into consideration the portion of

bone, side, etc. The MNE of a bone can be determined by several different methods. For long bones, an element was counted as one individual if it had either the proximal end and the shaft, the distal end and the shaft, or the entire midshaft. This allowed for a comprehensive count of long bones without double counting due to a lack of possible overlap. For cranial elements, only elements considered whole, such as a whole parietal, were included in the MNE calculation.

The MNEs for each vertebra type were established by adding all of the complete vertebrae and complete centra. In addition, whole isolated dens of the 2nd cervical vertebra were counted for the MNE of the cervical vertebrae. For the hyoid, those that were whole, the body and at least half of a greater horn, or isolated bodies were counted toward the element's MNE. The author determined the innominate MNE by counting the whole or almost whole innominates and all the isolated pubic symphyses. Determining the MNE for the sacra was completed by adding all of the whole or almost whole sacra together. Complete elements were counted to develop the MNE for the patellae. The MNE for the metacarpals and metatarsals was established by adding those in the complete, nearly complete, and proximal end plus shaft categories together. The MNEs for the carpals and tarsals were estimated by counting the whole and almost whole elements.

For some elements, the MNE was unable to be determined. For instance, the ribs and the sterna were too degraded and fragmented to isolate singular elements in most cases. Furthermore, there were no MNEs calculated for the hand and feet phalanges, because they were unable to be put into right and left categories. There was no MNE

calculated for the dentition, because the teeth were categorized into incisors, canines, premolars, or molars.

Measurements

A Paleo-Tech Concepts osteometric board was used for measuring the bones of the adults in the collection, particularly for stature estimation. The stature estimations depended on the lengths of individual long bones. The methods for measuring these elements followed Buikstra and Ubelaker (1994).

Scoring, Software, and Statistics

As mentioned above, the principal purpose of this research was to construct the overall biological profile for the adult remains in this collection. The majority of methods that were used for this analysis utilized characteristic scoring systems following Buikstra and Ubelaker (1994).

Microsoft Office Excel was used to determine sex ratios of several of the past anatomized sites and the Winchester site. These sex ratios were also researched for the population of Middlesex County, Massachusetts in 1850 and the populations in Massachusetts' poorhouses, penitentiaries, jails, and houses of correction in 1850.

The *FORDISC* 3.1 (Jantz and Ousley 2005) program was used to perform statistical analyses. *FORDISC* 3.1 (Jantz and Ousley 2005) analyzes measurements of skeletal remains and produces a statistical classification of an individual's sex, population affinity, and stature.

Social Science Statistics, a statistical website (www.socscistatistics.com), was used to determine the correlation and significance between the sex proportions of the adult remains of the Winchester site and the sex proportions of multiple other anatomized sites and sex proportions of Middlesex County, Massachusetts in 1850. In addition, the significance of the populations in Massachusetts' poorhouses, penitentiaries, jails, and houses of correction in 1850 were compared to the sex proportions of the Winchester site adult remains. Social Science Statistics (www.socscistatistics.com) was also used to determine the correlation between the age proportions of the adult, juvenile, and fetal remains of the Winchester site and the age proportions of past anatomical sites. For both sex proportions and age proportions, chi-square tests were conducted to determine significance.

Table 3.1. Total amount of adult human remains from the Winchester Site in Massachusetts.

	Not Sawn	**Sawn**	**Total**
Adult	13,104	1,365	14,469
Juvenile	648	67	715
Faunal	1,431	13	1,444
Total	15,183	1,445	16,628

Sex Estimation

Postcranial Sex Estimation

Methods for estimating the sex of an individual followed Buikstra and Ubelaker (2004), Phenice (1969), Rogers et al. (2000), Vance et al. (2011), and Walker (2005, 2008). The Phenice method examines the ventral arc, sub-pubic concavity, and ischio-pubic ramus in order to estimate sex of the pelvis (Phenice 1969). These three features were given a score of 1 through 3. If the feature had female characteristics, it received the score of 1. If the feature had male characteristics, it received the score of 3. A score of 2 was assigned to those features that were indeterminate.

Similar to the Phenice (1969) method, the greater sciatic notch of the pelvis was scored based on shape (Walker 2005). This method classified the notch into male and female categories. Those scored as a 1 or 2 were estimated to be female, although, according to Walker (2005), a score of 2 was assigned to many male os coxae. Those scored a 3 through 5 were estimated to be male. Based on Walker's (2005) research, this method was useful for fragmentary elements, as the greater sciatic notch was often preserved even on heavily fragmented innominates. The preauricular sulcus was also examined based on Buikstra and Ubelaker (1994); however, instead of scoring it 1 through 4, the author gave each preauricular sulcus a score of 0 or 1. A score of 0 meant that the sulcus was absent, and therefore, the individual was likely male. If given a score of 1, this meant that the sulcus was present in some form, which meant the individual was likely female.

In addition, the presence of the rhomboid fossa of the clavicle was used to estimate sex (Rogers et al. 2000). If a rhomboid fossa, or a depression, was present, it received a score of 1. This meant it was most likely the clavicle from a male individual. A rhomboid fossa often appears in men because of the prominence of the costoclavicular ligament attachment from the clavicle to the first rib (Rogers et al. 2000). If the rhomboid fossa was absent, it received a score of 0. This meant the clavicle was deemed indeterminate for sex estimation, because one cannot be certain that the individual was not male and just lacked a pronounced ligament attachment.

Nonmetric analysis and scoring of the distal humeri, specifically the olecranon fossa shape, angle of the medial epicondyle, and the trochlear extension, was an important technique to use, since the majority of the long bones in the collection were fragmented (Vance et al. 2011). Individually, the olecranon fossa shape, the angle of the medial epicondyle, and the trochlear extension were given a score of 1 through 5. Much like the greater sciatic notch scoring, a score of 1 meant that the characteristic was extremely male, while a score of 5 meant that the characteristic was extremely female. A score of 2 meant probable male, and a score of 4 meant probable female. This "probable male" or "probable female" meant that the characteristic being assessed was leaning towards one sex, but it was not blatantly one sex or the other. The feature received a score of 3 if the trait was ambiguous, which meant it could not be determined male or female. After each feature was scored, these scores were added up to create an overall score. If the total score was 3 through 8, the individual was likely male. A total score of 9 meant that the individual was ambiguous. If the total score was 10 through 15, the

individual was likely female. The three characteristics combined are accurate sex determiners, but not when they are assessed individually. Unlike in the Vance et al. (2011) research which only observed left humeri, in the present research both the right and left humeri were scored.

Cranial Sex Estimation

The cranial traits of the skulls were scored. These cranial traits included the nuchal crest, mastoid processes, glabella/supraorbital area, supraorbital margins, and mental eminence (Walker 2008). Each of these features received a score of 1 through 5. A score of 1 meant extremely female, 2 meant probable female, 3 was ambiguous, 4 was probable male, and 5 was extremely male. If multiple traits were able to be scored, they were then inputted into Walker's (2008) discriminant function equations that produced a percentage ratio of the likelihood that the features were from a female or male individual. Univariate statistical analysis has shown that the mastoid process and the glabellar area are the best sex determiners. When applied to a highly fragmentary sample, this method was limited in its effectiveness. This was because the Walker (2008) equations needed certain traits to be present, and since many of these traits were missing, numerous crania in the sample lacked enough traits to produce an output from the available equations. Isolated portions displaying only one trait were analyzed using Table 5 from Walker (2008), which provided a probability for a sex estimate.

Age Estimation

Methodologies for estimating the age of an individual followed Brooks and Suchey (1990). The Suchey-Brooks method was used to score the os pubis of the pelvis (Brooks and Suchey 1990). This method examined the presence or lack of billowing on the symphyseal face of the pubis and categorized them into six phases. If sex estimation could not be determined, the age estimations for both sexes were combined for a given pubic bone. If the majority of the pubic symphysis was not intact or visible, then the author did not score the element for age estimation. Some pubic symphyses that had minor damage received two phases (i.e., 2 or 3, etc.). Sternal rib end analysis was considered; however, it was impossible to isolate the fourth ribs from the sample due to the abundant fragmentation and commingling of all of the ribs (İşcan et al. 1984, 1985).

Population Affinity Estimation

Estimation of population affinity was performed using methods from the studies by Hefner (2009), Hefner and Ousley (2014), and Hefner and Linde (2018). The technique used in this research was the scoring of seventeen cranial nonmetric traits. These traits being observed include the (1) anterior nasal spine, (2) inferior nasal aperture, (3) interorbital breadth, (4) malar tubercles, (5) nasal aperture width, (6) nasal bone contour, (7) nasal overgrowth, (8) post-bregmatic depression, (9) supranasal suture, (10) transverse palatine suture, (11) zygomaticomaxillary suture, (12) nasal aperture shape, (13) nasal bone shape, (14) nasofrontal suture, (15) orbital shape, (16) palate shape, and (17) posterior zygomatic tubercle. For this analysis, the presence, size, and

shape of the features were examined. Hefner and Linde (2018) provides further description of each of the macromorphoscopic, or cranial nonmetric traits. In order to classify the population affinity of the skulls, discriminant functions were calculated (Hefner and Ousley 2014). After the author scored the cranial traits, a website application by Osteomics (www.osteomics.com/hefneR) was used to produce population affinity percentages by taking the scores of the first eleven cranial traits previously mentioned and produces percentages of population affinity (African, Native American, Asian, and European populations). While this database compares four populations, it is best used for distinguishing between Black, White, and Asian-derived individuals, because Asian and Native American populations are so closely related (Hefner 2009; Hefner and Ousley 2014; Hefner and Linde 2018). The remaining six cranial characteristics were not used in the analysis or estimation of population affinity.

Stature Estimation

In the present research, only the overall stature profiles per given long bone of the adult Winchester collection were computed. Because the remains were commingled, the author was unable to discern which long bones belonged to any specific individual. The maximum length of the complete humeri, ulnae, radii, femora, tibiae, and fibulae was measured using an osteometric board, and the femoral bicondylar length also was measured. Each measurement was then entered into *FORDISC* 3.1 (Jantz and Ousley 2005) to estimate the stature of an individual based on that bone. The dataset used for comparison was the 19th Century Stats, along with "Any" sex and ancestry population.

For each bone, the point estimate was derived along with the 95% confidence interval. To determine the general populational stature based on each long bone type, the lowest and highest point estimates for each element were used to calculate a confidence interval for the mean. A 95% confidence interval was determined, providing a range within which one can be 95% confidence that the true population stature falls, while accounting for the standard deviation.

RESULTS

Skeletal Inventory

Within the Winchester sample, there was evidence of all 206 elements of the adult human body, as well as dentition, sesamoids, and ossified cartilage. The NISP of adult remains was 14,469.

Representation

Cranial and postcranial remains comprised the collection of the adult remains in differing percentages. Out of the adult remains, 16.3% of 14,469 were cranial with dentition, while 75.7% were postcranial. Unknown adult remains that could not be differentiated between cranial and postcranial made up 7.0%, and ossified cartilage (throat, intercostal, etc.) made up 1.0%.

In addition, representation of the specific areas of the body within the sample was also analyzed. The axial skeleton, which includes the skull, vertebral column, ribs, sternum, and hyoid, was comprised of 62.6% of the total 14,469 adult remains. The appendicular skeleton, which includes the upper limbs, lower limbs, pectoral girdle, and pelvic girdle, made up 26.4% of the total 14,469 adult remains. This could be broken down further into skull, torso, upper limbs, and lower limbs. The torso includes the hyoid, scapulae, clavicles, vertebral column, sternum, ribs, sacrum, coccyx, and pelvis. This area of the body contributed 55.6% of the 14,469 adult remains. The upper limbs made up 8.0% of the sample, while the lower limbs were 12.1% of the total 14,469 remains.

Specific Element Inventory

These remains occurred in a varying state of fragmentation ranging from pieces smaller than 2 cm to complete bones. Representation ranged from the vertebrae (15.8%), crania (13.3%), and innominates (3.8%) having the highest percentages to the coccyx (0.2%), patellae (0.4%), clavicles (0.5%), and hyoid (0.5%) having the lowest percentages. Those data, along with those pertaining to other bones can be found in Table 4.1 and Table A.1. in the Appendix, which breaks down fragmentation by bone and area of the bone.

Table 4.1. Representation of adult human remains from the Winchester Site, Massachusetts.

Element	NISP	%
Cranial/fragments	1,923	13.1
Dentition	441	3.0
Vertebrae	2,237	15.8
Hyoid fragments	71	0.5
Innominates	557	3.8
Sacrum	194	1.3
Coccyx	35	0.2
Scapulae	288	2.0
Clavicles	67	0.5
Humerus	121	0.8
Ulna	94	0.7
Radius	83	0.6
Femur	216	1.5
Tibia	213	1.5
Fibula	123	0.9
Patella	55	0.4
Carpals	214	1.5
Metacarpals	153	1.1
Hand phalanges	481	3.4
Tarsal elements	332	2.5
Metatarsals	243	1.8
Feet phalanges	509	3.5

MNE and MNI

In addition to the NISP, the MNE and MNI were determined for each element (Table A.1). The elements with the highest MNE were the femora (n=35), os coxae (n=33), calcanei (n=33), and tibiae (n=30). The MNI for the adult remains was 35. This was calculated based on the number of (left) femurs in the sample. There was a possible maximum of 39 reconstructed crania; however, it was impossible to determine the efficacy of reconstruction because of the severe fragmentation among the remains. According to Hill et al. (n.d.), the MNI of fetal individuals was 7. In addition, the MNI

of juveniles was 2 (Hill et al. n.d.), for a total MNI of 44 individuals within the Winchester sample.

Sex Estimation

Postcranial Sex Estimation

The author was able to observe and score 40 out of 43 pubic symphyses following the research of Phenice (1969). Of these, 60.5% were estimated male or probable male, 23.7% were estimated female or probable female, and 15.9% were ambiguous. As for the greater sciatic notch and the preauricular sulcus of the pelvis, 51 were analyzed following the research of Walker (2005). Out of those, 58.8% were estimated male or probable male, 31.4% were estimated female or probable female, and 9.8% were ambiguous. According to Walker (2005), os coxae that scored a 3 through 5 had a 90% chance of being male, and those os coxae scored a 1 had a 90% chance of being female. In addition, 34% of those os coxae that received a score of 2 were female (Walker 2005).

Regarding the humerus, the olecranon fossa shape, angle of medial epicondyle, and trochlear extension of the humerus were observed (Vance et al. 2011); 28 humeri were examined and scored based on these characteristics. Seven (25.0%) of the humeri were unable to be included because they lacked all three traits due to poor bone preservation. Of these 21 scorable humeri, 10 or 47.6% were estimated male, 7 or 33.3% were estimated female, and 4 or 19.1% were ambiguous. According to Vance et al. (2011), this method has an accuracy 75.5% when determining the correct sex of an

individual. Specifically, there is a 74% accuracy rate for males and a 77% accuracy rate for females (Vance et al. 2011).

The presence of rhomboid fossae on the clavicles were examined following the research of Rogers et al. (2000). Out of 52 clavicles examined, 42 could be scored. Of these 42 clavicles, 35 or 83.3% lacked rhomboid fossae and were indeterminate regarding sex, while 7 or 16.7% were estimated as male, because a rhomboid fossa was present. According to Rogers et al. (2000), if there is no fossa present on the left or right clavicle, there is about a 40% chance that the individual is male and a 60% chance that the individual is female. In addition, age has an effect on the presence of a rhomboid fossa. Younger individuals are more likely to display a rhomboid fossa (Rogers et al. 2000).

Cranial Sex Estimation

In addition, the author examined cranial portions that included the nuchal crest, mastoid processes, supra-orbital margins, mental eminence and/or glabella (Walker 2008). Only 11 out of the 39 fragmented crania observed and scored provided enough traits to be used in the Walker (2008) equations; 15 isolated mastoid processes were scored and compared to results in Walker (2008:Table 5) that presents a sex probability for isolated cranial traits. Based on the assigned score of 3, three out of the 15 isolated mastoid processes, or 20%, were estimated as males. According to Walker (2008), those with a score of 3 had a 74% chance of being male. The remaining 12 isolated mastoid processes, or 80%, were given a score of one (5) and two (7) and were estimated as females. Based on Walker (2008), a score of 1 meant the mastoid process had an 88%

chance of being female, and a score of 2 meant the mastoid process had a 61% chance of being female. Much like these isolated mastoid processes, 12 isolated mandibles were scored based on the mental eminence and were also compared to Walker (2008:Table 5). Of these 12 mental eminences, six were estimated as male, and six were estimated as female. According to Walker (2008), the most accurate sex discriminators of the cranium are the mastoid processes and glabella. The worst sex discriminators are the nuchal area and the supraorbital margins (Walker 2008). Of the 11 out of 39 fragmented crania, six, or 54.5%, were classified as female, and five, or 45.5%, were classified as male.

Based on the outcomes of the most available, and therefore more accurate, sex estimation techniques observing regions of the os coxae and humeri, the author concluded that the majority of the adult remains found at the Winchester Site were likely male.

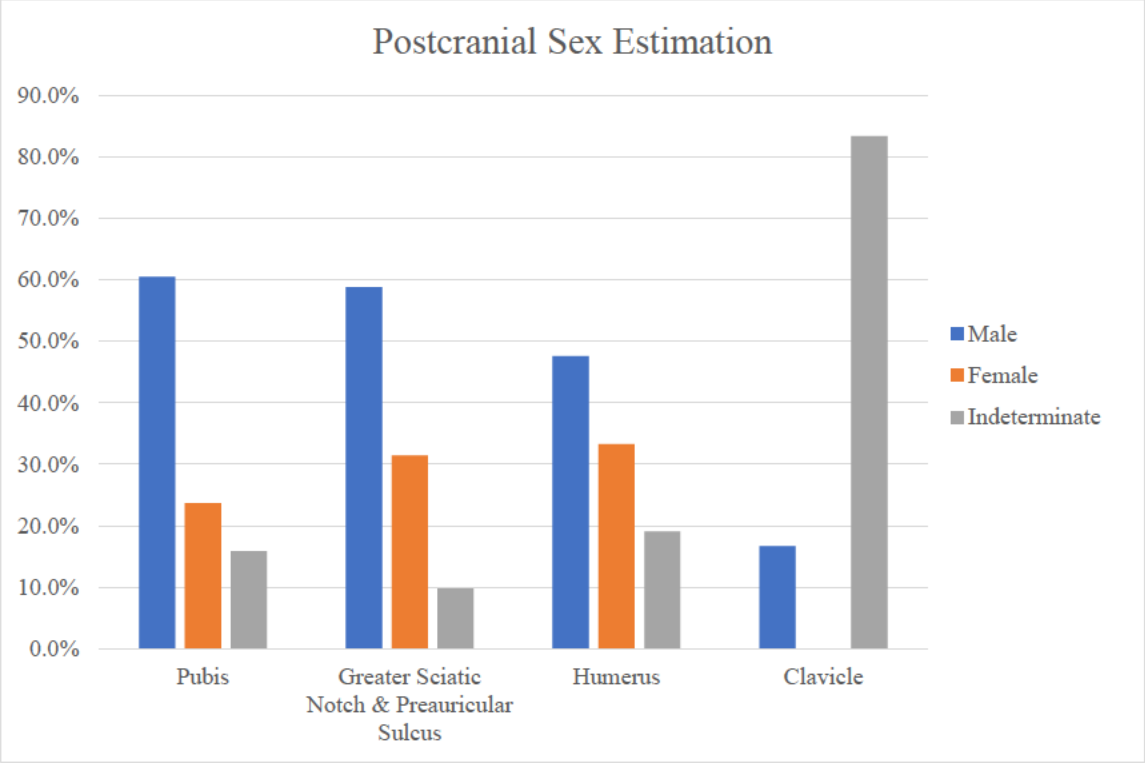

Figure 4.1. The percentages of male and female individuals determined by postcranial sex estimation methods of the pubis, greater sciatic notch and preauricular sulcus, humerus, and clavicle, from the Winchester Site in Massachusetts.

Statistics for Sex Estimation

The adult males and females of the Winchester site, based on the results of the pubic symphyses analysis, were statistically compared to those in several of the previously studied anatomization sites and other populations in Massachusetts during the mid-1800s and early 1900s. Chi-square tests were performed to determine significance and dependency among the samples. In addition, sex proportion ratios of the Winchester site and several of the previously studied sites were determined (Table 4.2).

A comparison of sex proportions between the Winchester site and the Medical College of Georgia (n=19 males, 5 females) produced a chi-square statistic of 0.311 with a p-value of 0.577097. After applying the Yates correction, the chi-square statistic reduced to 0.0605, and the p-value increased to 0.805672. These results indicate no significant difference between the samples at the $\alpha=0.05$ level. A similar analysis between the Winchester site and the Point San Jose site (n=4.5 males, 3.36 females) resulted in a chi-square statistic of 0.6679 and a p-value of 0.413783. With the Yates correction, the chi-square statistic became 0.1319, and the p-value rose to 0.716438, again indicating no significance at the $\alpha=0.05$ level. When comparing the Winchester site and the Blockley Almshouse (n=166.16 males, 74.4 females), the chi-square statistic was 0.1738 with a p-value of 0.676737. Applying the Yates correction resulted in a chi-square statistic of 0.0463, with the p-value rising to 0.82968, indicating a lack of statistical significance. Examining sex proportions between the Winchester site and the Medical College of Virginia (n=16.9 males, 8.06 females) yielded a chi-square statistic of 0.1534 and a p-value of 0.695292. After the Yates correction, the chi-square statistic was 0.0101, and the p-value increased to 0.920002. Therefore, the comparison is not statistically significant.

In contrast, when comparing sex proportions between the Winchester site and the 1850 Middlesex County Census (n=77,286 males, 84,097 females), the chi-square statistic was 8.1559, and the p-value was 0.004292. The Yates correction resulted in a chi-square statistic of 7.191 and a p-value of 0.007327, indicating significance at the $\alpha=0.05$ level. A comparison with the 1850 Massachusetts Census of the poorhouses

(n=1,990 males, 1,722 females) produced a chi-square statistic of 4.8092 and a p-value of 0.028308. The Yates-corrected chi-square statistic was 4.0709, and the p-value was 0.043629, demonstrating statistical significance. Finally, comparing sex proportions between the Winchester site and Massachusetts jails and correction houses (n=978 males, 237 females) during 1850 yielded a chi-square statistic of 1.2245 with a p-value of 0.268479. With the Yates correction, the chi-square statistic was 0.7829, and the p-value was 0.376248, showing no significance at the α=0.05 level.

Table 4.2. Ratios of the sex proportions from the Winchester Site, Massachusetts and previously studied anatomized sites.

Site	Sex Proportion Ratio (Males to Females)
Point San Jose	1.34:1
Medical College of Virginia	2.1:1
Blockley Almshouse	2.23:1
Winchester	2.6:1
Medical College of Georgia	3.8:1

Age Estimation

Not only used for sex estimation, the pubic symphysis was also used to estimate age of the adult remains (Brooks and Suchey 1990). Unlike for sex estimation, the author observed and scored 44 of the pubic symphyses for age (Table 4.3). The scoring system

(Brooks and Suchey 1990) goes from phase 1 to phase 6. The majority of the pubic symphyses were scored a phase 4. Out of all 44, the total age range was 15 to 87 years old based on the all-encompassing age intervals presented by Brooks and Suchey (1990); however, the average age of death was 23 to 45 years old, which was based on the averages provided by Brooks and Suchey (1990).

Table 4.3. Summary results of the pubic symphyses observed and their assigned age score from the Winchester Site, Massachusetts.

Pubic Symphysis #	Side	Sex Estimation	Age Score	Age Range in Years Suchey and Brooks (1990)
PS-1	L	unknown	4	23-70 (avg. 35.1-38.2)
PS-2	L	male	5	27-66 (avg. 45.6)
PS-3	L	male	4	23-57 (avg. 35.2)
PS-4	L	male	3	21-46 (avg. 28.7)
PS-5	L	female	4	26-70 (avg. 38.2)
PS-6	L	indeterminate	4	23-70
PS-7	L	female	5	25-83 (avg. 48.1)
PS-8	L	male	3	21-46 (avg. 28.7)
PS-9	L	male	2 to 4	19-57 (avg. 23.4-35.2)
PS-10	L	prob male	6	34-86 (avg. 61.2)
PS-13	L	male	4	23-57 (avg. 35.2)
PS-14	L	male	2 to 4	19-57 (avg. 23.4-35.2)
PS-15	L	indeterminate	4	23-70 (avg. 35.1-38.2)
PS-16	L	female	5 to 6	25-87 (avg. 48.1-60.0)
PS-17	L	male	1 to 2	15-34 (avg.18.5-23.4)
PS-18 (F1-25)	L	female	3 to 4	21-70 (avg. 30.7-38.2)
PS-19	R	male	4	23-57 (avg. 35.2)
PS-20	R	indeterminate, prob male	4 or 5	23-66 (avg. 35.2-45.6)
PS-21	R	male	1	15-23 (avg. 18.5)
PS-22	R	indeterminate	n/a	
PS-23	R	female	6	42-87 (avg. 60.0)
PS-24	R	female	n/a	
PS-25	R	female	6	42-87 (avg. 60.0)
PS-26	R	female	1	15-24 (avg. 19.4)
PS-27	R	male	4 or above	23-86 (avg. 35.2-61.2)

Pubic Symphysis #	Side	Sex Estimation	Age Score	Age Range in Years Suchey and Brooks (1990)
PS-28	R	indeterminate	2-5	19-87
PS-29	R	prob female	4	26-70 (avg.38.2)
PS-30	R	indeterminate, prob male	6	34-86 (avg. 61.2)
PS-31	R	male	4	23-57 (avg. 35.2)
PS-32	R	male	2-5	19-66 (avg. 23.4-45.6)
PS-33	R	prob male	2 to 3	19-46 (avg. 23.4-28.7)
PS-34	R	male	5	27-66 (avg. 45.6)
PS-35	R	male	3 to 5	21-66 (avg. 28.7-45.6)
PS-36	R	male	5	27-66 (avg. 45.6)
PS-38 (F1-47)	R	male	5	27-66 (avg. 45.6)
PS-39	L	male	4	23-57 (avg. 35.2)
PS-40	L	male	4	23-57 (avg. 35.2)
PS-41	R	male	5	27-66 (avg. 45.6)
P-1 (SAWN)	L	indeterminate, prob female	4	26-70 (avg. 38.2)
P-2 (SAWN)	L	male	4	23-57 (avg. 35.2)
P-15 (SAWN)	R	indeterminate	4	23-70 (avg. 35.2-38.2)
PS-1	L	n/a	4	23-70 (avg. 35.1-38.2)
PS-2	L	male	5	27-66 (avg. 45.6)
PS-3	L	male	4	23-57 (avg. 35.2)
PS-4	L	male	3	21-46 (avg. 28.7)

Statistics for Age Estimation

The proportions of adults, juveniles, and fetal individuals of the Winchester site (adult=35, juvenile=2, fetal=7) were statistically compared to those in multiple previously studied sites. Chi-square tests were performed to determine significance and dependency among the samples.

Comparison between the adult, juvenile, and fetal age proportions of the Winchester site and the Point San Jose site (adult=16, juvenile=2, fetal=3) produced a chi-square statistic of 0.6173 and a p-value of 0.734454. A Yates correction for these

results was not able to be calculated, because three categories were being compared. These samples are not significantly different at $\propto$=0.05. When comparing the age proportions of the Winchester site to the Medical College of Georgia, only the number of individuals for the adult and juvenile categories were compared, because the number of fetal remains (if any) were not provided. The test between the Winchester site and the Medical College of Georgia site (adult=45, juvenile=17) produced a chi-square statistic of 7.2407 and a p-value of 0.007127. Considering the Yates correction, the chi-square statistic is 5.8908 and the p-value is 0.01522 at the α=0.05, which means these samples are statistically significantly different.

Like the Medical College of Georgia, the Medical College of Virginia only provided the number of adult and juvenile individuals. When comparing the proportions of adults and juveniles of the Winchester site to those of the Medical College of Virginia (adult=44, juvenile=9), the chi-square statistic was determined to be 2.7214 with a p-value of 0.099009. The chi-square statistic with Yates correction is 1.7494 and the p-value is 0.185953, which is not significant at the α=0.05 level. The age proportions between adults and juveniles from the Winchester site and the Holden Chapel site (adult=9, juvenile=2) had a chi-square statistic of 1.8119 and a p-value of 0.178277. With the Yates correction, the chi-square statistic is 0.5254 and the p-value is 0.468568 at the α=0.05 level. Therefore, the comparison is not significant.

A statistical analysis comparing the Winchester site age proportions to the age proportions presented in the 1850 Census of Middlesex County (U.S. Census Bureau 1850) was unable to be performed. This is because, unlike the Winchester site data, the

age categories in the census were separated by the population affinities of White and "Free Colored".

Population Affinity

In order to determine the ratios of African, Native American, Asian, and European descent, 70 partial crania or cranial fragments were analyzed and scored based on the research of Hefner (2009) (Table 4.4). Out of the total of 70 partial crania or cranial fragments examined, only 20 display sufficient data or observable traits to enable a statistical analysis that produced an output that represented the majority, such as a cranial fragment having a 51% chance of being from an European individual, while the other 49% was divided among African descent, Native American descent, or Asian descent. These 20 partial crania or cranial fragments ranged from having 1 to 7 cranial traits that were scorable. The average number of traits available for scoring was 3.35.

Of these 20 specimens, 35.0% were classified as European descent, 35.0% were classified as Asian descent, 20.0% were classified as African descent, and 10.0% were classified as Native American descent (Figure 4.2). It is important to note that these results should be approached with caution due to the nature of the fragmentation and lack of accurate association of these cranial elements. Only two individuals had seven traits that were scorable. One of these individuals was estimated to be Asian descent and the other was estimated to be European descent.

Table 4.4. Reconstructed crania and cranial fragments and their corresponding population affinity proportions from the Winchester Site, Massachusetts. Percentages in bold point out chances of population affinity over 50%.

Cranial # (# of traits compared)	African	American Indian	Asian	European
Bag 4 (1)	16.4%	29.2%	28.4%	26.0%
Bag 5 (1)	16.4%	29.2%	28.4%	26.0%
Bag 11 (1)	16.4%	29.2%	28.4%	26.0%
F1-17 (3)	13.2%	20.8%	**51.9%**	14.1%
F1-26 (7)	4.7%	27.3%	**65.8%**	2.2%
F1-27 (5)	8.4%	**61.9%**	16.4%	13.6%
F1-30 (2)	15.5%	27.6%	26.3%	30.7%
F1-36 (4)	8.4%	**50.2%**	34.6%	6.7%
F1-52 (2)	15.5%	27.6%	26.3%	30.7%
F1-31 (3)	20.6%	33.8%	28.4%	17.2%
CF-1 (3)	14.0%	28.5%	**52.2%**	5.4%
CF-2 (1)	23.1%	28.4%	20.9%	27.6%
CF-3 (2)	29.6%	22.9%	37.3%	10.2%
CF-4 (0)	n/a	n/a	n/a	n/a
Bag 9 (1)	27.2%	22.0%	23.0%	27.7%
CF-5 (2)	19.1%	22.7%	34.1%	24.1%
CF-6 (2)	29.6%	22.9%	37.3%	10.2%
CF-7 (2)	19.4%	32.3%	21.2%	27.1%
CF-8 (2)	26.6%	13.4%	28.3%	31.6%
CF-9 (2)	37.9%	17.4%	33.3%	11.4%
CF-10 (2)	24.4%	31.2%	20.0%	24.4%
CF-11 (1)	21.1%	28.7%	25.5%	24.7%
CF-12 (2)	13.9%	38.9%	27.2%	19.9%
CF-13 (SAWN) (3)	6.6%	0.8%	3.7%	**89.0%**
CF-14 (1)	13.0%	34.2%	38.4%	14.4%
CF-15 (F1-35) (2)	15.7%	18.7%	3.1%	**62.5%**
CF-16 (F1-30) (1)	18.1%	20.3%	5.5%	**56.1%**
CF-17 (1)	13.0%	34.2%	38.4%	14.4%
CF-18 (3)	8.6%	45.8%	35.7%	9.9%
CF-19 (1)	39.3%	32.6%	23.5%	4.6%
CF-20 (2)	15.7%	18.7%	3.1%	**62.5%**
CF-21 (1)	13.0%	34.2%	38.4%	14.4%
CF-22 (2)	41.2%	36.3%	16.3%	6.2%
CF-23 (1)	39.3%	32.6%	23.5%	4.6%
CF-24 (1)	18.1%	20.3%	5.5%	**56.1%**
CF-25 (1)	13.0%	34.2%	38.4%	14.4%
CF-26 (F1-41) (3)	8.6%	45.8%	35.7%	9.9%
CF-27 (F1-41) (3)	7.4%	36.1%	**53.2%**	3.4%
F1-40 (SAWN) (1)	16.4%	29.2%	28.4%	26.0%
F1-29 (SAWN) (4)	15.9%	14.2%	**64.9%**	5.0%
Bag 9 (SAWN) (3)	12.0%	31.6%	45.3%	11.1%
F1-38 (SAWN) (7)	0.3%	0.02%	0.1%	**99.7%**
F1-39 (SAWN) (4)	**60.4%**	8.6%	6.1%	24.9%
F1-44 (SAWN) (1)	16.4%	29.2%	28.4%	26.0%

Cranial # (# of traits compared)	African	American Indian	Asian	European
F1-51 (SAWN) (0)	n/a	n/a	n/a	n/a
F1-57 (SAWN) (3)	26.3%	16.0%	**51.0%**	6.7%
F-28 (SAWN) (0)	n/a	n/a	n/a	n/a
F-49 (SAWN) (1)	16.4%	29.2%	28.4%	26.0%
BAG 6 (SAWN) (1)	**58.5%**	8.7%	11.9%	20.9%
F-37 (SAWN) (1)	16.4%	29.2%	28.4%	26.0%
F1-43 (SAWN) (3)	**53.1%**	27.4%	14.8%	4.7%
BAG 10 (SAWN) (1)	16.4%	29.2%	28.4%	26.0%
F1-34 (SAWN) (6)	3.9%	0.1%	2.3%	**93.7%**
BAG 8 (2/9, SAWN) (2)	13.9%	38.9%	27.2%	19.9%
BAG 8 (7/9, SAWN) (2)	7.6%	38.0%	47.6%	6.8%
BAG 8 (8/9, SAWN) (1)	23.6%	23.7%	23.2%	29.5%
F1-28 (SAWN) (1)	18.6%	24.6%	41.0%	15.8%
CR 11 (SAWN) (1)	18.6%	24.6%	41.0%	15.8%
CR-12 (SAWN) (2)	25.3%	28.3%	24.6%	21.8%
CR-13 (SAWN) (2)	25.3%	28.3%	24.6%	21.8%
CR-14 (SAWN) (2)	**69.3%**	12.2%	9.4%	9.1%
CR-16 (SAWN) (2)	19.1%	28.2%	41.6%	11.1%
CR-17 (SAWN) (1)	33.4%	26.8%	9.4%	30.4%
CR-18 (SAWN) (1)	33.4%	26.8%	9.4%	30.4%
CR-21 (SAWN) (1)	33.4%	26.8%	9.4%	30.4%
CR-23 (SAWN) (1)	33.4%	26.8%	9.4%	30.4%
CR-24 (SAWN) (1)	23.6%	23.7%	23.2%	29.5%
CR-84 (SAWN) (3)	14.0%	28.5%	**52.2%**	5.4%
CR-92 (SAWN) (1)	13.0%	34.2%	38.4%	14.4%
BAG 12 (SAWN) (0)	n/a	n/a	n/a	n/a

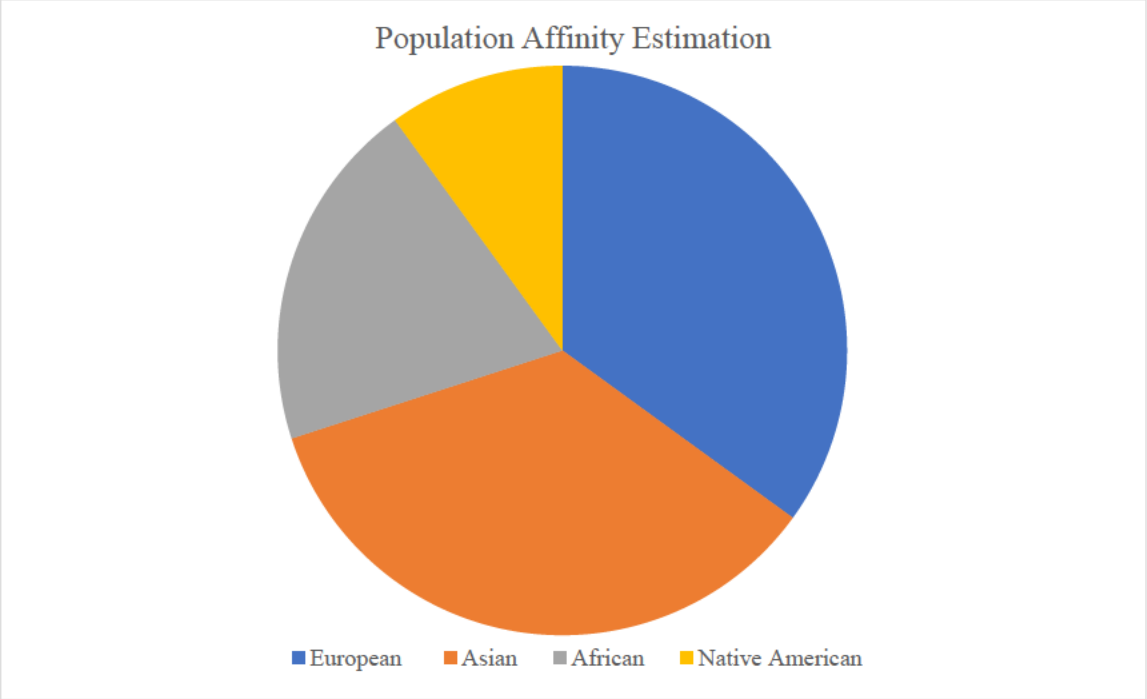

Figure 4.2. The percentage of population affinity populations via population affinity estimation of cranial remains from the Winchester Site, Massachusetts.

Stature Estimation

For stature estimation, the author measured the maximum length of complete humeri (n = 14), ulnae (n = 12), radii (n = 10), femora (n = 15), tibiae (n = 8), and fibulae (n = 7). The femoral bicondylar length (Buikstra and Ubelaker 1994) was measured as well. All of these measurements were input into *FORDISC* 3.1 (Jantz and Ousley 2005), and point estimates and the lower and upper limits of the stature interval for each isolated element were yielded (Figure 4.3). The maximum length and the bicondylar length measurements for each femur were both entered into *FORDISC* 3.1 and not kept separate (Jantz and Ousley 2005) in order to produce a more accurate stature estimation. Utilizing

point estimates from *FORDISC* 3.1 (Jantz and Ousley 2005), the estimated height intervals for different skeletal elements are as follows: humeri (59.4-69.9 inches), ulnae (60.1-67.4 inches), radii (58.1-67.5 inches), femora (58.9-69.8 inches), tibiae (59.7 to 69.9 inches), and fibulae (59.3-66.1 inches). To establish a general height range for the Winchester collection's adult remains, the author combined shortest height point estimate (from one of the radii) with the tallest height point estimate (from one of the humeri and one of the tibiae). The combination produced a range of 58.1- 69.9 inches, or 4 feet 10 inches to 5 feet 10 inches (Table 4.5).

Table 4.5. Stature intervals for each long bone based on point estimates and the overall combined stature range estimation for the Winchester Site, Massachusetts.

Skeletal Element	Stature Interval Based on Point Estimate (in.)
Humeri	59.4-69.9
Ulnae	60.1-67.4
Radii	58.1-67.5
Femora	58.9-69.8
Tibiae	59.7-69.9
Fibulae	59.3-66.3
Combined Stature Interval	58.1-69.9 in or 4 ft 10 in to 5 ft 10 in

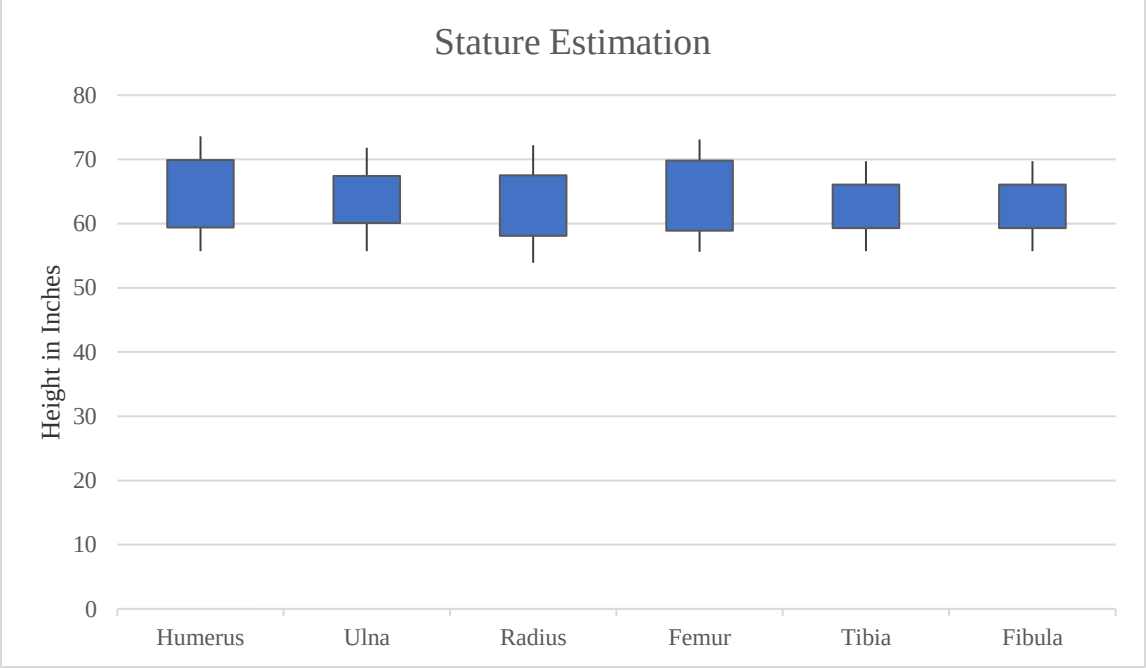

Figure 4.3. The mean height of the population broken down by each long bone from the Winchester Site, Massachusetts.

DISCUSSION

Comparison of Other Anatomized Sites to the Winchester Collection

Much like the previously discussed sites that contained anatomical remains (Chapter 2), the analysis of the Winchester site has supplemented valuable information to the understanding of the history of medicine, particularly within the context of Massachusetts.

Inventory

In terms of the range and variation across the different sites, there are several notable observations. The NISP varied greatly among the sites mentioned, with Dr. Thompson's Privy (Mann et al. 1991) having a NISP of 3, the Holden Chapel site (Hodge 2013) having a NISP of 683, the Point San Jose site (Hart 2019) having a NISP of approximately 4,000, and the Winchester site standing out with a significantly higher NISP of 15,184 human remains, indicating both substantial fragmentation and a larger collection (Figure 5.1). Among these sites, the NISP that most closely resembled the Winchester collection was the Medical College of Georgia, with 9,808 (Blakely and Harrington 1997) (Figure 5.1) and therefore provides evidence that the Winchester collection may have also be used in medical education within a larger institution.

The University of North Dakota (Stubblefield 2011) study examined a singular individual (MNI=1), while the Newburgh Colored Burial Ground (Nystrom 2011) study analyzed one individual as well (MNI=1) (Figure 5.2). Dr. Thompson's Privy in Annapolis, Maryland had a small MNI of 2. The Somerville, Massachusetts site (Saul and Saul 1986) had at least 6 individuals. At the Holden Chapel site at Harvard

University, there was a MNI of 11. The Point San Jose site had a MNI of 25 (Figure 5.2), and the Medical College of Virginia (Owsley et al. 2017) had a MNI of 53. The Blockley Almshouse site (Crist et al. 2017) had a relatively high MNI of 248. The Medical College of Georgia site had an extensive collection, with a MNI of 300 adults. The Albany County Almshouse (Lowe 2017) in New York had the highest MNI recorded at 903 (Figure 5.2). In comparison, the Winchester site demonstrated a substantial collection, with an overall MNI of 44 individuals. The interpretation that the Winchester remains possibly came from a larger institution is further supported by the fact that the Winchester site MNI of 44 was most similar to the MNIs from the Point San Jose site (MNI=25) and the Medical College of Virginia site (MNI=53) (Hart 2019; Willey et al. 2018; Owsley et al. 2017). The size of the Winchester collection suggests a larger and more organized source of human remains, indicating an institutionalized and broader availability of cadavers.

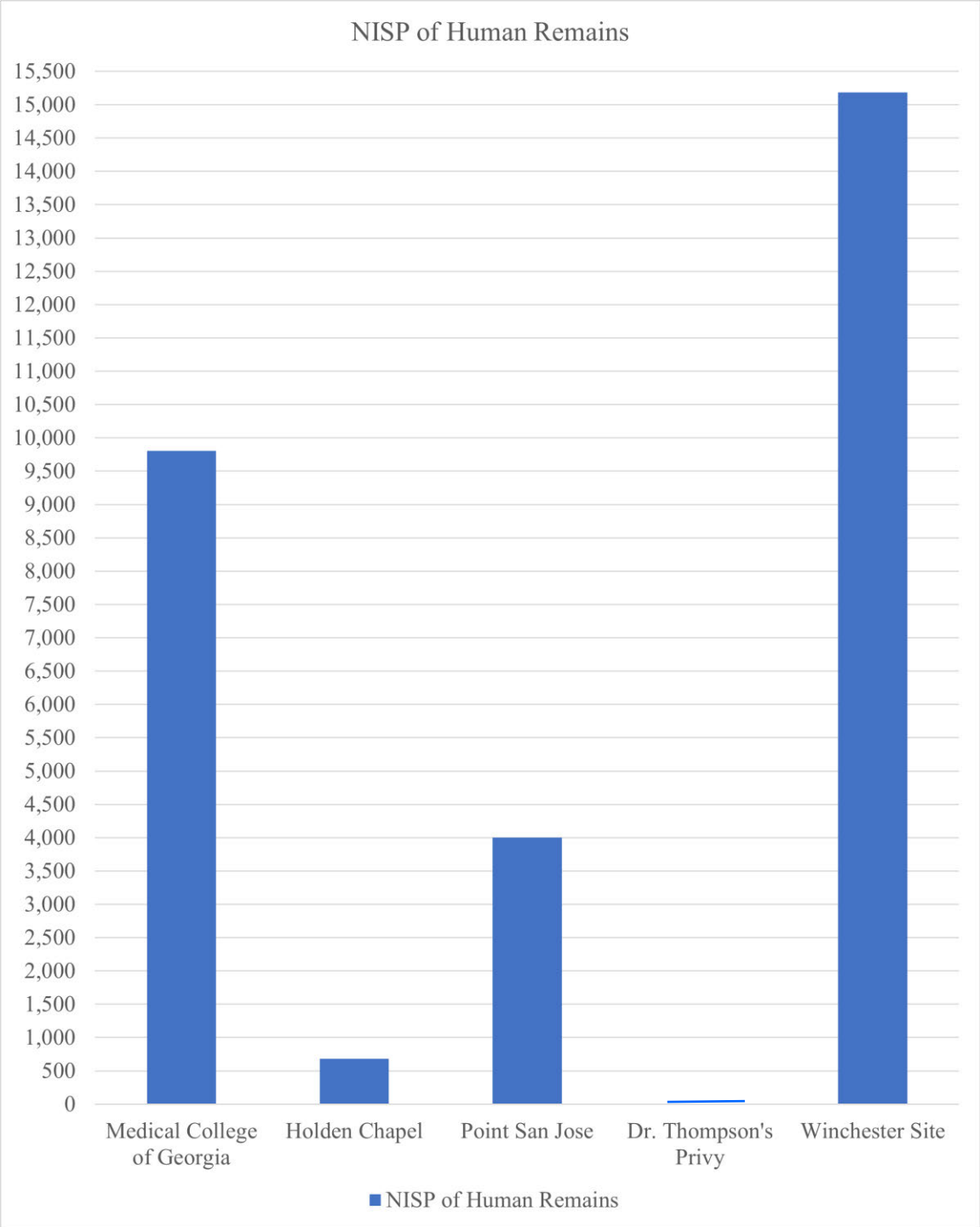

Figure 5.1. The NISP from other anatomized sites compared to the Winchester Site, Massachusetts.

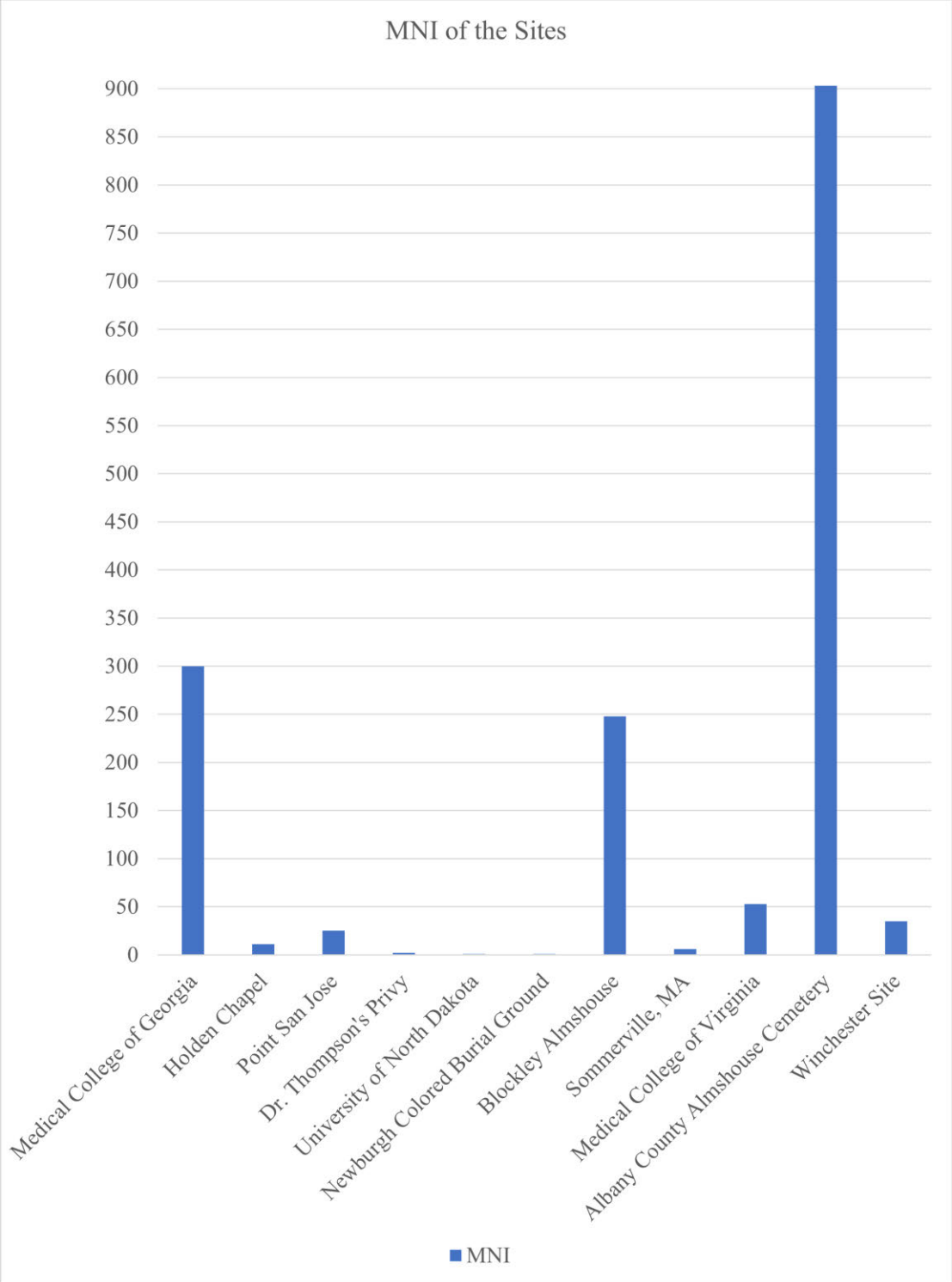

Figure 5.2. The MNI from other anatomized sites compared to the Winchester Site, Massachusetts.

Sex

Analyzing the proportion of male to female human cadavers uncovered at anatomized archaeological sites from the 1800s and early 1900s contributes to our understanding of the representation of men and women in historical anatomical practices and the social dynamics and sex roles of that era. The remains discovered at the Medical College of Georgia were primarily male individuals. Specifically, 79.2% of their 24 tibia were from males, and 20.8% of their 24 tibia were from females (Blakely and Harrington 1997) (Table 2.1). The sex ratio was determined to be 3.8 males per 1 female (Table 4.2). Analysis of Holden Chapel at Harvard University could not produce specific proportions of sex among the sample due to severe fragmentation; however, both males and females were present (Hodge 2013) (Table 2.1). At Point San Jose, only 14 out 25 individuals could be determined either male or female (Hart 2019; Willey et al. 2018). Out of these, 32.0% were male and 24.0% female (Table 2.1). The rest were of unknown sex (Hart 2019; Willey et al. 2018). The sex ratio was determined to be 1.3 males per 1 female (Table 4.2). Dr. Thompson's Privy in Annapolis, Maryland had the remains of two individuals. One was likely female based on muscle attachments, while the other individual was indeterminate and juvenile (Mann et al. 1999) (Table 2.1). The one individual from the University of North Dakota site was estimated to be female (Stubblefield 2011) (Table 2.1). Similarly, the Newburgh Colored Burial Ground site analyzed one individual, who was likely a female (Nystrom 2011) (Table 2.1). At the Blockley Almshouse, 67.0% of 248 individuals examined were males, 30.0% were females, and 3.0% were indeterminate (Crist et al 2017) (Table 2.1). The sex ratio was

determined to be 2.2 males per 1 female (Table 4.2). In Somerville, MA, only two out of the six individuals, or 33.3%, found at the site were able to have their sex determined with certainty, which was male. The other four individuals (66.7%) were either indeterminate or possibly female (Saul and Saul 1986) (Table 2.1). Based on the examination of 26 crania at the anatomical site of the Medical College of Virginia, researchers estimated that 65.0% of the remains were male, while 31.0% were female. There was also one individual (3.8%) whose sex classification remained indeterminate (Owsley et al. 2017) (Table 2.1). The sex ratio was determined to be 2.1 males per 1 female (Table 4.2). The analyzed remains from the Albany County Almshouse Cemetery consisted of 48.8% males, 31.3% females, and 19.8% of ambiguous sex classification (Lowe 2017) (Table 2.1).

During the comparative analysis of all of the anatomical sites, it was observed that sites with a MNI exceeding two exhibited greater proportions of males than females within their respective samples (Figure 5.3). Specifically, these sites included the Medical College of Georgia, Point San Jose. the Blockley Almshouse, the Medical College of Virginia, and the Albany County Almshouse Cemetery. Much like these sites, the Winchester site contained a larger proportion of male individuals than female individuals, especially when observing characteristics of the os coxae and the humerus. The exact number of adult males and females within the Winchester site was unable to be determined because of the severity of the fragmentation and commingling of the remains. However, proportions of males and females based on different elements were produced. For example, based on the pubic symphyses analyzed, 60.5% were estimated male or

probable male, 23.7% were estimated female or probable female, and 15.9% were ambiguous. This produced a sex ratio of 2.6 males per 1 female (Table 4.2). The average sex ratio between these other anatomization sites and the Winchester site was 2.4 males per 1 female. This larger proportion of males used as cadavers from the Winchester site and the previous sites may indicate that males made up the majority of the general population during the 1800s. In addition, it is possible that physicians and medical schools avoided using women as cadavers as a way to honor the gender social norms, as seeing a women's body was taboo during the time period (Floyd 2022). Although this cause is less likely, because research of various sites shows that the bodies of men and women both experienced the same trauma from dissection (Dittmar and Mitchell 2018). It seems that neither sex received any special treatment by physicians and medical students. However, research by Dittmar and Mitchell (2018) has determined likely causes for the sex disparity among cadavers. Workhouses, or poor houses, were often home to mostly men, and these individuals, if unclaimed after death, were commonly given to medical schools and physicians for dissection (Nystrom 2011; US Census Bureau 1850). The bodies of women were less likely to go unclaimed, and it is possible that the managers of the poor houses did not like given the women's bodies away for dissection (Dittmar and Mitchell 2018).

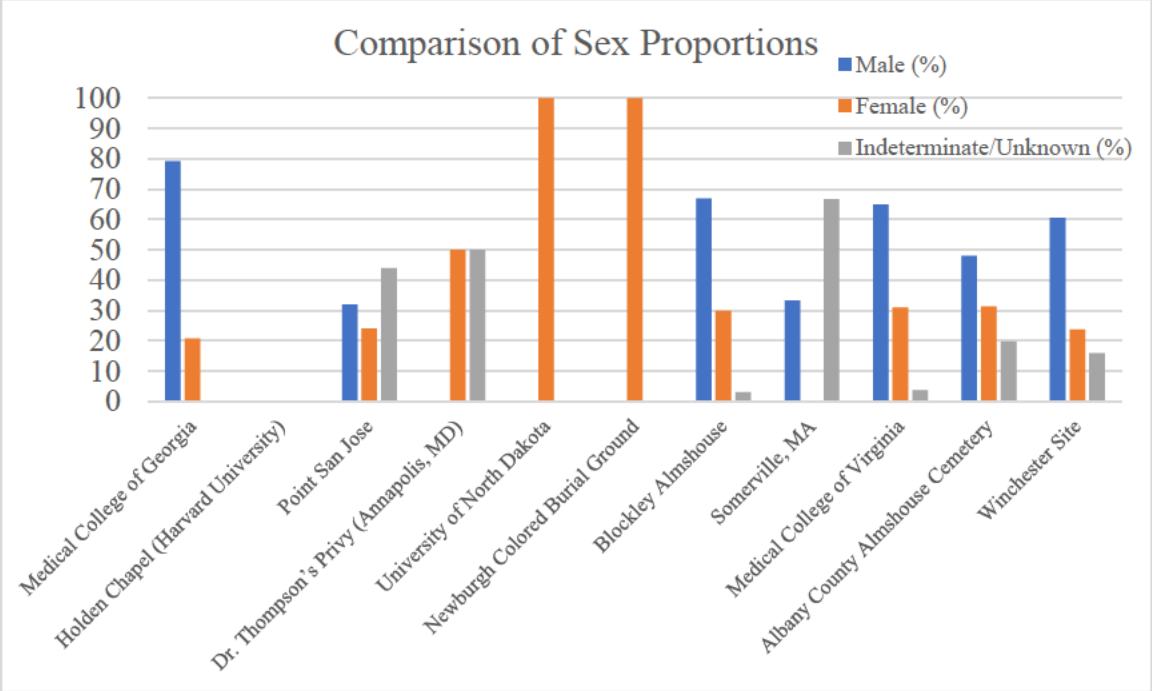

Figure 5.3. Comparison of sex proportions of other anatomized sites and the Winchester Site, Massachusetts. The pubic symphyses sex estimation was used for the Winchester Site proportions.

Statistics for Sex Estimation

One of the hypotheses tested in the present study was that most of the adult remains at the Winchester site were males, as seen in other sites from the mid-1800s and early 1900s with anatomized remains. To test this theory, the author used chi-square tests to compare the sex proportions at the Winchester site with various reference sources and sites. These comparisons helped determine if the sex composition at the Winchester site is similar to other places with anatomized remains.

When comparing the Winchester site to the Medical College of Georgia, Point San Jose, Medical College of Virginia, and Blockley Almshouse sites, there were no significant differences in sex proportions. This suggests that the Winchester site's sex

composition was similar to these other anatomized sites, supporting the initial hypothesis. Similarly, when comparing the Winchester sex proportions to those from the 1850 census of the Massachusetts jails and correction houses, there was no significant difference between these samples. This suggests that the sex proportions at the Winchester site align with these sites and other historical sources, supporting the author's initial hypothesis regarding sex composition.

There were two exceptions presented by the chi-square results. When comparing the Winchester site to the 1850 Middlesex County Census and the 1850 Massachusetts Census of poorhouses, significant differences in sex proportions were observed. This suggests that the sex composition at the Winchester sites differs from what was presented in these historical references. These findings highlight the importance of considering historical and contextual factors when interpreting sex compositions in anatomized remains. While the author's hypothesis held true for most comparisons, the differences presented in specific historical references indicate that site-specific factors may have influenced the sex proportions at the Winchester site. Sample size also may have influenced the results because it is much easier to achieve significance with these much larger sample sizes.

Age

When examining and comparing the results of age at death estimation across these various anatomized sites, an understanding of demographic patterns and mortality rates concerning cadavers during the 19th century begins to emerge. Age at death of the remains from the Medical College of Georgia site ranged from fetal to adult; however,

72.6% of the sample was categorized as being over 20 years old (Blakely and Harrington 1997). Specifically, the age ranges were between 13 to 20 years old and 21 to 35 years old. The next highest percentage fell into the generic category of adult (Blakely and Harrington 1997). The analysis of the Holden Chapel remains determined that nine, or 81.8%, were from adult individuals, but an exact age range was not provided (Hodge 2013). However, at least one of the individuals was a young adult. In addition, two, or 18.2%, were juvenile individuals (Hodge 2013). Similarly, the adult age range was not provided in the analysis for the Point San Jose remains; however, 16, or 64.0%, of the 25 individuals were estimated to be adults (Willey et al. 2018). Two individuals out of the 25 were juveniles, with one aged 7 to 15 years old and the other aged 15 to 18 years old. Three of the 25 were fetal remains. The last four individuals of the assemblage were unable to be assigned an age estimate (Willey et al. 2018). Two of the three bones found at Dr. Thompson's Privy in Annapolis were likely from an individual who was a young to middle aged adult. The third bone was likely from an individual aged 9 to 12 years (Mann et al. 1991). Analysis of the human remains found at the University of North Dakota determined that the individual was aged between 33 to 46 years old (Stubblefield 2011). Age at death of the individual examined from the Newburgh Colored Burial Ground was determined to be around young adulthood, based on epiphyseal closure. Nystrom (2011) did not provide a specific age range. At the Blockley Almshouse site, the age at death for 62.0% of the assemblage was estimated to be 35 years and older (Crist et al. 2017). There was no discussion about the age that the other 38.0% of the remains were at death. In Somerville, Massachusetts, the remains at the site ranged from

fetus to adulthood. The adults were aged late 20s to late 40s (Saul and Saul 1986). Age at death of the remains from the Medical College of Virginia site ranged from child to adult (Owsley et al. 2017). Of the 53 individuals analyzed, 83.0% of them were categorized as adult, which in this case meant that they were 15 years and older. The other 17.0% of the assemblage were children, which meant that they were 14 years old and younger (Owsley et al. 2017). Lowe (2017) analyzed 903 individuals from the Albany County Almshouse Cemetery and estimated that about 27.9% of the assemblage was likely children under the age of 13. In addition, there were several adolescent individuals between the ages of 13 and 19 years old. However, the majority of the sample consisted of individuals that were likely 50 years and over (Lowe 2017).

When comparing the average age of death of the Winchester assemblage to these various sites, there appear to be similarities among the ages of these individuals that were used as cadavers (Table 5.1). There were fetal (MNI=7), juvenile (MNI=2), and adult (MNI=35) remains in the Winchester assemblage. The author estimated that the adult individuals in the Winchester sample ranged from 15 to 87 years old based on the scoring of the pubic symphyses and results from Brooks and Suchey (1990), with an average age at death of the adult remains between 23 to 45 years old. This age range is most similar to the remains of the Medical College of Georgia and Somerville, Massachusetts. Although the individual found at the University of North Dakota was also estimated to be within this age range, no substantial comparison can be made, because it had an MNI of 1. The similarity of age at death of the Winchester remains to the remains found at the

Medical College of Georgia, again provides evidence that the Winchester remains were likely used to teach in an academic setting.

Table 5.1. Comparison of age proportions of other anatomized sites and the Winchester Site, Massachusetts. N/A indicates that the information was not provided or specified in the original text.

Site	Age Range	Percentage of Sample (if provided)
Medical College of Georgia (Blakely and Harrington 1997)	Fetal to adult	27.4% under 20 yrs., 72.6% over 20 yrs.
Holden Chapel (Hodge 2013)	Infant to adult	81.8% adults, 18.2% juveniles
Point San Jose (Hart 2019)	Fetal to adult	64% adults, 8% juveniles, 12% fetal
Dr. Thompson's Privy (Mann et al. 1991)	9-12 years; young to middle-aged adult	50% juvenile, 50% young to middle-aged adult
University of North Dakota (Stubblefield 2011)	33-46 years old	100%
Newburgh Colored Burial Ground (Nystrom 2011)	Young adulthood	100%
Blockley Almshouse (Crist et al. 2017)	Majority 35 years and older, unknown how young others are	62% 35 years and older
Somerville, Massachusetts (Saul and Saul 1986)	Fetal to late 40s	N/A
Medical College of Virginia (Owsley et al. 2017)	Juvenile to adult	83% adult, 17% juvenile
Albany County Almshouse Cemetery (Lowe 2017)	Children under 13 to 50 years and older	27.9% were children, majority 50 years and older
Winchester Site	Fetal to adult (Average 23-45 years)	79.6% adults, 2.3% adolescent, 2.3% child, 15.9% fetal

Statistics For Age Estimation

Although it was not a part of the initial hypothesis, based on the statistical analyses of the age proportions of various sites against the age proportions of the Winchester site, it is probable that the ratios of adults, juvenile, and fetal individuals, if included, found in anatomized sites were relatively similar during the mid-19th century

and early 20th century. When comparing the age proportions of the Winchester site to the Point San Jose site, Medical College of Virginia site, and the Holden Chapel site, there were no significant differences, indicating a degree of similarity in the distribution of adults, juveniles, and fetal individuals. Differences in age proportions were significant when comparing the Winchester site to the Medical College of Georgia. One explanation for this difference could have been a variation in bone preservation and screening techniques. Previous sites that used screens to sift through the dirt included the Medical College of Georgia (Blakely and Harrington 1997) and the University of North Dakota (Stubblefield 2011). The Medical College of Virginia "non-systematically retrieved from the back-dirt pile" (Owsley et al. 2017:144). All of the other previously mentioned sites did not provide information on the use of screens during excavation.

Due to the inability to compare statistically the age proportions of the 1850 Census of Middlesex County to the age estimations of the adult individuals at the Winchester site, the author cannot conclusively accept or reject the hypothesis that the age profile at the Winchester site would reflect the average age at death during the 1850s in the broader United States, and specifically in Middlesex County, Massachusetts.

Population Affinity

Examining the population affinity proportions of humans remains found at various anatomical sites emphasizes the selection criteria and representation of different populations as cadavers in medical training. Furthermore, exploring the demographics of these remains reveals both similarities and differences among populations depending on the geographical regions where these sites were located in the United States. Analysis of

the remains from the Medical College of Georgia found that both Black and White individuals were present within the sample. However, 79.0% of the sample was of Black descent (Blakely and Harrington 1997) (Table 5.2). The remains found at Holden Chapel were too degraded to be able to determine population affinity of the assemblage (Hodge 2013). Population affinity estimation of the remains of the Point San Jose site revealed the assemblage consisted of 50.0% Hispanic individuals, 30.0% Asian or Asian-descent (Native American) individuals, and 20.0% White individuals (Hart 2019; Willey et al. 2018) (Table 5.2). According to population affinity analysis, no Black individuals were present. Although sex and age were able to be determined for the human remains of Dr. Thompson's Privy, population affinity was unable to be estimated due to the limited sample (Mann et al. 1991) (Table 5.2). The estimation of population affinity for the remains at the University of North Dakota site indicated that the individual present was likely of Black descent (Stubblefield 2011) (Table 5.2). The one individual analyzed from the Newburgh Colored Burial Ground was estimated to be of Black population affinity, unsurprising due to the location (Nystrom 2011) (Table 5.2). As for the Blockley Almshouse site in Philadelphia, the majority of the 72 remains that could be estimated for population affinity were revealed to be indeterminate. Out of these 72, 24.0% were of White, or European descent (Crist et al. 2017). Among the individuals examined, 4.0% were of African descent, as well as 1.0% whose population affinity was identified as Asian or Native American (Crist et al. 2017) (Table 5.2). The Somerville, Massachusetts assemblage analysis did not include population affinity (Saul and Saul 1986) (Table 5.2). Population affinity estimation of the remains from the Medical

College of Virginia concluded that the 18 of the 26 (69.2%) crania observed were from individuals of African descent. In addition, three (11.5%) of the crania were of European descent, while five, or 19.2% were indeterminate (Owsley et al. 2017) (Table 5.2). The Albany County Almshouse Cemetery study indicated that ancestry was estimated, but Lowe (2017) did not present any population affinity results (Table 5.2).

When interpreting these outcomes, it is important to consider the regional demographics and societal views on population affinity during the mid-1800s in the U.S. The sites located in the southern region of the U.S., like the Medical College of Georgia (Blakely and Harrington 1997) and Medical College of Virginia (Owsley et al. 2017), had larger proportions of Black individuals compared to the sites located in the west, such as Point San Jose (Hart 2019; Willey et al. 2018), and in the north, like the Blockley Almshouse (Crist et al. 2017). The University of North Dakota individual being of Black descent was surprising, because Black people living in North Dakota at the time of the 19th and early 20th centuries was not common (Stubblefield 2011). This discovery highlights the significance of considering regional differences and the potential migration that may have played a role in the presence of individuals from diverse population affinities.

Regarding the Winchester site, the fragmented nature of the remains made it difficult to determine population affinity. Because of this, the analysis yielded inconclusive results, with only four crania allowing for observation of 5 to 7 traits by the author, while the remaining 15 crania exhibited only 3 to 4 observable traits, rendering the reliability of the findings questionable. Presently, no compelling evidence supports

the hypothesis that the Winchester remains originated from the raiding of African American cemeteries.

Table 5.2. Comparison of population affinity proportions of other anatomized sites and the Winchester Site in Massachusetts.

Site	# of Crania Analyzed	African (%)	Asian/Native American (%)	European (%)	Hispanic (%)	Indeterminate/ Not Analyzed (%)
Medical College of Georgia	n/a	79.0%	---	21.0%	---	---
Holden Chapel	---	---	---	---	---	100.0%
Point San Jose	10	---	30.0%	20.0%	50.0%	---
Dr. Thompson's Privy	---	---	---	---	---	100.0%
University of North Dakota	1	100.0%	---	---	---	---
Newburgh Colored Burial Ground	1	100.0%	---	---	---	---
Blockley Almshouse	72	4.0%	1.0%	24.0%	---	71.0%
Somerville, MA	---	---	---	---	---	100.0%
Medical College of Virginia	26	69.2%	---	11.5%	---	19.2%
Albany County Cemetery	---	---	---	---	---	100%
Winchester Site	20	20.0%	10.0% (NA) 35.0% (Asian)	35.0%	---	---

Stature

Some studies, including the Albany County Almshouse Cemetery, mention that stature was a part of the analysis performed on the remains; however, those authors did not present the results (Lowe 2017). The only site that provided a stature estimation was the University of North Dakota (Stubblefield 2011). The one individual that was discovered had an estimated height range of 56.3-61.0 inches (Stubblefield 2011). It was determined that there was an average height range of 58.1- 69.9 inches for the remains found at the Winchester site. The University of North Dakota analysis identified the individual as a 33- to 46-year-old female, which is likely a contributing factor explaining the relatively shorter height range observed (Stubblefield 2011). In contrast, the height range for the Winchester site encompasses both females and males of varying ages, resulting in a broader range.

Comparison of the Winchester Collection to Mid-to Late-1800s U.S. Population

By examining census data, particularly the 1850 United States Census, otherwise known as the Seventh Census of the United States, a comprehensive understanding of the population dynamics and social context of these cadavers can be achieved (U.S. Census Bureau 1850).

Sex

The town of Winchester is located in Middlesex County, Massachusetts. In addition, the large towns of Lowell, Charlestown, and Cambridge (with Harvard University) are also located in Middlesex County. In 1850, the total amount of White

and “Free Colored” individuals living in Middlesex County was 161,383. The total number of White males in Middlesex County during 1850 was 76,918, or 47.7% of the population, and the total number of White females in Middlesex County during the same time was 83,758, or 51.9% of the population (U.S. Census Bureau 1850). As for the “Free Colored” individuals, the total number of males in Middlesex County was 368, or 0.23% of the population, and the total number of females was 339, or 0.21% of the population (U.S. Census Bureau 1850). With all males and all females combined, there was a sex ratio of 0.92 males per 1 female.

As previously mentioned, the Winchester assemblage was primarily comprised of males. This is evident through the results of the sex estimation conducted on the pubic symphyses, which produced 60.5% male, 23.7% female, or a sex ratio of 2.6 men per 1 female. This did not match the proportions of males and females in Middlesex County during 1850 (U.S Census Bureau 1850). However, it is essential to emphasize that this discrepancy highlights the historical preference for male cadavers in medical education. This preference is attributed to the distinct biological features of males, notably their robust musculature, as mentioned above (Dittmar and Mitchell 2018).

Age

The reliability of census data during this era, particularly before the 1860 Census, has been a matter of inquiry due to the probability of deaths being underreported (Vinovskis 1972). Notably, statistical analysis shed light on the changing life expectancies over a span of half a century during the 1800s. For instance, between 1800 and 1804, the life expectancy of a 10-year-old was recorded as being 55.2 years (Haines

2004). However, from 1850 to 1854, this figure had declined to an average life expectancy of 47.8 years (Haines 2004). Providing further context, the 1850 Census revealed that Middlesex County alone had 2,903 recorded deaths in the county for the year ending June 1, 1850 (U.S. Census Bureau 1850*)*.

In Middlesex County, during 1850, the age categories of the White individuals with the highest totals were the 20 to <30 and the 30 to <40 categories. Specifically, there were 17,391 White males and 20,371 White females in the 20 to <30 category. Furthermore, there were 12,039 White males and 11,861 White females in the 30 to <40 category (Figure 5.4). This trend was also seen among the "Free Colored" individuals in Middlesex County. There were 79 males and 60 females within the 20 to <30 years old category, and there were 53 males and 57 females in the 30 to <40 years old category (U.S. Census Bureau 1850) (Figure 5.4). This population trend of higher counts in the 20 to <30 and 30 to <40 categories, in both Black and White individuals, aligns with the average age of death observed in the Winchester site assemblage, which falls within the range of 23 to 45 years old (Figure 5.5). The drop in population starting with the 40 to <50 age category, as indicated by the 1850 Census, corresponds to the age range in which fewer individuals were found at the Winchester site (U.S. Census Bureau 1850) (Figure 5.6).

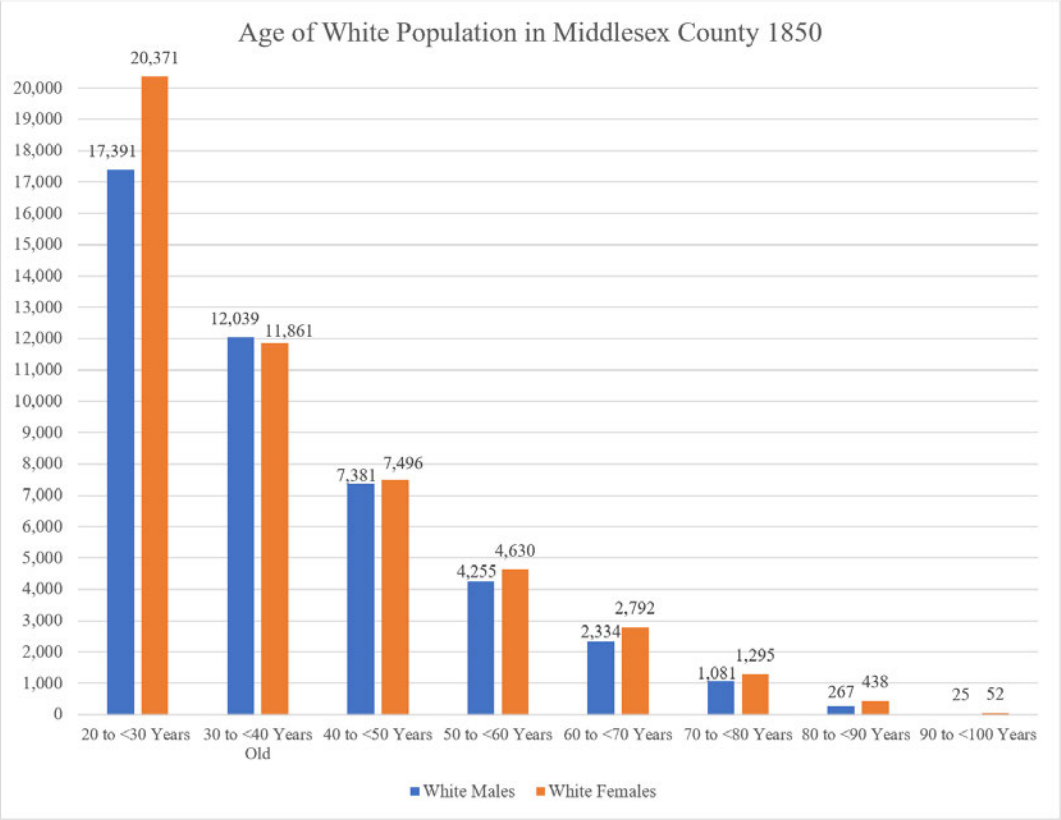

Figure 5.4. Number of White individuals in age categories living in Middlesex County, MA during the 1850 Census (U.S. Census Bureau 1850).

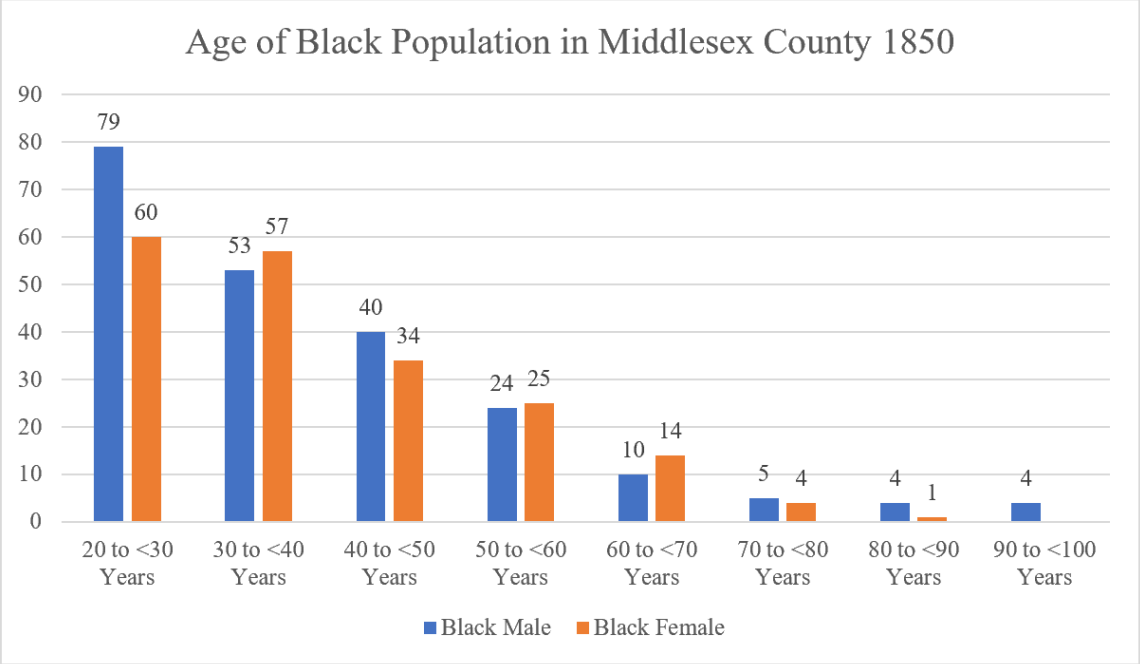

Figure 5.5. Number of Black ("Free Colored") individuals in different age categories alive and living in Middlesex County, MA during the 1850 Census (U.S. Census Bureau 1850).

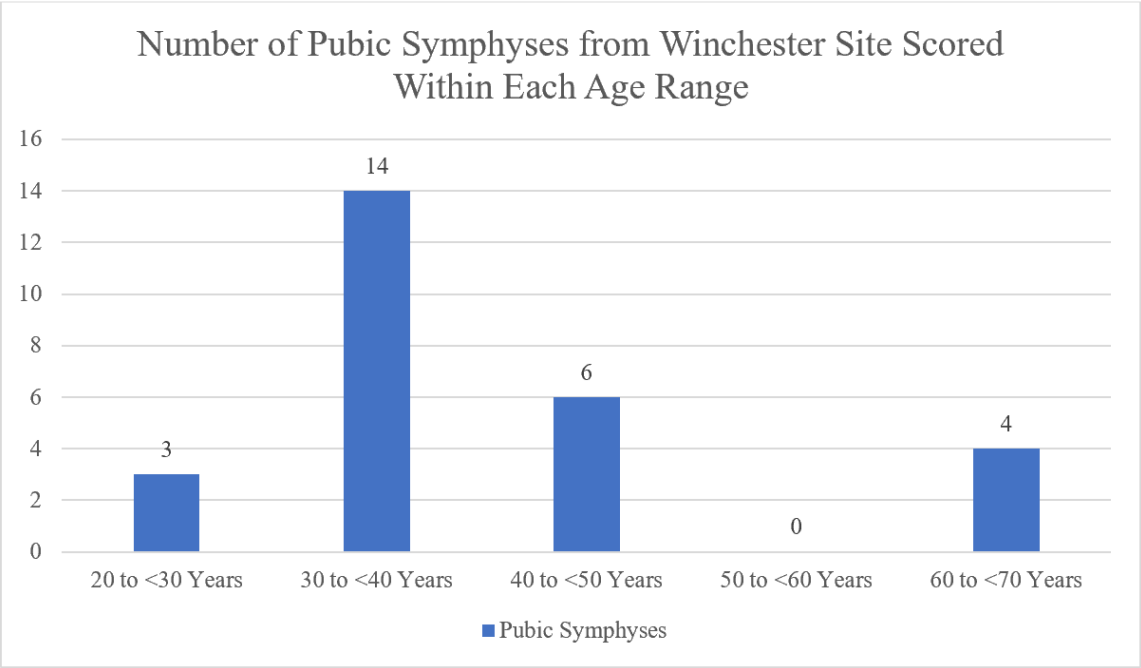

Figure 5.6. Number of pubic symphyses from the Winchester site in different age categories. Multiple pubic symphyses were unable to be assigned to one category, because they were initially scored a range; therefore, these pubic symphyses had their average age within an interval.

Therefore, the age distribution among the population in Middlesex County during 1850, in which there was a decline in individuals living within the 40 to <50 years category, provides a possible explanation for the average age of death observed in the Winchester site. The concentration of individuals in the younger adult age categories and the subsequent decline in population in older age categories correlates with the age range represented in the Winchester assemblage. This suggests that the age composition of the population in Middlesex County during that era likely affected the age distribution observed in the Winchester site.

Sex and Age in Poor Houses and Correctional Facilities

In the Massachusetts poor houses, the census records indicated a larger count of White males (1,947) in comparison to White females (1,676). In addition, there were 32 "Free Colored" males and 38 "Free Colored" females, along with 11 males and 8 females of mixed White and Black population affinity (U.S. Census Bureau 1850). With all males and all females combined, there was a sex ratio of 1.2 males per 1 female. This higher representation of males in the poor house population provides a possible additional explanation for the prevalence of males in the assemblage at the Winchester site.

Similarly, the 1850 Census data showed a significant disparity among the sex ratio in the Massachusetts penitentiaries, with no female convicts recorded. In contrast, the penitentiaries housed 389 White male convicts, along with 34 "Free Colored" males and 8 "Mixed" males (U.S. Census Bureau 1850). A sex ratio could not be determined, because there were no females present. This vast overrepresentation of males in the penitentiaries could have been a contributor to the overall higher presence of males in the Winchester assemblage, if bodies were procured from prison graveyards, or prior to burial. In addition, the 1850 Census reports the demographics of Massachusetts' jails and houses of correction, which are for short-term sentences, while penitentiaries are for long-term sentences. Among a total of 1,118 White individuals, there were 906 males and 212 females. Within these jails and houses of correction were 60 "Free Colored" males and 17 "Free Colored" females, along with 12 "Mixed" males and 8 "Mixed" females (U.S. Census Bureau 1850). This population had a sex ration of 4.1 males per 1 female.

The 1850 Census data also demonstrated that the majority of individuals in the poor houses, penitentiaries, jails, and houses of correction were 24 years and older. Among the population living in poor houses, 2,547 out of a total of 3,712 individuals were 24 years and older. Similarly, among the penitentiary population, 266 out of 431 individuals fell into the 24 years and older category, and for the jail and correction house populations, 617 out of 1,215 were in the 24 years and older category (U.S. Census Bureau 1850). This prevalence of individuals aged 24 years and older aligns with the observed average age of death at the Winchester site, which is within the range of 23 to 45 years old. It is possible to suggest that the harsh living conditions and other hardships that individuals in poor houses and imprisonments experienced may have contributed to a higher mortality rate among the younger age group.

Population Affinity

It is important to keep in mind that the population affinity results were deemed inconclusive due to insufficient morphological cranial traits. However, upon consideration of the crania traits that were observed and no other compelling evidence, these results do not support the initial hypothesis suggesting these remains were predominantly Black individuals who were targeted by grave robbers. Furthermore, the data on sex and population proportions mentioned above from the 1850 Census challenge the initial hypothesis, as the number of individuals of European descent, significantly exceeds those of African descent (U.S. Census Bureau 1850). Notably, because Black individuals made up a small portion of the total population in Middlesex County in 1850,

it may be significant that over 20% of the Winchester remains were potentially of African descent.

The 1850 U.S. Census did not document the proportions of Asian or Native American populations in Massachusetts (U.S. Census Bureau 1850). This suggests that the presence of both of these populations were small and insignificant in number in comparison to the White and Black individuals. Due to population affinity results of the Winchester site being inconclusive and lack of historical data pertaining to certain populations, like Asians and Native Americans, a statistical analysis of population affinity was not conducted.

Stature

Gathering information concerning the average stature of individuals during the 19th century, especially in relation to Massachusetts residents, poses a significant challenge due to the scarcity of available data. Accounts and historical records documenting height from this era are rare. The available data predominantly focus on the average stature of individuals across the United States. For instance, around the time of 1850, the average height of an adult White male living in the United States was 67.3 inches, or 5 feet and 7 inches (Haines 2004: Fig. 1). The average height of an adult "Free Colored" man was not documented for this year. In addition, the average stature of an adult female, White or Black, was not documented either, as the data concerning adult White men originated from measurements taken from men in the U.S. Army at the time (Haines 2004). When considering the comparison of stature estimations of the Winchester site, which ranges from 58.1 to 69.9 inches, or 4 feet 10 inches to 5 feet 10

inches, it can be concluded that the average height of an adult White male in 1850 falls within the calculated interval.

CONCLUSIONS

Summary of the Results

In summary, there was a total of 14,469 identified adult remains in the assemblage. Of this NISP, 1,365 exhibited sharp force trauma. The MNI for the adult remains was 35 based on the number of left femora. The os coxae (33), calcanei (33), and tibiae (30) had the next largest MNEs. The Winchester site's MNI was similar to the Point San Jose site (MNI = 25) and the Medical College of Virginia site (MNI = 53) (Willey et al. 2018; Hart 2019; Owsley et al. 2017). This indicates that the number of cadavers utilized from medical study did not significantly differ based on the site's geographic location. However, it is important to consider that the other sites could have many undiscovered remains. Although the remains at the Winchester site were very localized and were all retrieved, there is always a possibility that other sites was located in the vicinity, however. The large collection found at the Winchester site suggests that it may have been associated with a larger institution rather than private physicians, much like Dr. Thompson's Privy (Mann et al. 1991) and the Somerville, Massachusetts site (Saul and Saul 1986), who typically had access to a limited number of cadavers. It cannot be totally ruled out that the Winchester remains were cadavers used by a private physician.

The collection of adult remains at the Winchester site consisted of both cranial and postcranial elements in varying proportions. Out of a total of 14,469 adult remains, 13.3% were cranial, while 79.7% were postcranial. There were also 7.0% unknown adults remains that could not be classified as either cranial or postcranial, and 1.0% were

ossified cartilage. In terms of skeletal representation of specific body areas within the sample, the axial skeleton accounted for 62.6% of the total 14,469 adult NISP. The appendicular skeleton made up 26.4% of the total adult remains. Breaking down the appendicular skeleton further, the skull comprised 13.3% of the total adult remains, while the torso contributed 55.6% to the overall sample. The upper limbs accounted for 8.0% of the remains, and the lower limbs represented 12.1% of the total 14,469 NISP. Overrepresentation may be seen in the extreme fragmentation of the ribs and crania, creating the possibility that the adult population of the Winchester assemblage significantly exceeds the MNI. Conversely, the number of vomers, nasal conchae, and lacrimals are underrepresented compared to the adult MNI, which is likely due to the fragility of these bones.

The general adult population of the Winchester collection was predominately male. Based on the analysis of the pubic symphyses, 60.5% were male, 23.7% were female, and 15.9% were indeterminate. Sites with an MNI exceeding two, including the Winchester site, displayed a greater proportion of males than females, possibly reflecting the sex distribution in the general population or the population demographics in poor houses and correctional facilities during 1850 in the United States.

In addition, the average age at death of the adult Winchester remains was determined based on the analysis of the pubic symphyses, per the research of Brooks and Suchey (1990). The majority of the age estimations obtained from this analysis fell within the range of a score of 2 to 5. By combing the average ages associated with these scores, an average age range of 23 to 45 years old was derived for the adult individuals at

the Winchester site. The average age at death for the Winchester site's adult remains was most similar to the Medical College of Georgia, University of North Dakota, and Somerville, Massachusetts sites (Blakely and Harrington 1997; Stubblefield 2011; Saul and Saul 1986).

Since it was difficult to conduct a population affinity estimation for the Winchester site due to severe fragmentation and the inability to score a sufficient number of cranial characteristics per crania, the results were deemed inconclusive.

Furthermore, the general stature of the assemblage ranged from 58.1- 69.9 inches. This stature estimation could only be compared to the University of North Dakota's findings, which provided a height range for one individual (Stubblefield 2011). Also, the broader height range of the Winchester site encompassed both females and males of varying ages, while the University of North Dakota sample was a singular female.

Hypothesis Outcome

The biological profile, including sex, age, population affinity, and stature, of the adult remains of the Winchester site, was constructed and compared to past demographic studies of various populations in the United States. Following the principles of demography, which examines population size, composition, distribution, changes, and their influencing factors, the research findings have provided valuable information in regard to the composition of the Winchester site population during the 1850s.

The first hypothesis posited that the majority of the remains would be from male individuals, similar to other sites comprised of anatomized remains. The results for the current analysis supported this hypothesis, revealing a higher representation of males

among the remains, aligning with the historical practice of using made cadavers in medical training due to their musculature (Dittmar and Mitchell 2018). In addition, this hypothesis was also supported by the 1850 U.S. Census that documented more males than female were living in poor houses and who were incarcerated. It has been well documented that marginalized individuals who could not afford a proper burial and those who were criminals were a common source for the cadaver supply going to institutions and private physicians (Blakely and Harrington 1997; Novak and Willoughby 2010).

The second hypothesis proposed that the age profile of the adult remains found at the Winchester site would reflect the average age at death during the 1850s in the United States, particularly in Massachusetts. The outcome of this analysis supported the hypothesis, demonstrating that the age distribution of the individuals at the Winchester site was consistent with the average age of death during that period. Ultimately, general population data of White and Black individuals in Middlesex County during 1850 revealed that the population declined starting with the 40 to <50 age category, which implies that many people died before reaching the age of 40. In addition, the demographics of those in poor houses and imprisonments during 1850 in Massachusetts exhibited that the majority of these individuals were 24 years and older.

The third hypothesis proposed that the majority of the adult remains from the Winchester site were from Black individuals who were potentially targeted and robbed from Black cemeteries. However, while population affinity estimation results were inclusive, it is presently suspected that the population affinity of the individuals does not align with this theory, pointing to different sources or factors contributing to the

composition of the assemblage. However, grave robbing of cemeteries could not be ruled out as a source of the cadavers (Anonymous 2014).

Sources of the Bodies

To date, historians from the Massachusetts Historical Commission (MHC) have not been able to determine precisely the source of the Winchester site assemblage (Pokines et al. n.d.). One prevailing hypothesis suggests that the site may have been associated with medical schools or local physicians who were engaged in anatomical studies and surgical practices during the era. However, there were no medical schools located in the town of Winchester or in the vicinity at the time. Harvard University would have been the closest medical school to the town of Winchester during 1850. Furthermore, there is no documented evidence of a physician living on the property of 25 Dartmouth Street (Pokines et al. n.d.). While less likely, it remains plausible that a private physician or personnel from a medical school in the state traveled a relatively long distance to dispose of these cadaver remains, nonhuman remains, and artifacts. In terms of cemeteries that were in Winchester to be pillaged for cadavers, the oldest cemetery in the town was the nearby Wildwood Cemetery. This cemetery was founded in 1851; however, the oldest headstones date back to 1805 (Massachusetts Historical Commission 1987). There were also numerous other cemeteries during this time in the surrounding areas like Cambridge and Boston. One cemetery that stands out as a possible source for the Winchester remains is the South End Burying Ground, located in Boston's South End (Anonymous 2014). This cemetery was formed in 1810, and the individuals buried there were often of low socio-economic status. In addition, it is known

that this burial ground and its “residents” were subject to grave robbing, so the bodies could be used for dissections (Anonymous 2014).

Regardless, it is known based on observed sawn trauma on both the human and nonhuman remains, in addition to the presence of archaeological artifacts buried alongside these bodies, that the purpose and use of these remains was to teach or explore anatomy and surgical techniques (Mazza 2024). However, the critical question that remains unanswered and warrants further investigation is the specific reason behind choosing this particular site for the disposal of these remains and materials.

Further Research

In the future, the Forensic Anthropology Program at Boston University School of Medicine possibly could conduct a DNA and isotope analyses on the remains from the Winchester Collection to develop additional information regarding the origins of the individuals and provide insight into their population affinity (Stenton et al. 2017; Olszewski et al. 2023) and the size of the region from which they come.

Concluding Remarks

Not only were the adult remains of the site investigated, but this larger research project also encompassed studies on juvenile remains (Hill et al. n.d.), nonhuman remains (Scialdone 2023), trauma (Mazza 2024), pathology, and taphonomy (Swift 2024). Together, these separate investigations have provided a more thorough analysis and understanding of the remains from the Winchester site, thereby making substantial contributions to anthropology and the history of medicine.

As construction and rebuilding of schools, universities, and private houses, as exhibited in this case, persists, remains of individuals who were once used as cadavers will likely continue to be unearthed. Ultimately, these individuals played an invaluable role in the medical and scientific study and education. Upon the rediscovery of these remains, it becomes the responsibility of anthropologists and archaeologists to address the historical mistreatment and marginalization experienced by these individuals, who were potentially subjected to the utilization of their bodies without consent for scientific purposes.

APPENDIX

Table A.1. MNE, MNI, and NISP for the Winchester assemblage.

Element	MNE Left	MNE Right	MNE Unk.	MNI	NISP: Total Frags. (Including Sawn)
Cranium					
Frontal			28	28	104
Parietal	27	24			96
Occipital			19		96
Temporal	9	9			151
Zygomatic	5	6			61
Maxilla	4	6			130
Palatine	2	2			27
Vomer					17
Nasal Conchae			1		1
Ethmoid			2		21
Lacrimal					0
Nasal	6	6			35
Sphenoid			6		241
Mandible			3	3	47
Unknown					896
TOTAL					1,923
Dentition					441
Humerus	29	20		29	
Complete					19
Proximal					30
Prox. + Shaft					8
Cylinder					16
Distal + Shaft					21
Distal					24
Unknown					3
TOTAL					121
Radius	16	18		18	
Complete					12
Proximal					21
Prox. + Shaft					9
Cylinder					13
Distal + Shaft					15
Distal					12
Unknown					10
TOTAL					92
Ulna	18	22		22	
Complete					15
Proximal					22
Prox. + Shaft					15
Cylinder					17
Distal + Shaft					11

Element	MNE Left	MNE Right	MNE Unk.	MNI	NISP: Total Frags. (Including Sawn)
Distal					9
Unknown					5
TOTAL					94
Femur	35	32		35	
Complete					16
Proximal					18
Prox.+Neck					3
Prox. + Shaft					18
Cylinder					41
Distal + Shaft					21
Distal					65
Head					5
Unknown					29
TOTAL					216
Tibia	28	30		30	
Complete					11
Proximal					60
Prox. + Shaft					16
Cylinder					41
Distal + Shaft					21
Distal					33
Unknown					31
TOTAL					213
Fibula	24	23		24	
Complete					8
Proximal					15
Prox. + Shaft					10
Cylinder					41
Distal + Shaft					19
Distal					21
Unknown					9
TOTAL					123
Scaphoid	16	14		16	30
Pisiform	11	8		11	19
Hamate	17	16		17	33
Trapezium	13	15		15	28
Trapezoid	15	10		15	25
Lunate	12	13		13	25
Capitate	15	18		18	33
Triquetral	10	11		11	21
Metacarpal 1	20	16		20	
Complete/~Complete					34
Proximal					0
Proximal + Shaft					2
Distal + Shaft					2
Distal					0
TOTAL					38

Element	MNE Left	MNE Right	MNE Unk.	MNI	NISP: Total Frags. (Including Sawn)
Metacarpal 2	13	9		13	
Complete/~Complete					20
Proximal					0
Proximal + Shaft					2
Distal + Shaft					2
Distal					1
TOTAL					25
Metacarpal 3	18	17		18	
Complete/~Complete					32
Proximal					0
Proximal + Shaft					3
Distal + Shaft					0
Distal					0
TOTAL					35
Metacarpal 4	17	11		17	
Complete/~Complete					25
Proximal					1
Proximal + Shaft					3
Distal + Shaft					0
Distal					0
TOTAL					29
Metacarpal 5	12	13		13	
Complete/~Complete					23
Proximal					1
Proximal + Shaft					2
Distal + Shaft					0
Distal					0
TOTAL					26
Prox. Phalanges					166
Int. Phalanges					128
Dist. Phalanges					163
Unk. Hand Phalanges					24
Calcaneus	33	22		33	55
Talus	24	24		24	28
Cuboid	16	24		24	40
Navicular	17	29		29	46
Med. Cuneiform	24	26		26	50
Int. Cuneiform	17	25		25	42
Lat. Cuneiform	16	15		16	31
Unk. Tarsals					40
Metatarsal 1	21	25		25	
Complete/~Complete					42
Proximal					1
Proximal + Shaft					4
Distal + Shaft					3
Distal					2
TOTAL					52

Element	MNE Left	MNE Right	MNE Unk.	MNI	NISP: Total Frags. (Including Sawn)
Metatarsal 2	21	22		22	46
Complete/~Complete					34
Proximal					3
Proximal + Shaft					9
Distal + Shaft					0
Distal					0
TOTAL					46
Metatarsal 3	21	21		21	
Complete/~Complete					40
Proximal					0
Proximal + Shaft					2
Distal + Shaft					0
Distal					0
TOTAL					42
Metatarsal 4	29	29		29	
Complete/~Complete					43
Proximal					1
Proximal + Shaft					15
Distal + Shaft					0
Distal					0
TOTAL					59
Metatarsal 5	22	22		22	
Complete/~Complete					34
Proximal					0
Proximal + Shaft					10
Distal + Shaft					0
Distal					0
TOTAL					44
Pedal Prox. Phalanges					259
Pedal Int. Phalanges					114
Pedal Dist. Phalanges					123
Fused Int. and Dist. Phalanges					10
Sternum					188
Clavicle	24	17		24	
Complete					18
Medial End					5
Medial + Shaft					18
Cylinder					5
Lateral + Shaft					13
Lateral End					6
Unknown					2
TOTAL					67
Scapula	28	18		28	288
Complete/~Complete					34
Spine Fragments					43
Border Fragments					46

Element	MNE Left	MNE Right	MNE Unk.	MNI	NISP: Total Frags. (Including Sawn)
Glenoid Fragments					11
Acromion Fragments					31
Coracoid Fragments					13
Os Acromiale					3
Glenoid Fossa + Coracoid Process					1
Spine + Border					1
Unknown					105
TOTAL					288
Ribs					4,358
Hyoid			31	31	
Whole/Partial					6
Body					25
Horn					40
TOTAL					71
1st Cervical Vertebrae			13		
Complete/~Complete					13
Articular Facets					8
Posterior Arch					3
Transverse Process					3
Transverse Foramen					3
Transverse Foramen + Anterior Arch + Posterior Arch					1
Anterior Arch + Posterior Arch					1
Unknown					1
TOTAL					33
2nd Cervical Vertebrae			16		
Complete					11
Dens					5
1/2 Vertebrae					7
1/2 Vertebrae + Dens					1
Unknown					2
TOTAL					26
C3-C7 Vertebrae			104		
Complete					60
Centrum					44
Posterior Portion					22
Transverse Foramen + Articular Facets					26
Centrum + Side					15
Full Posterior Face					2
Half Posterior Face					3
Spinous Process					13
Lamina/Pedicle+ Sup. Articular Facets					1

Element	MNE Left	MNE Right	MNE Unk.	MNI	NISP: Total Frags. (Including Sawn)
Unknown					1
TOTAL					187
Thoracic Vertebrae			386		
Complete/~Complete					166
Spinous Processes					63
Transverse Processes					122
Full & Half Centrums					178
Posterior Face (Full-Half)					187
Centrums (Half & Full) + Part of Posterior Portion					36
Articular Surfaces					5
Centrum + Transverse Process					1
Centrum + Articular Facets + Transverse Process					2
Centrum + Articular Facets					2
Centrum + Articular Facets + Spinous Process					1
Articular Facet + Spinous Process					2
Unknown					15
TOTAL					780
Lumbar Vertebrae			163		
Complete/ ~Complete					96
Full + Half Centrums					55
Posterior Face					52
Articular Surfaces (some w/ transverse processes)					71
Spinous Processes					31
Unknown Articular Surfaces					4
Centrums (Half & Full) + Part of Posterior Portion					16
Transverse Processes					7
Centrum Portion					1
Centrum + Articular Facet					4
Centrum + Transverse Processes					1

Element	MNE Left	MNE Right	MNE Unk.	MNI	NISP: Total Frags. (Including Sawn)
Centrum + Articular Facet + Transverse Process					1
Articular Facet + Spinous Process					1
Unknown					5
TOTAL					345
Unknown Vertebrae					
Centrum					240
Spinous Process					40
Articular Facets					213
Unknown Vert Type					51
Other					316
TOTAL					860
Sacrum			25	25	
Whole/Partials					26
Various Fragments					141
One Wing + S1					4
S1					2
Dorsal Wall					13
S2-S5					2
Wing					2
Unknown					4
TOTAL					194
Coccyx			35	35	35
Pelvis	29	33		33	
Whole/Partial					25
Isolated Pubic Symphyses					38
Ilium					190
Ischium					50
Pubis					69
Acetabular Region					94
Greater Sciatic Notch/Preauricular Sulcus					17
Unknown					74
TOTAL					557
Patella	25	29	1	29	55
Unknown Metacarpal/ Tarsal/Long Bone Frags					1,010
Cartilage					
Ossified Throat Cartilage					~46
Various Cartilage					~100
TOTAL					~146

Element	MNE Left	MNE Right	MNE Unk.	MNI	NISP: Total Frags. (Including Sawn)
GRAND TOTAL					14,469

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