2019

Multidimensions of Poverty: An Analysis of the Differential Effects of Racism and Poverty on Skeletal Growth

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Recommended Citation

Halliday, Jennifer Lyn, "Multidimensions of Poverty: An Analysis of the Differential Effects of Racism and Poverty on Skeletal Growth" (2019). *Electronic Theses and Dissertations*. 7675.
https://scholar.uwindsor.ca/etd/7675

Multidimensions of Poverty: An Analysis of the Differential Effects of Racism and Poverty on Skeletal Growth

By

Jennifer Halliday

A Thesis
Submitted to the Faculty of Graduate Studies
through the Department of Sociology, Anthropology, and Criminology
in Partial Fulfillment of the Requirements for
the Degree of Master of Arts
at the University of Windsor

Windsor, Ontario, Canada

2019

Multidimensions of Poverty: An Analysis of the Differential Effects of Racism and Poverty on Skeletal Growth

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April 11, 2019

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ABSTRACT

There is evidence that people with a higher income tend to have better overall social, physical, and economic well-being. However, poverty is multidimensional and means more than just a lack of money and income (UNDP 2009; Potter et al. 2012). The differential effects of economic poverty, such as malnutrition and exposure to environmental pollutants, have variable effects on human growth and development depending on the conditions to which individuals and populations are subject. Understanding how the long-term consequences of food scarcity and pollution will affect the human body in its entirety will better contribute to understanding social harms. As such, detailed descriptive statistics and multivariate linear regression were used to analyze skeletal and documentary data from the Robert J. Terry Anatomical Collection and the Coimbra Identified Skeletal Collection, with the goal of addressing the impacts of racism, poverty, and chronic stress on growth and development. Specifically, this study used Ecofeminist theory to look at why racism and poverty in the Terry Collection has a very different impact than poverty in the Coimbra Collection.

DEDICATION

I would like to dedicate this thesis to Madisen Hvidberg for always believing in me when I lost sight of it. I wouldn’t have gotten here without you. You are my family, I love you.

To Daniel Matte for the support and encouragement you’ve given me, both within and outside of academia. You made all the difference. I love you and thank you for everything you’ve done for me.

And to Bruno Ujevic. You left too soon and we all miss you every day. You brought so much joy to every room you were in and I will never forget you.

ACKNOWLEDGEMENTS

Thank you to my advisor, Dr. John Albanese, for all your support, guidance, and reassurance throughout this process. Your kindness and enthusiasm really helped me develop the confidence I needed to complete this research with as much dedication and passion as I witness from you in your own work. I value your advice and encouragement, and it is always appreciated.

Thank you also to my committee members, Dr. Cara Fabre and Dr. Gerald Cradock for your interest in and commitment to my research. Your perspectives and input are greatly appreciated.

Lastly, thank you to my family and all my friends and colleagues in the graduate program for your support and encouragement. I definitely could have finished this sooner without you but you made the process that much better.

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LIST OF ABBREVIATIONS/SYMBOLS

CWF:	Coimbra “White” Female
CWM:	Coimbra “White” Male
TBF:	Terry “Black” Female
TBM:	Terry “Black” Male
TWF:	Terry “White” Female
TWM:	Terry “White” Male

Note: see text for critical description and context for use of racial terms.

CHAPTER 1: INTRODUCTION

Poverty is most often conceptualized as a lack of money and income since people with a higher income tend to have better overall social and economic welfare. However, the concept of poverty itself is multidimensional. As the United Nations Development Programme (UNDP 2009) states, poverty means that opportunities and choices that are basic to human development are not available to those experiencing it. In effect, poverty is represented by a lack of power and access to things such as education, employment, housing, and health. While income poverty is a very real issue, a lack of other basic rights and freedoms can also constitute poverty (White 2008). For instance, in addition to material consumption, physical and mental health, education, social relationships, spiritual and political freedoms, happiness, and environmental quality are all critical for an individual's overall well-being and a deprivation in any of these may be considered a form of poverty. That is to say, poverty cannot simply be defined as the lack of financial resources. Therefore, this study aims to outline the varying ways poverty impacts already marginalized groups by adapting Ecofeminist theory to skeletal and documentary data to argue that environmental degradation has disproportionate effects on these populations.

Despite the cognitive ability which separates humans from other animals, human beings are fundamentally part of the natural world. From an evolutionary perspective, all organisms shape and are shaped by their environment. For example, expanding agriculture in the D.R. Congo increased suitable habitats for the *Anopheles* species of mosquitos which then increased the prevalence of malaria. This then became a selection force for elevated frequencies of the hemoglobin variants which lead to sickle cell anemia in nearby populations because the condition provides an immunity to malaria (Janko et al. 2018). Beyond the evolutionary relationship however, humans are also dependent on the natural environment for food, water, oxygen, and other resources to provide shelter, fuel, technology, and other material goods.

There is evidence that people with a lower income are more often exposed to poor environmental quality (Mackillop et al. 2000; Evans and Kantrowtiz 2002; Ladd and Edward 2002; Donohoe 2003; Wright 2005), and that racial minorities are exposed at an even greater rate (Commission for Racial Justice 1987; Evans and Kantrowitz 2002). This environmental poverty places further stress on individuals who are already burdened by a lack of financial resources and the aforementioned variations of poverty can all become stressors in themselves, having different consequences on human health. Moreover, these causes and consequences are not discrete ends of a linear progression but feedback on each other synergistically (Desjarlais et al. 1995; Thomas 1998). Therefore, depending on the particulars of the stressors which an individual or population are subject to, poverty may have different effects on human health.

Disproportionate exposure to environmental degradation comes with associated adverse health conditions. Chronic exposure to air and water pollution can have a lasting effect on bone and climate change induced food and water shortages can affect bone through malnutrition. In the field of physical anthropology, analyses have been tightly focused on issues of sex and/or "race" whereas other factors are not considered as potential contributors to human variation. That is, any observed variation has been reduced to a consequence of biological sex or "race" without considering the impacts of gender or racism.

As Alves-Cardoso (2018) highlights, even when 'everything' is known about an individual skeleton or collection, there is still information missing that can help explain the conditions of their lives. The individuals in the Terry and Coimbra skeletal collections are considered 'identified' – that is, there is thorough documentation associated with each individual.

However, much of the information regarding the conditions they would have faced during their lives, which could have impacted their growth and development, is excluded from the discussion. Another factor which would have impacted the individuals in these collections but researchers tend to ignore is the conditions of their natural environment. It is widely accepted that skeletal growth is particularly sensitive to external factors such as socioeconomic status, disease, and malnutrition (Jones and Dean 1956; Adams and Berridge 1969; Agarwal et al. 2002; Hosseinpanah et al. 2010; Cardoso and Magalhaes 2011; Calderón- Garcidueñas et al. 2013; Brickley, Moffat, and Watamaniuk 2014) yet research using these identified skeletal collections offer no explanations for such variation other than economic poverty.

The Ecofeminism perspective is ideal to explore the effects of racism, poverty and chronic stress on growth and development because until the entire picture is revealed there is no certainty that any interpretations of it are accurate. That is, until a problem is seen from all available perspectives our understanding of it can only remain incomplete. Today’s ecological problems are intensified as the capitalist system exploits nature and vulnerable populations in its quest for profit and the consequences therein have not been afforded much scholarly thought when making use of identified skeletal collections. Environmental degradation negatively affects food and water supply, thus influencing skeletal growth through malnutrition, and results in airborne and toxic waste pollutants which can have lasting effects on bone development (Jones and Dean 1956; Adams and Berridge 1969; Agarwal et al. 2002; Hosseinpanah et al. 2010; Cardoso and Magalhaes 2011; Calderón- Garcidueñas et al. 2013; Brickley et al. 2014) and these issues are exacerbated in marginalized populations. Therefore, this study adapts the theoretical framework of Ecofeminism to alternative types of data (i.e. skeletal and documentary) to argue that environmental degradation and the disproportionate effects of it on racialized minorities contribute additional stressors to already marginalized populations, which is described in Chapter 2. In Chapter 3, the context for the problem will be outlined, introducing the skeletal collections and the range of research for which they have typically been used. It will also explore the unique multi-dimensional impacts of poverty and how environmental degradation is known to affect the skeletal system. Chapter 4 describes the statistical tests completed, including linear regression and 1-way ANOVA, the results of which are analyzed in Chapter 5. In Chapter 6, these results are discussed in relation to their historical context and the implications they have with respect to poverty in the broader global context.

CHAPTER 2: THEORETICAL FRAMEWORK

Ecofeminism

Ecofeminism is not only a theoretical framework but an academic and activist movement that critically examines connections between the domination of nature and the exploitation of women and other marginalized groups. The central concept posits that the same processes of exploitation and degradation of women can be applied to the natural world (Mellor 1997). As an academic movement, the major aim is to go beyond narrow, limited perspectives and to express and address diversity and inequality in world structures that allow for oppression in any form. That is, it addresses the inherent inequalities in world structures which permit the domination of marginalized groups and plundering of resources for economic gain.

Ecofeminism maintains that the boundaries between knowledge and ignorance are arbitrary and paralleled by those between expert and non-expert, and value and non-value. These boundaries serve only to shift the power into the hands of the “experts;” however, these delineations are determined by said “experts” and work to marginalize those whose knowledge or ability might remove power from those holding it (Shiva and Mies 1993; Mellor 1997). This results in a two-fold marginalization of these peoples, reducing their agency to change their situation and leaving them as merely subjects in their own experiences. Consequently, as non-experts, these people are valued only for their contributions to the capitalist framework based on neoliberal ideology.

Neoliberalism is an economic ideology that holds an individualistic stance with an aversion to government intervention. That is, under a neoliberal ethic, the state should reduce its interference in economic and social activities. Neoliberalism holds that as long as the government observes that capital is flowing and the free-market is working then society is considered to be sufficiently functioning (Navarro 2007; Bevir 2011). However, this attitude of individualism works to further marginalize those who are assumed to be self-responsible yet lack the capacity to impact more than their day-to-day lives. Environmental issues are not often seen as a priority for these people because their energy and capital are spent taking care of more immediate needs, such as sustenance and shelter. Consequently, these marginalized groups become vulnerable to exploitation by capitalism which takes advantage of their condition and makes it difficult for them to resist because they are bound by the limits of poverty.

Capitalism is based on the production of commodities and profit thus is built upon and maintains itself through colonization. While the idea of development is to create well-being and affluence for all - to affect equality and equity - the process of development focuses primarily on a model derived from Westernized standards that favours productivity and growth (Shiva and Mies 1993). In effect, colonialism is a necessary condition for capitalism to thrive and without a lower, subordinate class to exploit, the capitalist means of production would cease to generate profit. Since marginalized groups are subject to the ethos of neoliberalism but are without actual agency to improve their condition their need transforms them into commodities themselves and they become a resource which can be manipulated to keep the capitalist framework functioning.

The Ecofeminist framework recognizes that modernization, development, and progress are inherently responsible for environmental degradation. This is due to the reductionist nature of capitalism which is built upon and maintains itself through colonization and exploitation. Since commercial capitalism is based on the production of specialized commodities it necessitates uniformity in production thus reduces organic wholes to fragmented, separate parts. In effect, it diminishes complex ecosystems to a single component and function (Shiva and Mies 1993). In this sense, the world is believed to be composed of objects and once something is objectified it becomes a tool that can be used and exploited. This is not limited to environmental resources but extends to humanity since all human beings are rooted in nature. As such, ecofeminism is centered around the idea of connectedness and wholeness of theory and practice, with every living thing and every struggle being interconnected as part of a larger whole.

As Shiva and Mies (1993) discuss, the feminist perspective is a critique of the prevailing paradigm in science and social science that can look beyond the structures of power to view the world as an active subject rather than a mere resource to be manipulated and appropriated. Therefore, it is necessary to look beyond just one theoretical lens because an intersectional approach provides a closer look at issues as a whole. Marginalization and environmental degradation are interconnected issues, and so too are their causes and consequences. Therefore, Shiva and Mies argue that feminist research must be accompanied by the study of individual and social history and not restrict itself to academic discourse. Feminist research must collectivize the experiences of the oppressed and work to affect societal change.

With that in mind, Shiva and Mies (1993) posit that the view from above must be replaced by the view from below. That is, the view from above serves only those who are in positions of power, thus research must be undertaken from the perspective of those being oppressed. In accordance with that, the research process must work to ensure that the study of oppression is not carried out by so-called "experts" but instead by the objects of oppression. This would fulfill another obligation of feminist research which is to change the *status quo* in order to fully understand an issue. By becoming a process of conscientization, the study of oppression can be carried out by those who are actually experts – those being oppressed – thus returning to them the status of "expert." Moreover, this would not be at the exclusion of academic experts but rather a coalition with those who are actually experiencing the issues first hand.

Therefore, the Ecofeminism perspective is ideally suited to explore the effects of racism, poverty and chronic stress on growth and development since today's ecological problems are intensified as the capitalist system exploits nature and vulnerable populations in its quest for profit. Environmental degradation has negative effects on food and water supply, thus can influence skeletal growth through malnutrition. Furthermore, airborne and toxic waste pollutants can have lasting effects on bone development and these issues are exacerbated in marginalized populations. Ecofeminism addresses the inherent inequalities in world structures which permit the domination of marginalized groups and plundering of resources for economic gain and provides an alternative perspective with which to understand the complex nature of poverty (Shiva and Mies 1993).

CHAPTER 3: BACKGROUND

Before analysis, it is necessary to first provide context for the problem. Therefore, this chapter will introduce the Robert J. Terry Anatomical Collection and the Coimbra Identified Skeletal collection, discussing their histories and the range of research for which they have typically been used. It will then discuss how this past approach is inadequate for investigating the unique multi-dimensional impacts of poverty. Finally, this chapter will explore how environmental degradation is known to affect the skeletal system and why this is an important variable to consider.

3.1 - Robert J. Terry Anatomical Collection

The Robert J. Terry Anatomical Collection consists of 1,728 individuals ranging from 14 to 102 years of age and was compiled by Robert J. Terry and Mildred Trotter at the medical school at Washington University in St. Louis, Missouri. It was amassed from the end of the second decade of the 20th Century until 1967 and is composed of anatomy school cadavers which were primarily unclaimed bodies from medical facilities across Missouri (Hunt and Albanese 2005).

Terry was primarily interested in representing the complete range of human skeletal variation so he did not focus only on individuals with specific pathological conditions but included all forms of ‘normal’ individuals. One of the most beneficial attributes of the Terry Collection is the associated documentary data that Dr. Terry very diligently collected and independently verified. At the very minimum, all individuals in the collection have a morgue record which includes their name, sex, age, “race,” cause of death, date of death, morgue or institution of origin, and various other records relating to the embalming and processing of the cadaver. In an effort to ensure complete accuracy, Dr. Terry did not rely on the information provided on death certificates or identity documents. Instead, he reached out to hospitals and various other institutions, as well as people who knew the deceased to request confirmation of the age, place of birth, and occupation of the individuals. Where data could not be confirmed or was unavailable, he made notations (Hunt and Albanese 2005).

Aside from the morgue record, the majority of individuals have an inconsistent combination of records including dental charts, anthropomorphic and anthroposcopic data forms, bone inventory lists, skeleton index cards (with date they were added to the collection after maceration), summary checklists of documents, hair samples, stature and/or weight, cadaver photographs (or photo negatives), and plaster death masks. As such, this collection has accurate and detailed records for each individual including name, sex, age, and "race" (Hunt and Albanese 2005).

The fact that the individuals in the Terry collection were unclaimed strongly suggests that they came from lower socioeconomic classes and that neither they nor their family members could afford to pay for their burial expenses. The Terry collection was amassed over the first half of the 20th century (Hunt and Albanese 2005). As a result, the racial designations were recorded based on the perceptions of "race" in St. Louis at the time. Racial categories were based on socio-economic categories and on perceived differences rather than any meaningful biological differences.

After World War II, the economic boom in United States led to significant social and economic change. More people had the financial means to claim their family members and cover the expenses of funerals, burials, and care in perpetuity. However, at the same time social views regarding anatomical instruction were shifting and new legislation instituted testamentary bequests of human remains for the purposes of scientific research. This ultimately had an effect on the demographic composition and economic status of the remains being made available for anatomical study (Hunt and Albanese 2005).

Terry retired in 1941 and the collection process was taken over by Mildred Trotter until her own retirement in 1967 (Hunt and Albanese 2005). When Mildred Trotter began her work collecting for the Terry Collection over 80% had already been amassed. However, she made significant contributions to the collection in her attempts to balance the demographic composition. Since social and economic factors limited the number of females available for anatomical study in the early 20th century there was an imbalance in the ratio of males to females included in the collection, with males and older individuals being considerably overrepresented. Endeavoring to create a more even representation of human variation, Trotter focused her collection efforts on “white” females and younger individuals (Trotter 1981; Hunt and Albanese 2005). Consequently, there is a mortality bias in this collection that is routinely misrepresented as racial differences (Albanese and Saunders 2006; Albanese 2018; Sharman and Albanese 2018).

3.2 - Coimbra Identified Skeletal Collection

The Coimbra Collection is composed of 505 individuals who died between 1904 and 1938 and were exhumed from the common burial ground at the *Cemitério de Conchada* in the city of Coimbra, Portugal (Rocha 1995). This collection was amassed by Professor Eusébio Tamagnini in two phases. The first phase consisted of a batch of 72 individuals who died between 1904 and 1912 and were a combination of those from the *Cemitério de Conchada* as well as the Anatomical Museum of the University of Coimbra. The second phase is that wherein the majority of skeletons were collected from the *Cemitério de Conchada.* In total, the collection was amassed between 1914 and 1942. Detailed records were kept by cemetery officials and included place of birth, sex, age, date, place of death, cause of death, profession, family situation, name, and place of birth.

Unlike North American burial practices, Portuguese cemeteries were not places for burial in perpetuity. Permanent burial plots were costly thus originally reserved only for the wealthy. For the majority of the population, disinterment and secondary burial in an ossuary was the norm. Portuguese cemeteries had a policy wherein after a span of 5 years (or more if applicable) skeletal remains were transferred from the common burial ground to a common ossuary unless they were claimed or their storage contract was renewed (Cardoso 2006). Exhumations for this reason were performed by the official of the cemetery, at which point the bones were discreetly transported to the Museum (Rocha 1995).

3.3 - Previous Research using the Collections

The Terry and Coimbra collections, along with other skeletal reference collections, have primarily been used to create and test metric methods for determining an individual's biological profile (Hunt and Albanese 2006). That is, methods for determining age, sex, "race/ancestry", and stature have been the focal points of most of the research using skeletal collections. While some research has looked beyond these areas to examine pathology and other non-normal sources of variation (Kurki 2007; de la Cova 2011, 2012; Atwell 2013; Chirchir 2016; Langley et al. 2016; Spekker et al. 2018, among others), most research has circled around these ideas using varying bones to look for measurable differences between sexes and "races."

Since the Terry and Coimbra collections are considered identified, the sex and age of each individual was recorded at the time of death. Consequently, many researchers have used these collections to estimate sex (Steele 1976; Albanese 2003; Albanese, Cardoso, and Saunders 2005; Correia, Balseira, and Areia 2005; Urbanova et al. 2013; Albanese 2013; Novak, Schultz, and McIntyre 2012; García-Parra et al. 2014; Gama, Navega, and Cunha 2015; Navega et al. 2015; Curate et al. 2016, 2017a, 2017b) and age (Stewart 1955; Ericksen 1982; Galera, Ubelaker, and Hayek 1995, 1998; Osborne, Simmons, and Nawrocki 2004; Snodgrass 2004; Rissech et al. 2006; Coqueugniot and Weaver 2007; Rougé-Maillart et al. 2009; Curate, Albuquerque, and Cunha 2013; Lynnerup 2013; Venara et al. 2013; Villa et al. 2015; Stoyanova et al. 2017; Alves-Cardoso and Assis 2018; Kotěrová et al. 2018a, 2018b; Navega et al. 2018). Other popular uses for the Terry collection include stature development (Trotter and Gleser 1952; Raxter, Auerbach, and Ruff 2006; Albanese, Osley, and Tuck 2012, 2016; Niskanen et al. 2013) and the much more problematic "race" or "ancestry" estimation (Ousley and Jantz 1998; Kindschuh, Dupras, and Cowgill 2012; Meeusen, Christensen, and Hefner 2015).

3.3.1 – Critique of Previous Literature

Efforts to improve and expand upon existing models of sex, "race", and stature estimation have been thorough in terms of statistical analyses. However, few studies have considered alternative explanations for some of the observed variation. While Steele (1976) questioned whether socioeconomic conditions and secular change could have affected the size of the individuals under analysis, he posited that there was no way to measure the effect of socioeconomic differences. Urbanova et al. (2013) acknowledged that variations between populations complicate the accuracy of any sex estimation method but did not offer an explanation for why. Similarly, Gama et al. (2015) recognized secular change as a factor in human variation but failed to discuss any reasons why body size changes over time. García-Parra et al. (2014) attribute some of the variation to potential environmental, genetic, or sociocultural factors, citing Macaluso (2010), but neither of the studies expand on these ideas.

Alves-Cardoso and Assis (2018) recognize that the results of their study could be influenced by external factors. However, they discuss only direct individual issues such as joint morphology, limb alignment, and physical damage but fail to consider the effects of local environments. Curate et al. (2013) note that bone mineral density declines with age but that their method of age estimation consistently overestimates the age in younger individuals while underestimating the age in older people. Genetic and 'environmental factors' are cited as reasons for this disparity, however no definitions are provided nor are any connections drawn between their results and the environmental context for the individuals sampled. Similarly, Niskanen et al. (2013) demonstrate that there is an age-related loss in stature due to a reduction in intervertebral disk thickness. However, they do not consider factors external to the aging process which could attribute to a loss in disc thickness.

Raxter et al. (2006) note that age-related changes affect the ability to accurately estimate stature but they attribute these changes solely to natural age-related bone degeneration. However, there are more factors to consider that can interfere with bone development and degradation than simply the non-pathological effects of age. Similarly, Coqueugniot and Weaver (2007) noted that their age-estimation methods were tested on a sample that was known to be of a very low socioeconomic status and took measures to ensure their results were not influenced by malnutrition. However, they only considered the effects of malnutrition whereas low socioeconomic status can affect skeletal changes in a myriad of ways.

Snodgrass (2004) does link osteophyte (bone spurs at joints linked to degeneration and osteoarthritis) development to individual occupation, citing a study by Gantenberg who observes that osteophyte development is negatively correlated with socioeconomic status. That is, those living under better socioeconomic conditions experienced a lower prevalence of osteophyte development. However, Snodgrass simply states it but does not expand on this connection to discuss its value. Similarly, Osborne et al. (2004) acknowledge the contribution of occupational stressors to changes in the auricular surface but attribute the variation in their results primarily to that of individual difference rather than any kind of collective experience. Like Snodgrass, Osborne et al. simply state the connection to occupation but look no further for any underlying causes.

Population-specificity is a recurring explanation for the accuracy rates in the methods being developed or tested, however few researchers take the time to delve deeper into this explanation**.** Rather, they opt to include only a sentence or two acknowledging the issue without looking further into contextual explanations for this variation. Kotěrová et al. (2018a, 2018b) stress that globalization and migration have an undeniable effect on the composition of populations, thus if there is nothing that indicates to which population an individual belongs then they cannot be assigned with any certainty. However, while this acknowledgement for population specificity is sound, there is no insight as to why there are observable differences between groups from different environments, and the parameters for inclusion in a population are poorly defined or not defined at all. Furthermore, they cite a vague concept of “ancestry” or “race” for the source of variation without first considering how these terms are defined or alternative sources for said variation, such as environmental context (Armelagos and VanGerven 2003).

Trotter and Gleser (1952) also attribute differences in stature to be linked to “race,” but do not consider the larger, systemic societal issues that can cause said differences. Similarly, Kindschuh et al. (2012) use the hyoid bone from individuals in the Terry collection in an effort to find an observable difference between racial categories without acknowledging the contextual data at the time. Villa et al. (2015) argue that there are benefits to eliminating subjectivity from forensic analyses of human bone and push for mathematical rigidity that effectively forces an unidentified bone into a category (i.e. sex or “race”) that it may or may not belong to without consideration for alternative explanations of an observation. Looking for discernable differences between “races” or “ancestries” ignores the larger issue of “race” being a social construction and further propagates the idea that all human variation can be reduced to biological differences between groups rather than the result of external factors.

While the studies examined here are not exhaustive of the available literature, they exemplify the current state of research using skeletal reference collections. The majority of these studies are clearly cognizant of external influences and their effects on bone, however these effects are primarily attributed to nothing more than human variation. It is accepted that malnutrition, secular change, and sexual dimorphism are population-specific issues that must be accounted for during metric analyses, yet little research has examined beyond the obvious to elucidate the more systemic causes that are leading to these issues in the first place.

However, some researchers have at least begun to explain the relevance of population-specificity. For example, Albanese (2003) recognized that the applicability of the sex-estimation methods developed are restricted by the reference sample and Albanese et al. (2016) acknowledge that alternative explanations, such as economic policy, can have an impact on growth and development, overall health, and stature. While they do not expand on the idea, Navega et al. (2018) do cite literature by Mays (2015) who discusses some causal factors, besides age, that can affect skeletal indicators of age. Among these factors are hormonal changes, diet and nutritional deficiencies, occupation, and other individual or population-specific reasons why there may be differences between groups. While this article does not look any further into the larger issues that can cause some of these factors (environmental degradation, oppression, poverty etc.) it does open the door to explain the reasons why population-specificity is such a prevalent issue in studies of skeletal variation and admits that thorough analysis of background documentation can facilitate better controlled studies.

As mentioned, it is necessary to look beyond just one theoretical lens when analyzing an issue. An intersectional approach provides a closer look at issues as a whole. As such, when using skeletal reference collections, examining their individual contexts from an Ecofeminist lens can illuminate some larger structural causes that could contribute to their skeletal variation, incorporating a more holistic examination of poverty and marginalization.

3.4 - Multidimensions of Poverty

It is well evidenced that external factors such as pollution and food scarcity can affect human growth and development. Both of these issues can lead to disease, malnutrition, and physiological stress that can have a lasting effect on bone, but poverty puts one at a disadvantage with respect to these factors to different degrees. As Lister (2004) discusses, definitions of poverty have heretofore been a source of argumentation amongst researchers. While some definitions venture into broader explanations and look at issues such as human dignity and independence (United Nations 2009; Nolan and Whelan 2007), the most common definitions have been narrow and focused primarily on an individual's ability to participate in economic activity. Since there is evidence of a strong, positive correlation between income and social or economic well-being, poverty is most often conceptualized as a lack of financial capital (Potter 2012). That is, people with a higher income tend to have better overall social and economic welfare. As a result, poverty lines are estimated based on statistical analyses of absolute and relative measures that consider only things such as food costs and average income. These standard measures of poverty generally refer to an individual's personal buying power and their ability to afford the basic needs for human life: food, shelter, and clothing (Macarov 2003).

As the United Nations Development Programme (UNDP 2009) states, poverty means that opportunities and choices that are basic to human development are not available to those experiencing it. In effect, poverty is represented by a lack of power and access to things such as education, employment, housing, and health. White (2008) argues that while income poverty is a very real issue, a lack of other basic rights and freedoms can also constitute poverty. For instance, in addition to material consumption, physical and mental health, education, social relationships, spiritual and political freedoms, happiness, and environmental quality are all critical for an individual's overall well-being and a deprivation in any of these may be considered a form of poverty.

As Jenkins (1991) discusses, poverty is also a lack of economic independence because it leaves people vulnerable should anything happen to the person they depend upon for financial security. This idea of independence can be extended beyond the economic aspect to help explain the alternative issues that White (2008) discussed. For example, should a person lose access to independent mobility due to a complication with their physical health this may impact their ability to fulfil other fundamental needs such as maintaining social bonds. This, in turn, may affect their mental health and their happiness thus depriving them even further. Furthermore, as

Macarov (2003) discusses, there are places where there are additional stressors such as contaminated drinking water, lack of educational or employment opportunities, and inadequate medical care where increased financial capital cannot purchase what is not available. As such, places lacking in these basic resources are impoverished despite their economic capabilities.

Macarov (2003) also discusses how the idea that certain ethnic or social groups are more likely to be poor has been normalized in most societies. That is, stereotyping of the elderly, people with cognitive or physical disabilities, immigrants, and racial minorities, among others, as more likely to be poor leads to the public perception that they are poor, regardless of their individual situations. Under the colonial capitalist framework, this normative view of who is and is not poor has political advantages. For example, the expectation that certain groups are supposed to be poor erases any real imperative to help them. Given that these groups are thought to be “incapable of being helped” (Macarov 2003:26) their focus is, necessarily, on taking care of their basic needs and lifting themselves out of poverty independently. As a result, they are left vulnerable to exploitation and capitalist industry can take advantage of this situation. Consequently, these lower socioeconomic status groups suffer an increased proximity to the manifestations of environmental degradation

There is evidence that people with a lower income are more often exposed to poor environmental quality in terms of increased levels of air and water pollution (Mackillop et al. 2000; Evans and Kantrowtiz 2002; Ladd and Edward 2002; Donohoe 2003; Wright 2005). In addition, racialized groups tend to be marginalized and are at a greater risk of exposure than their counterparts (Commission for Racial Justice 1987; Evans and Kantrowitz 2002). For instance, Evans and Kantrowtiz (2002) provide an extensive analysis of the literature surrounding economic poverty and health. They demonstrate that, globally, the poor are the most likely to be exposed to hazardous waste, ambient air pollution, and water contamination. Mackillop et al. (2000) and Donohoe (2003) also demonstrate that Superfund sites, garbage dumps, and waste incinerators are more common in lower socioeconomic status neighbourhoods. Similarly, Ladd and Edward (2002) and Wright (2005) provide further support for this assertion, demonstrating that, in the United States, people of lower socioeconomic status and people of colour are disproportionately exposed to toxic waste from manufacturing and industrial agriculture. On a global scale, the World Health Organization (WHO 2016) indicates that people living in low-and middle-income countries disproportionately experience air and water pollution compared to high-income countries.

Evans and Kantrowtiz (2002) also posit that racialized groups in the United States are more likely to be exposed to these issues than non-racialized groups. In 1987, the United States commissioned a report that analyzed racial and socioeconomic demographics of communities near hazardous waste sites. This report detailed that toxic waste facilities are predominately situated in working class and low-income communities, primarily of people of colour. The study concluded that “race” was the primary factor, over socioeconomic status, which dictated the location of hazardous waste sites (Commission for Racial Justice 1987; Krauss 1993; Warren 1997). As such, racialized groups are demonstrated to be disproportionately exposed to uncontrolled toxic waste.

Living within the proximity of heavy environmental degradation is a form of poverty in itself. Depression and other emotional or mood disorders are known to be a risk factor for a range of chronic physical illnesses from asthma to diabetes, strokes, or cardiovascular disease (Hippisley-Cox, Fielding, and Pringle 1998; Turner and Kelly 2000; Ostir et al. 2001; Pretty 2004). However, as Pretty (2004) discusses, access to the natural environment has been proven to positively influence mental and physical health which, in turn, positively influences behaviour and interpersonal relationships. In contrast, environmental poverty places further stress on individuals who are already burdened by a lack of financial resources. Each form of poverty, and its causes and consequences are not discrete ends of a linear progression, rather they all feedback on each other synergistically (Thomas 1998) and depending on the particulars of the stressors which an individual or population are subject to, poverty may have different effects on human health.

3.5 - How Environmental Degradation affects Bone

In 1985 Clyde Snow coined the term 'osteobiography' wherein the human skeleton contains a brief but informative biography of an individual (Weizman 2011; Foote 2014). In effect, the bones carry a record of a lived life where illnesses, trauma, and conditions of nutrition, labour, and habit are effectively fossilized into skeletal morphology. Since approximately 95% of the adult skeleton is formed by the end of the adolescent period (at approximately 18 years of age), the amount and quality of bone growth during childhood is a major determinant of bone health in adults (Bogin 1999; Bailey et al. 2009; Farr and Kohsla 2015). As such, looking at the bones of adults provides valuable information about the physiological processes of growth and development, as well as the socioeconomic and environmental context for these processes. Understanding the complex ways that the external environment can influence skeletal growth during childhood can help explain the condition of fully-developed adult bones.

Disproportionate exposure to environmental degradation comes with associated adverse health conditions. Chronic exposure to air and water pollution can have a lasting effect on bone and climate change induced food and water shortages can affect bone through malnutrition.

Normal skeletal homeostasis is dependent on a balance in the activity of cells responsible for bone resorption and formation. Osteoblasts are cells which synthesize collagen and produce a matrix that mineralizes with calcium and phosphate to form hydroxyapatite, the mineral which gives bone its rigidity. In other words, osteoblasts are responsible for the formation of new bone. On the other hand, osteoclasts break down bone tissue and are critical for repair, maintenance, and remodeling of bone. For normal skeletal homeostasis, after bone is resorbed the lacunae must be filled in with new bone and this is mediated by osteoblastic activity (Holz et al. 2007; Waldron 2009). Additionally, bone turnover markers are proteins which originate from osteoclastic and osteoblastic activity that are released during the formation or degradation of collagen. When their concentrations rise it is a signal that bone is being remodeled at a faster rate than usual (Thomas 2012).

3.5.1 - Air Pollution

Outdoor air pollution originates from anthropogenic sources such as fuel combustion, heat and power generation, and industrial facilities. Particulate matter, consisting of sulfate, nitrates, ammonia, sodium chloride, black carbon, and mineral dust, affects more people than any other pollutant and can have effects when encountered even at very low concentrations (WHO 2016). Higher levels of bone turnover markers are negatively associated with bone mass and density, thus contributing to rapid bone loss, loss of structural elements, reduced bone strength, and increased prevalence of fractures (Liu et al. 2015).

Empirical studies have attempted to measure the effect of ambient air pollution and particulate matter on human bone. For example, Prada et al. (2017) studied the association of long-term concentrations of particulate matter air pollution with bone health. Their results had three major determinations which ultimately suggested that poor air quality was a risk factor for bone fractures and osteoporosis: (1) it was demonstrated that bone fracturing and osteoporosis was greater in areas with higher particulate matter concentrations, (2) that black carbon and particulate matter concentrations were associated with lower serum parathyroid hormone (which decreases calcium levels and stimulates osteoclastic activity), and (3) black carbon concentration was associated with higher bone mineral density loss.

Liu et al. (2015) studied two German birth cohorts of healthy neonates, with follow-ups at two, three, four, six, and ten years of age and found that exposure to ambient air pollution and road traffic is associated with increased bone turnover markers. Their study suggests that ambient air pollution may be associated with increased bone turnover rates thus negatively impacting bone development in children. Similarly, Calderón-Garcidueñas et al. (2013) examined the effects of ambient air pollution on six-year-old children from Mexico City and found that they had decreased bone mineral density and insufficient levels of Vitamin D.

Alvær et al. (2007) and Alvær et al. (2010) studied the effects of outdoor air pollution on bone mineral density in elderly men and found a weak but statistically significant inverse association between air pollution and total body bone mineral density. That is, they found that bone mineral density was lower in those that had been exposed to higher levels of ambient air pollution. Alvær et al. note that today's level of air pollution is significantly lower than in previous decades, however of the men included in their study, 77% had lived at or near their present address for the past 30 years. Thus, these men had probably been exposed to larger amounts of pollution earlier in their lives. This is significant because bone growth and resorption is a slow process, so for the effects to be measurable the individual must have dealt with repeated or chronic exposure to the causal factor.

Wang et al. (1997) determined that there was an association between ambient air pollution and low birth weight in infants in Beijing. In addition. Liu et al. (2003) and Liu et al. (2007) found that even relatively low concentrations of ambient air pollution in Canadian urban centres could have adverse effects on fetal growth. Similarly, Schell et al. (2006) and Kampa and Castanas (2008) determined that air pollution and maternal exposure to heavy metal pollutants (particularly lead) increases the risk of reduced fetal growth and Sram et al. (2013) found that coal combustion in homes impaired skeletal growth of children under the age of 3 in the Czech Republic.

3.5.2 - Water Pollution

It has been documented that poorly treated domestic, industrial, and agricultural wastewater contains high concentrations of heavy metals (Gupta 2008; Chowdhury et al. 2016). Some of the major sources of the contaminants are through manufacturing and refining industries such as electroplating and metal smelting (He et al. 2008; Chowdhury et al. 2016). Heavy metal and other contaminants can also be introduced into drinking water through the oil and gas industries. Lead, mercury, cadmium, and other metals are known to be present in tailings from oil sands and wastewater from hydraulic fracturing. Damage to these storage facilities can cause them to release large volumes of these contaminants into the environment. Additionally, tailings ponds and wastewater storage tanks can leak gradually into surface and groundwater sources (Järup and Åkesson 2009; Frank et al. 2014; Lauer, Harkness, and Vengosh 2016).

There have been documented cases where industrial wastewater has contaminated local drinking water. Liu et al. (2011) demonstrated that, despite attempts to remove metals from industry effluent, electroplating industries in the Guangxi province of China still released heavy metal contaminants into the environment via wastewater discharge. This led to the contamination of paddy soil, rice, and drinking water with cadmium, lead, and other metals. Furthermore, heavy metal contamination of water not only affects human health through direct uptake via drinking water but can also contribute to the contamination of subsequent food sources.

For example, zinc mining at the Kamioka mine in Japan produced cadmium that was disposed of in the Jinzu river which was a water source for nearby rice paddies (Yoshida, Hata, and Tonegawa 1999). Besides showing the link between the use of leaded-petrol in automobiles and blood-lead concentrations in children, Rahbar et al. (2002) also demonstrated that seawater contaminated by the use of leaded-petrol as fuel in boats contributed to higher blood-lead concentrations in children due to consumption of marine-based foods and food growing in contaminated agricultural soils. As Fitzgerald and Baralt (2010) discuss, marine-based foods are also known to be risk factors for increased levels of mercury due to contamination of oceans by anthropogenic factors. Mercury is a naturally-occurring heavy metal, however when it is combined with water and associated bacteria it converts into methylmercury which is known to have significant adverse effects on humans. These effects include neurological disorders, sensory and motor impairments, and can also affect a developing fetus through maternal ingestion (Fitzgerald and Baralt 2010).

Holz et al. (2007) demonstrate that heavy metal exposure can decrease osteoblast and increase osteoclast activity. Since osteoblasts are the cells responsible for bone development, this means that heavy metal exposure can potentially slow the rate of bone growth. Furthermore, as osteoclasts are responsible for bone resorption, heavy metal exposure can increase the rate at which bone is broken down and resorbed, thus upsetting normal skeletal homeostasis and decreasing bone mineral density. Moreover, food and water scarcity can contribute to metabolic diseases which can further decrease bone mineral density and cause osteological conditions such as rickets, kwashiorkor, and osteoporosis.

3.5.3 - Food and Water Scarcity

Carbon and methane emissions from manufacturing, industrial agriculture, and consumption of fossil fuels add increased levels of carbon into the atmosphere. At the same time, deforestation reduces carbon sinks which would otherwise balance the increasing levels of atmospheric carbon (Pan et al. 2011). These factors work in conjunction to increase global air and ocean temperatures, thereby causing a series of negative consequences such as increased ocean acidity, drought, melting of glaciers and snow cover, reduction in arable land, shorter growing seasons and crop yields, and a reduction in livestock health and fish stocks (Agnew 2011). Therefore, carbon and methane emissions, deforestation, and industrial agriculture work in tandem, increasing global temperatures and leading to shortages in food and water supply worldwide.

It is widely accepted that skeletal growth and maturation is particularly sensitive to the effects of socioeconomic status and malnutrition. In both developing and developed nations, people with low socioeconomic status are disproportionately affected by food scarcity and are more vulnerable to the effects of malnutrition (Van de Poel et al. 2008). Since nutritional intake is differentially distributed based on biological need, when nutritional intake is inadequate caloric energy is diverted away from skeletal growth and maturation to more immediate needs, such as bodily maintenance, physical exertion, and the immune system. As such, skeletal growth is given the lowest biological priority and those who receive inadequate nutrition will experience a faltering in growth.

Under such stressful conditions the human body naturally attempts to remedy the situation by extending the growth period causing delays in maturation (Bogin 1999; Black et al. 2008; Varela-Silva et al. 2009; Kramer and Greaves 2011). However, when nutritional intake remains inadequate the bones will eventually reach full maturation without achieving their full potential in terms of size. Empirical studies have supported this assertion by demonstrating that children reared in such impoverished conditions have delays in skeletal growth and maturation. In other words, children who are raised without consistent access to adequate nutrition generally experience an extension of the growth period and a faltering in growth.

Guerrero et. al. (1973) provide an example of this pattern. They studied the effects of socioeconomic status in 140 boys, 6 to 12 years old, half from private school (which are often associated with higher income levels) and half from low socioeconomic status. They found that tooth development and eruption were delayed in undernourished children. Similarly, Gulati, Taneja, and Madan (1990) studied 80 malnourished and 40 well-nourished Indian children between 3 and 14 years of age and found a delay in both dental and skeletal maturation directly proportional to the severity of malnutrition. Fleshman (2000) found a similar pattern in their assessments. They looked at 219 children of low socioeconomic status from Nepal and discovered that there was a severe delay in skeletal maturation. The average bone age for these children was approximately 28% below chronological age, and 60% of these children fell two standard deviations or more below the norm for healthy children.

In another study, Baig-Ansari et al. (2006) interviewed 433 mothers from Karachi, Pakistan and found that food-insecure households were approximately three times more likely to have a stunted child than homes with consistent access to adequate nutrition. They also determined that 40% of children below the age of 5 in Karachi were stunted in households where all the women were illiterate but that this value decreased to 25% when at least one woman in the home achieved 10 years of schooling. This supports the work of Vella et al. (1994) which determined that maternal education is critically important for a child's health and nutrition, more so than socioeconomic status. Nawrotzki, Schlak, and Kugler (2016) also discuss that stunting is indicative of chronic nutritional deprivation during childhood and that an individual's growth potential is restricted based on long-term nutritional deficiencies. Additionally, Cardoso (2007) and Conceicao and Cardoso (2011) documented the sensitivity of skeletal growth and maturation in a sample of fully identified Portuguese children of differing socioeconomic status. Their results demonstrated that children of lower socioeconomic status displayed a skeletal delay of about one year.

Similar to Baig-Ansari and colleagues, Van de Poel et al. (2008) measured the nutritional status of children below the age of five from 47 developing countries surveyed by the Demographic and Health Survey (DHS). Their results demonstrated that there is a noticeable inequality in malnutrition that is correlated to socioeconomic status. That is, children from lower socioeconomic status families were more likely to be undernourished and experience a below-average height for their age. Black et al. (2008) found that 32% of children below the age of 5 in developing countries (totalling around 178 million individuals in 2005) experienced growth stunting with a Z-score of -2 or more. That is, these children were averaging a height that was two standard deviations below the mean for healthy children. Black et al. also determined that this stunting was primarily due to undernutrition, particularly due to a deprivation of dietary protein and that the largest number of affected children was observed to be in South-Central Asia. Furthermore, Saha et al. (2009) studied 1,343 children below the age of 2 in rural Bangladesh and found that proportions of stunting were lower in food-secure households.

Similarly, Mendez et al. (2016) recorded the height and weight of 3,243 children from 16 elementary schools in Merida, Mexico between the ages of 6 and 12. They determined that children from parents with lower incomes were more likely to be shorter in stature than those from high-income families and that this was due to a disparity in diet and health conditions.

It is evident that environmental degradation has serious effects on human health yet research using skeletal collections excludes this topic from the discourse. Furthermore, poverty is more complex than simply financial inequality and research in physical anthropology has not examined this issue from any other perspective. Environmental poverty adds more strain on people who are already struggling with the effects of other inequalities and this can have different effects on their skeletal growth. Understanding how the long-term consequences of food scarcity and pollution will affect the human body in its entirety will better contribute to understanding social harms within criminology. Therefore, this study uses detailed statistical analyses under the lens of Ecofeminist theory to examine why racism and poverty in the Terry Collection has a very different impact than poverty in the Coimbra Collection.

CHAPTER 4: METHODOLOGY

This project is primarily quantitative in nature, consisting of a statistical analysis of skeletal measurements from the clavicle, humerus, radius, ulna, pelvis, femur, and tibia. Long bone length was used to assess overall body size and stunting and these measurements include the maximum lengths for the clavicle, femur, humerus, radius, and tibia, as well as the physiological length of the ulna. Pelvic dimensions and joint measurements were used to assess the size of these elements relative to overall body size. Pelvic dimensions include the acetabular-ischium length (AIL), superior pubic-ramus length (SPRL), iliac breadth, and height of the innominate. Joint measurements include the epicondylar breadths of the femur and humerus, as well as the maximum diameter of the femur head and the maximum vertical diameter of the humerus head (see Appendix A for a full description of the measurements). It will also consider supporting documentary data and historical context for individuals sampled from the Robert J. Terry Anatomical Collection and the Coimbra Identified Skeletal Collection. The data used are a sample from these two collections that was previously collected and is being repurposed to address this research question (Albanese 2003, 2010).

The initial sample was collected to include the full range of adult ages with a wide range of birth years and any variation that could contribute to age at death or secular change was sampled. Upper and lower age limits were arbitrarily set to minimize the amount of missing data and to mitigate any misleading effects of incomplete growth or age-related bone loss. While both collections have accurate records for date of death, the date of birth is not available for most individuals. Year of birth was calculated by subtracting the age at death from the year of death for each individual and individuals whose year of death or age at death were in any way suspect where excluded (Albanese 2003, 2010). As such, age ranges from 19 to 79 years. The sample size consists of 589 individuals, 247 from the Coimbra collection and 342 from the Terry collection (see table 1) born between 1832 and 1934.

Collection	"Race"	Sex		
		Female	Male	Total
Coimbra	"Black"	0	0	0
	"White"	127	120	247
	Total	127	120	247
Terry	"Black"	108	93	201
	"White"	75	66	141
	Total	183	159	342
	Total	310	279	589

Table 1. Frequencies for sex and "race" in the sample analyzed

4.1 - Coding Scheme

Three string variables (sex, "race", collection) were recoded into numeric dichotomous variables with the reference groups being females, "white" individuals, and the Coimbra collection. Collection was also recoded into "collection2" with Coimbra as 1 and Terry as 2 in order to conduct t-tests using collection as the grouping variable. For the purposes of this study, the terms that were used in the original historical documents - "white" and "black" – are used here to refer to the groups as they were perceived at the time of death. However, to illustrate that the racial terms used were highly problematic for capturing variation, quotation marks will be used when referring to racial categorizations. A 'super variable' was also created that separates each of the sex, "race," and collection variations into their own coded categories. This was coded from zero to five, with Coimbra females (CWF) being coded 0, Terry "white" females (TWF) 1, Terry "black" females (TBF) 2, Coimbra males 3 (CWM), Terry "white" males (TWM) 4, and Terry "black" males (TBM) 5. Additionally, age at death was recoded into those above and below age 50.

4.2 - Assumption Testing

To determine if the analysis should be carried out using parametric or non-parametric tests, the data was tested for normality using Kolmogorov-Smirnov (K-S) and Shapiro-Wilk tests as well as visual analysis of histograms and normal q-q plots. The K-S and Shapiro-Wilk tests both had significance values below 0.05 for each variable indicating that they do not follow a normal distribution, however normal q-q plots and histograms show approximate normality. While these results are conflicting, a violation of the normality assumption does not lead to bias in the regression coefficients and its effect on significance tests and confidence intervals is partly dependent on the sample size. As such, because this sample consists of 589 cases it is large enough to be deemed safe to continue with parametric tests.

Scatterplots with quadratic and linear regression lines were created for each measurement against the vertical head diameter of the humerus to determine which method was most appropriate. Since there were no large differences between the R^2 for both types of equations, linear regression was chosen for analysis. Before further analyses were conducted, each variable was tested to ensure it meets the assumptions of ordinary least squares regression. Scatterplots of standardized and predicted residuals did not reveal any problematic heteroscedasticity. Durbin-Watson results have a value of 2.039 indicating that it is safe to accept the true hypothesis that the residuals are independent. Visual scans of histograms and boxplots reveal several potential outliers however, dfbeta tests do not indicate that they are of any significance. Since larger sample sizes decrease the problematic effects that outliers create, no remedial action is necessary for outliers in this model.

4.3 - Statistical Methods

Exploratory tests were conducted to look for obvious differences between groups. Descriptive statistics and frequencies were generated for each variable by collection, sex, and "race", and independent samples t-tests were conducted for collection using age at death, year of death, year of birth, and each osteometric measurement to look for significant differences between collections. Since significant differences were noted in the t-tests, to test if the subdivided groups (sex, "race", collection) were significantly different from each other, the super variable and age at death were tested using 1-way ANOVA with Tukey HSD *post hoc* tests to group their means into homogenous subsets. Multiple regression was then conducted to examine limb sizes using the humerus head measurement as the independent variable.

Hierarchical modelling led to the creation of five separate regression models. The first model contains only the osteometric variables to explore the relationship between the skeletal elements and how they change without consideration of social or biological influences. To control for any effects that secular change may have on the data model 2 includes age at death, year of birth, and year of death. To account for biological influences, model 3 controls for sex and model 4 introduces "race". Finally, to account for social influences, model 5 includes collection as a control variable. Multiple regressions were also performed using age at death, year of birth, sex, "race", and collection as the independent variables with each osteometric measurement individually acting as the dependent variable. This will allow for a better understanding of how each measurement is independently affected by the controls.

To visualize these differences, scatterplots were created plotting each osteometric measurement against the maximum vertical head diameter and the maximum length of the humerus. The humerus was chosen as the independent variable because it is known to be one of the most stable bones and is the least likely of the bones observed to be affected by environmental influences (Pomeroy et al. 2012). Furthermore, joints tend to be less affected than long bone lengths and mid-shaft measurements can be greatly affected by prolonged infirmity and wasting before death (Albanese 2003). The super variable was used as a filter to colour code each different group to visualize any differences between them.

4.4 - Contextual Methods

Supplementary documentary data are included with both collections. In the Coimbra collection, this data includes nativity, parish, municipality, district, place of death, cause of death, occupation, marital status, name, parent's names, burial location, and cemetery. In the Terry collection, there are cause of death, pathological observations, stature, weight, occupation, name, and hospital. To determine which, if any, of these variables could offer more insight into the life history of the observed individuals frequencies were examined for place of death/hospital, cause of death, and occupation in both collections, as well as pathological observations in the Terry collection. It was determined that the place of death/hospital had too many variants with a research scope that was outside the level of this study. In addition, the frequencies for pathological observations were too low in the Terry collection to provide significant information thus these variables were not analyzed any further.

The cause of death variable had adequate frequencies across both collections so was selected for analysis. However, for ease of analysis causes of death were consolidated into fewer groups with different types of conditions being combined into over-arching categories such as cancer, heart disease, tuberculosis, etc. Frequencies were again generated for cause of death by collection, sex, and "race". The frequencies for occupation were low in the Terry Collection but this variable was also chosen for contextual analysis with the notation that it could only provide limited information.

CHAPTER 5: RESULTS

5.1 - Exploratory

Descriptive statistics for the osteometric measurements show noticeable differences between groups. It is observed that males are larger than females in all categories except for the pelvic dimensions (see Appendix B for all descriptive statistics**)**. This is true for both collections and is expected considering that humans are known to be sexually dimorphic, wherein males are on average larger than females with the exception of the pelvis. However, it is also observed that Coimbra individuals are considerably smaller than Terry individuals with males from the Coimbra collection appearing more similar in size to females from the Terry collection and CWF are consistently the smallest in all dimensions except for the pelvis.

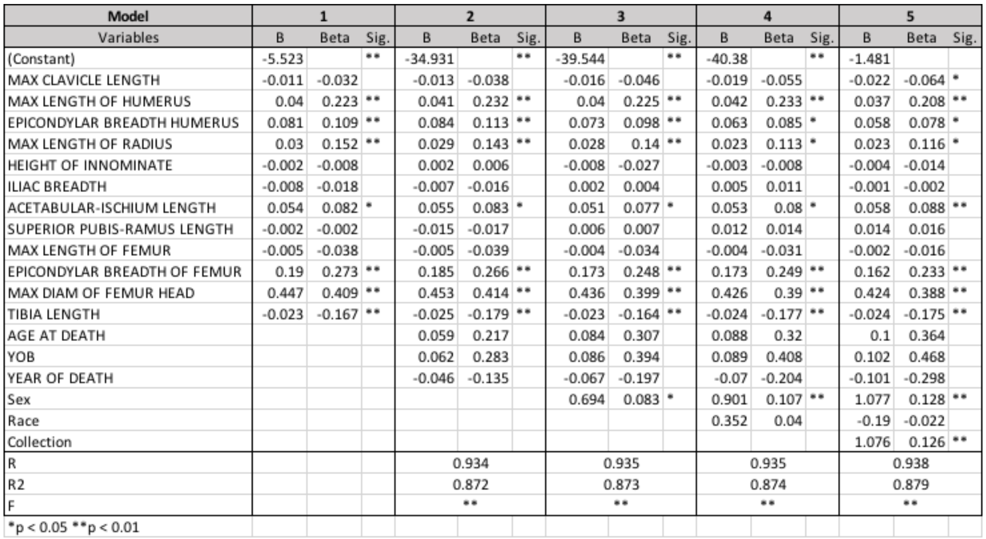
Independent sample t-tests support these results, demonstrating that there are significant differences in mean limb size between individuals in the Coimbra collection with those in the Terry collection for all of the measurements tested (Appendix C). The lowest mean difference is -1.2 cm in the superior pubis-ramus length ($p = 0.003$) whereas the maximum mean difference is -28.8 cm in the tibia length ($p = 0.000$). This indicates that Coimbra individuals have, on average, bone sizes between 1.2 cm and 28.8 cm smaller than Terry individuals.

There were also statistically significant differences for measurements between all six groups as determined by 1-way ANOVA (Appendix D). 1-way ANOVA with Tukey HSD *post hoc* tests were used since they test all pairwise differences and, given the number of independently varying relationships, they are more robust than a series of t-tests and group the means into homogeneous subsets. These tests revealed that there were significant differences between all six groups in the majority of cases, with distinct patterns of differences between the them. For most of the dimensions outside the pelvis, the TBF either cluster with, or are larger than, TWF, or cluster with CWM. However, for the pelvic dimensions tested, the TBF cluster with CWF who are consistently smaller in all dimensions.

AGE AT DEATH			
Group	N	1	2
Terry “black” males	93	40.23	
Terry “black” females	108	42.01	
Coimbra “white” females	127	45.87	
Coimbra “white” males	120	46.11	
Terry “white” males	66	46.15	
Terry “white” females	75		53.19
Sig.		0.085	1

Table 2. 1-way ANOVA for Age at Death in years

In addition, 1-way ANOVA tests for age at death determined that there were no significant differences between groups apart from TWF who were significantly different from everyone else (Table 2). That is, the average age at death for every group was between 40 and 46 years except for TWF who had an average age at death of 53 years. Since there is a mortality bias where the average age at death for TWF is significantly different from the other females, 1-way ANOVA tests were conducted to examine the impact of this on each osteometric measurement. For the purposes of these tests, age at death was subdivided into two categories: those above and below the age of 50. This age was chosen since the average age at death for TWF was 53 years and a cut-off age of 50 provides approximately equal cell counts in all three groups. Results show no deviancy from the patterns observed previously with TWF continuing to be the largest individuals overall once age was accounted for.



Model	1			2			3			4			5		
Variables	B	Beta	Sig.	B	Beta	Sig.	B	Beta	Sig.	B	Beta	Sig.	B	Beta	Sig.
(Constant)	-5.523		**	-34.931		**	-39.544		**	-40.38		**	-1.481		
MAX CLAVICLE LENGTH	-0.011	-0.032		-0.013	-0.038		-0.016	-0.046		-0.019	-0.055		-0.022	-0.064	*
MAX LENGTH OF HUMERUS	0.04	0.223	**	0.041	0.232	**	0.04	0.225	**	0.042	0.233	**	0.037	0.208	**
EPICONDYLAR BREADTH HUMERUS	0.081	0.109	**	0.084	0.113	**	0.073	0.098	**	0.063	0.085	*	0.058	0.078	*
MAX LENGTH OF RADIUS	0.03	0.152	**	0.029	0.143	**	0.028	0.14	**	0.023	0.113	*	0.023	0.116	*
HEIGHT OF INNOMINATE	-0.002	-0.008		0.002	0.006		-0.008	-0.027		-0.003	-0.008		-0.004	-0.014	
ILIAC BREADTH	-0.008	-0.018		-0.007	-0.016		0.002	0.004		0.005	0.011		-0.001	-0.002	
ACETABULAR-ISCHIUM LENGTH	0.054	0.082	*	0.055	0.083	*	0.051	0.077	*	0.053	0.08	*	0.058	0.088	**
SUPERIOR PUBIS-RAMUS LENGTH	-0.002	-0.002		-0.015	-0.017		0.006	0.007		0.012	0.014		0.014	0.016	
MAX LENGTH OF FEMUR	-0.005	-0.038		-0.005	-0.039		-0.004	-0.034		-0.004	-0.031		-0.002	-0.016	
EPICONDYLAR BREADTH OF FEMUR	0.19	0.273	**	0.185	0.266	**	0.173	0.248	**	0.173	0.249	**	0.162	0.233	**
MAX DIAM OF FEMUR HEAD	0.447	0.409	**	0.453	0.414	**	0.436	0.399	**	0.426	0.39	**	0.424	0.388	**
TIBIA LENGTH	-0.023	-0.167	**	-0.025	-0.179	**	-0.023	-0.164	**	-0.024	-0.177	**	-0.024	-0.175	**
AGE AT DEATH				0.059	0.217		0.084	0.307		0.088	0.32		0.1	0.364	
YOB				0.062	0.283		0.086	0.394		0.089	0.408		0.102	0.468	
YEAR OF DEATH				-0.046	-0.135		-0.067	-0.197		-0.07	-0.204		-0.101	-0.298	
Sex							0.694	0.083	*	0.901	0.107	**	1.077	0.128	**
Race										0.352	0.04		-0.19	-0.022	
Collection													1.076	0.126	**
R				0.934			0.935			0.935			0.938		
R2				0.872			0.873			0.874			0.879		
F				**			**			**			**		
*p < 0.05 **p < 0.01															

Table 3. Regression results using 'Maximum Vertical Head Diameter of the Humerus' as the dependent variable

5.2 - Regression Results

Table 3 shows the results of the linear regression analyses. For all the models tested, R^2 was above 0.870, reaching 0.879 in Model 5. This indicates that approximately 87% of the variability in humeral head diameter size is accounted for using these models. Additionally, in all five models the F-test was significant at the 0.001 level indicating that the observed R^2 is reliable and these models are a good fit.

Model 1 shows that when not controlling for any biological or social influences, the arm and leg measurements (excluding the maximum lengths of the femur and clavicle) are statistically significant predictors for maximum vertical humerus head diameter. In contrast, the acetabular-ischium length is significantly correlated to the vertical head diameter of the humerus but the rest of the pelvic measurements are not. These observations do not change with the inclusion of any additional control variables.

With the exception of the clavicle, femur, and tibia, throughout all five models the long-bone and joint measurements have significant positive correlations with the maximum vertical head diameter of the humerus. This is expected and signifies that as the size of the humerus increases so too does the size of each bone. However, while the clavicle, femur, and tibia have significant correlations they are negative throughout each regression model indicating the opposite effect: that as the humerus head size increases these three measurements decrease. In contrast, the pelvic measurements have non-significant negative correlations with the humeral head measurement (apart from AIL which has a significant positive relationship).

Model 2 includes age at death, year of birth, and year of death as control variables for any effects of secular change. However, the inclusion of these three variables do not have any significant changes on any other predictors, nor do they have statistical significance in any of the models. This may be reflective of attempts to minimize the effects of secular change by the original researcher responsible for the sample collection (Albanese 2003). Model 3 adds sex as a control variable to account for any biological variability due to sexual dimorphism. This variable is the strongest predictor for maximum vertical humerus head diameter (b = 0.694) with significance at the 0.05 level. As stated earlier, this result is expected considering that humans are known to be sexually dimorphic. The inclusion of "race" as a predictor in Model 4 increases the strength of the b coefficient for sex but is not a significant predictor itself. When collection is added in Model 5 it again increases the effect of sex but decreases and reverses the effect of "race".

To summarize, limb measurements generally appear to have significant correlations with maximum vertical humerus head diameter whereas pelvic measurements do not. The regressions are showing that as the humerus head gets larger, the long bone lengths and some joints also get larger. In contrast, with the exception of the acetabular-ischium length, the pelvic dimensions are not correlated to the humerus head and seem to remain stable as the body size increases or decreases. Furthermore, while sex and collection are the strongest predictors throughout the regression models, "race" is neither a strong nor statistically significant predictor in any model. This is supported by the 1-way ANOVA results which show that CWF are consistently the smallest in all dimensions yet TBF cluster with them in terms of their pelvic dimensions yet cluster with TWF or CWM for all other dimensions. Considering these results, and the mortality bias wherein TWF have an age at death that is significantly different from all other groups, it was decided here that only females would be examined any further.

5.3 - Scatterplots for Females

Initial analysis of the scatterplots shows two patterns which support the aforementioned observations. The first is that CWF are consistently the smallest individuals overall and that TWF are relatively and absolutely the largest. The second pattern is that individuals from the Terry collection consistently cluster together regardless of "race" but individuals from the Coimbra collection do not cluster with them. That is, European-Americans from the Terry Collection consistently cluster with African-Americans from the Terry Collection and not Europeans from the Coimbra collection. However, closer examination reveals patterns in relative bone lengths that elucidate those observed in the 1-way ANOVA.

1-way ANOVA observations revealed that while TBF did not appear significantly different from any other group they also did not cluster with any other group according to any consistent pattern. That is, they clustered with TWF for joint size and maximum lengths of the humerus and femur, CWM for long bone lengths, and CWF for pelvic dimensions. To visualize these observations, each measurement was plotted on the X axis against ‘maximum vertical head diameter of the humerus’ and ‘maximum length of the humerus’ on Y. In addition, scatterplots were generated with the pelvic dimensions against innominate height to examine relative pelvic dimensions, as well as tibia length against femur length to analyze the relative length of the lower limb. Appendix E shows the results of these scatterplots.

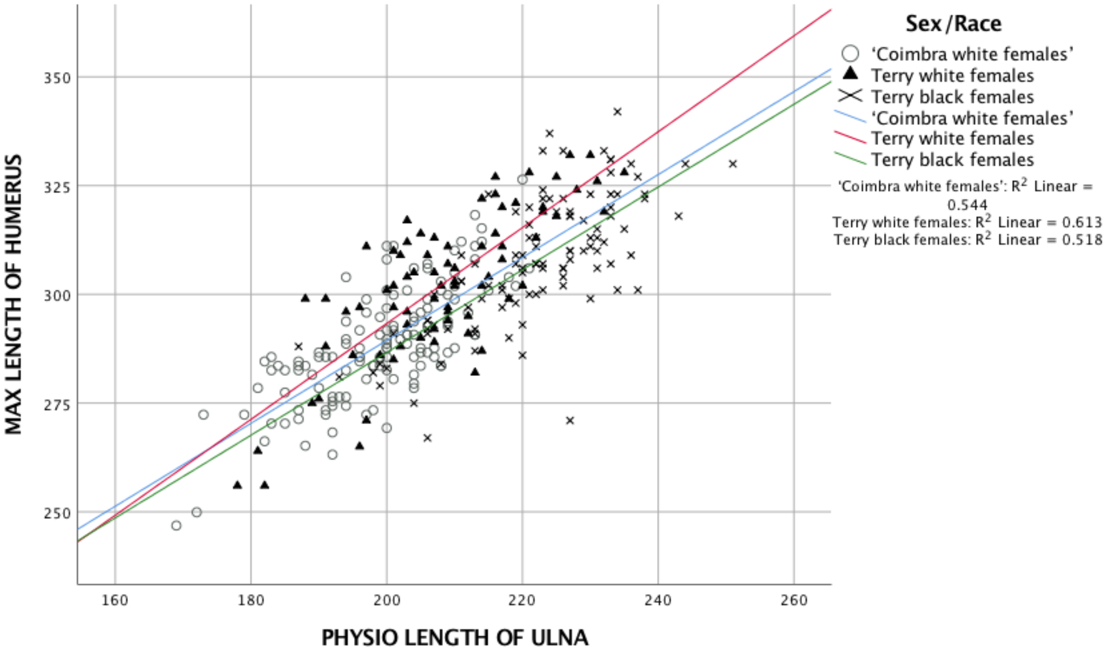


Figure 1. Maximum length of the humerus regressed on physiological length of the ulna for females, grouped by “race” and collection

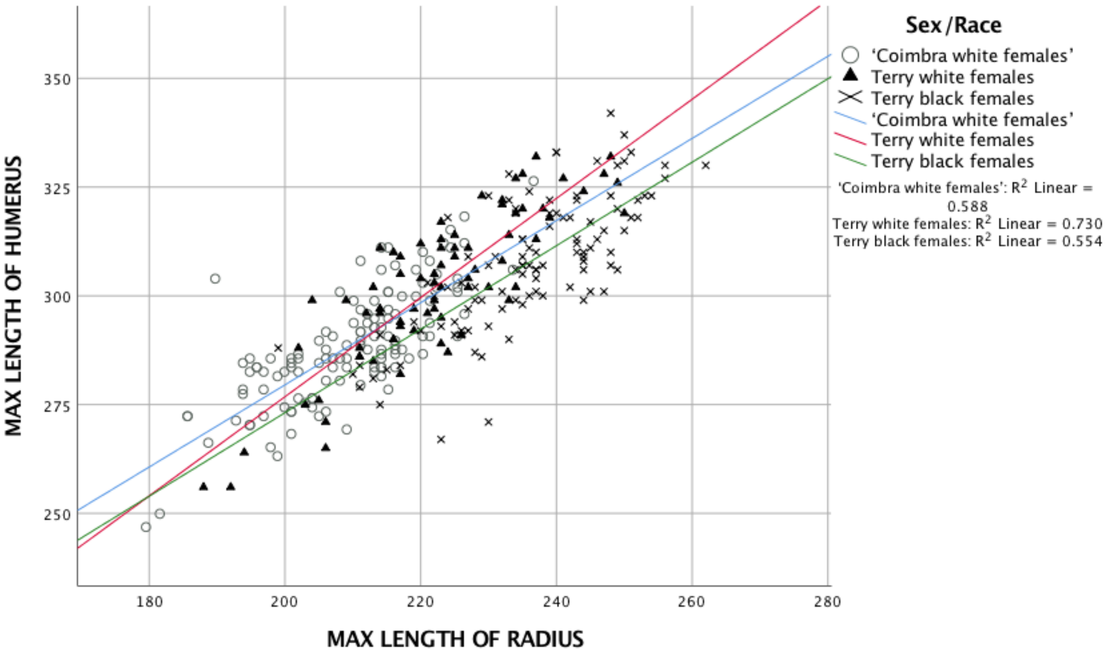


Figure 2. Maximum length of the humerus regressed on maximum length of the radius for females, grouped by "race" and collection

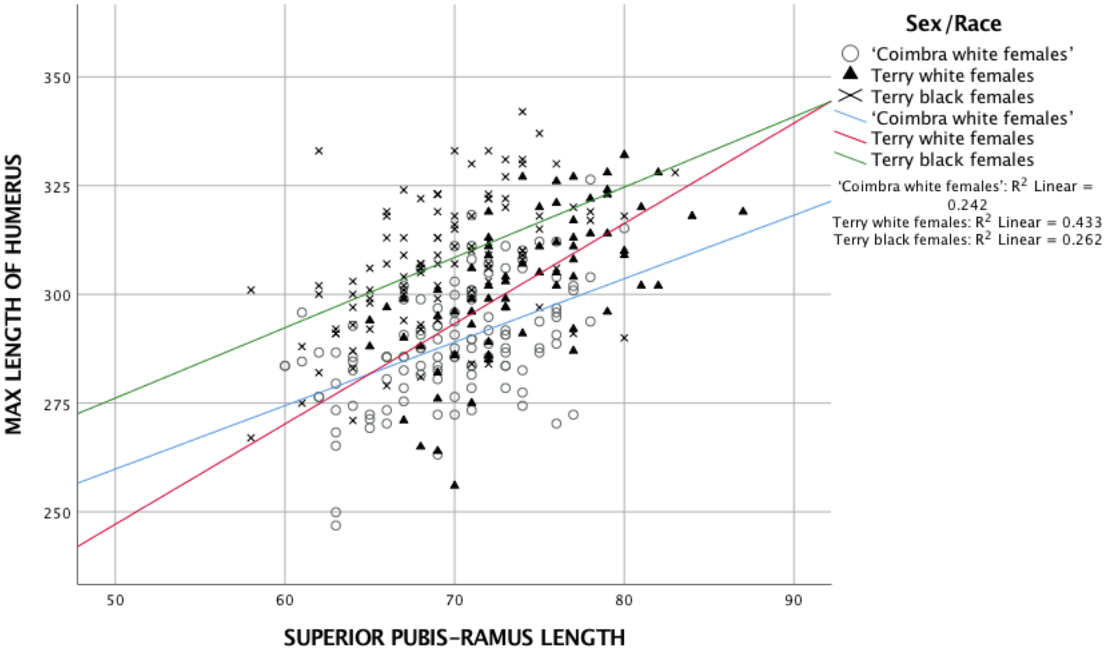


Figure 3. Maximum length of the humerus regressed on superior pubic-ramus length for females, grouped by "race" and collection

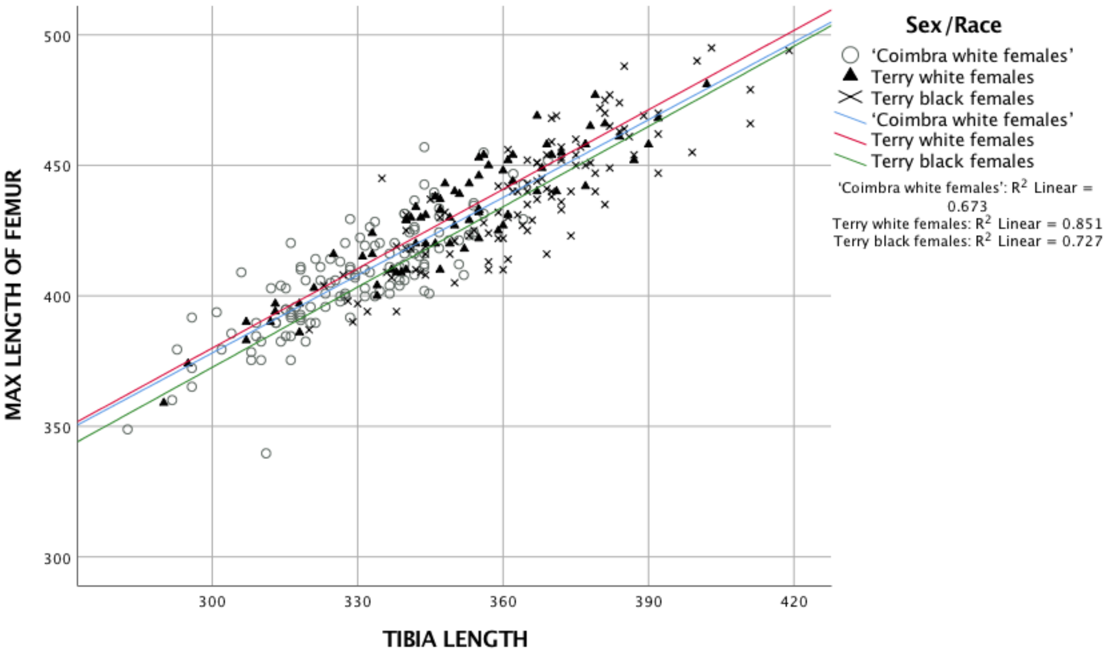


Figure 4. Maximum length of the humerus regressed on tibia length for females, grouped by "race" and collection.

When comparing the forearm (radius/ulna) to the maximum length of the humerus, despite any differences in absolute size, CWF and TBF have approximately similar relative lengths (Figures 1-4). This is not the case for TWF who have a markedly steeper slope with an R^2 of 0.613 for the ulna and 0.730 for the radius compared to R^2's which hover around 0.5 for CWF and TBF. The same effect is observed in the clavicle relative to the humerus measurements, albeit not as strongly as that of the forearm. SPRL when compared to the maximum humerus length and the iliac breadth compared to innominate height also exhibit the same pattern. In contrast, when SPRL was compared to innominate height it was observed that CWF were the ones with a steeper slope with an R^2 of 0.555. This was compared to an R^2 of 0.449 for and 0.478 for TBF. For the lower limb (Y = femur length, X = tibia length), TWF had the highest R^2 at 0.851. However, CWF and TBF did not cluster together for the lower limb like they did for the upper arm.

These patterns were also examined in females above and below the age of 50 (Appendix F), and it was observed that younger females maintained approximately similar relative bone lengths throughout but that these diverged to the aforementioned patterns in females over 50. However, the SPRL dimensions followed a different pattern wherein CWF had a considerably lower R^2 and Terry females clustered together. In summary: CWF and TBF have significantly smaller forearms and pelves for their size relative to TWF and this clearly demonstrates some impact of mortality bias on limb proportion rather than the racial differences most researchers have purported them to be.

5.4 - Contextual Analysis

Heart disease, tuberculosis, and cancer are the leading causes of death across all groups tested. Frequencies (Appendix H) show that in the Coimbra collection, tuberculosis is the primary cause of death accounting for 18.9% of all deaths whereas heart disease accounts for 15.7% and cancer for 13.4%. In the Terry collection heart disease is the primary cause of death accounting for 25.6% of all deaths (28% of TWF and 24.1% of TBF) with tuberculosis at 10.9% (5.3% for TWF, 14.8% for TBF) and cancer at 7.7% (12% of TWF, 4.6% of TBF). There were also noticeable differences between collections in terms of bronchial disease prevalence. The Coimbra collection listed bronchitis or asthma as a factor in the cause of death for 6.2% of the sample population whereas these conditions only appeared in 1.1% of the Terry collection sample as a whole. It is important to note that while telling of environmental factors, these causes of death do not necessarily represent the health of the living populations at the time.

Overall, the results determined that sex and collection were the strongest predictors for bone size but “race” was not significant in any model. This is important because individuals from the Coimbra collection were the smallest overall, but while TBF clustered with TWF in terms of overall size, their limb and relative pelvic dimension were more similar to CWF. TBF clustering with CWF in such a specific way clearly demonstrates that these differences are influenced by something beyond arbitrary racial categories. Furthermore, considering that these differences were most notable in females over the age of 50, this clearly demonstrates that purported racial differences are more likely to be the effects of a mortality bias in the collection which is consistent with previous findings (Albanese and Saunders (2006).

Researchers using the Terry collection are attributing differences in size and proportion to the effects of “race” without consideration for the age bias in TWF. When comparing TWF to TBF they are comparing older individuals to younger and, as this study has demonstrated, there is a clear disparity in relative dimensions between younger and older individuals. Furthermore, the relative dimensions of these bones do not differ significantly between TBF and CWF which indicates that something besides “race” is responsible for these differences. Analysis of the contextual results shows clear differences between collections for cause of death, with the Coimbra individuals having a higher prevalence of infectious lung and bronchial diseases whereas the Terry individuals suffered more from heart disease than any other condition.

CHAPTER 6: DISCUSSION

As discussed previously, external factors such as socioeconomic status, poverty, and environmental degradation can negatively affect human growth. Individuals in the Coimbra collection were known to have suffered cross-generational poverty in one of the poorest countries in Europe. Socioeconomic status was derived by evaluating cause of death, mortality rate, and occupation. The fact that they were buried in the common burial ground also provides strong evidence for lower socioeconomic status because it suggests that their families could not afford long-term perpetual care (Cunha 1995; Santos and Roberts 2001; Albanese 2003, 2010). In contrast, while the individuals in the Terry collection died during the Great Depression thus were known to be of low socioeconomic status at the time of death, it cannot be said with any certainty that they were impoverished during their growth period (Albanese 2003). Furthermore, the clear difference in skeletal growth patterns observed between females in the Terry collection demonstrates that although all of the individuals from both collections are described as "poor", the impacts of their life histories on their skeletons and the process for being designated as poor vary considerably between the three groups depending on the specifics of the biological and social factors to which they are subject.

6.1 - Biological Factors

The size and morphology of the pelvic canal is known to vary among populations, largely in conjunction with their body size and shape. There is an established connection between global latitude and body size, with a positive correlation between higher latitude and skeletal breadth. As such, wider-bodied people living at higher latitudes will, in general, have larger pelvic canals relative to body size (Kurki 2013). However, both Coimbra and St. Louis are at approximately similar latitudes (40.2033° N and 38.6270° N, respectively), and the major differences in relative dimensions are between two groups residing in the same location. That is, TBF cluster more with CWF in terms of pelvic dimensions than they do with TWF who have relatively larger dimensions. TWF forearms (radius/ulna) were also larger relative to the other groups and were more highly correlated to the size of the humerus. This effect was also observed in clavicle as well as the tibia relative to the femur, albeit to a lesser degree. In contrast, TBF and CWF had approximately similar relative dimensions for these elements despite their geographic differences. This demonstrates that these differences are not due to "race" or geography, but rather to social forces acting upon the groups in different ways.

From an evolutionary perspective, pelvic dimensions in human females are a balance of our reliance on bipedal locomotion with the size of our brains at birth. Since human beings have evolved to have larger brains relative to body size, female hips must be wide enough to allow for an infant's passage through the birth canal. At the same time, bipedal locomotion necessitates narrow centered hips for optimal balance and efficiency. These conflicting evolutionary needs have resulted in females becoming more buffered than males, particularly in the pelvis, from the effects of physiological stress due to their size-sensitive childbearing role (Brauer 1982). Resultantly, constrained growth in the pelvis signifies that an individual may have experienced chronic physiological stress during their growth period.

Faltering in growth can be caused by a deficit in required dietary nutrients. As discussed previously, when it comes to managing caloric and nutritional intake, the biological first priority is to distribute nutrients to body maintenance. Following this is recovery from illnesses, physical activity, and growth is given the lowest biological priority. As a result, if an individual was suffering chronic malnutrition during their growth and development period they are likely to be stunted in size as adults. It is known that individuals from both the Coimbra and Terry collections were of low socioeconomic status and this would have impacted their ability to receive adequate nutrition. However, an examination of the social factors that allowed for their situation is necessary to understand the full nature of poverty.

6.2 - Social Factors

Social factors can also lead to a faltering in growth due to their capacity to induce malnutrition or physiological stress. Poverty and racism are two such factors that are argued here to have affected the individuals in the Terry and Coimbra collections in different ways. While both collections were considered 'poor' from a socioeconomic standpoint, the impacts of their social environments vary considerably and have different impacts on their skeletons. These differences are not just limited to collection either but extend to affect African-American and European-American individuals in the Terry collection differently due to the effects of racism.

The individuals in the Coimbra sample were consistently the smallest in all dimensions. This may not be surprising considering that the Portuguese people from Portugal are known to be short in stature relative to other European groups (Stolz, Baten, and Reis 2013). However, prior to the mid 19th century people from Portugal were on par in terms of height with other European countries. It was not until around 1840-1870 that their stature began to deviate from the rest of Europe, becoming among the shortest throughout all of Europe by the end of the 19th Century (Lains 2006). The opening of Brazilian ports to all nations in 1808 and the commercial treaty with England in 1810 shook the foundations of the Portuguese economy. These two developments, coupled with political turmoil and civil wars in 1832-1834 and 1846-1847, as well as a succession of agricultural disasters, led to a decline in economic growth and real wages in the country (Marques 1972; Baten et al. n.d.; Stolz et al. 2013). This would have contributed to persistent poverty and malnutrition in the Portuguese population causing the stunting observed in the greater population and in the individuals from the Coimbra collection. Despite this, there are other factors to consider when analyzing why the people from Coimbra had such compromised growth.

One potential explanation that should be considered is cause of death. Tuberculosis and cancer were the leading causes of death in the Coimbra sample, compared to heart disease in the Terry collection. There will undoubtedly have been disparities in records and record-keeping practices between the two collections so these frequencies cannot be relied upon to be strong indicators of life histories in the two populations but they can be informative enough to shed some light on general differences. Both tuberculosis and cancer have a wasting effect on patients (Tisdale 1999; Paton and Ng 2006). That is, affected individuals become weaker and emaciated the longer they live with the condition. If a person lived long enough, this effect would extend to the skeletal system resulting in increased frailty. A higher prevalence of tuberculosis also implies overcrowded conditions. Tuberculosis is an infectious bacterial disease spread from person to person by droplets released into the air during coughing or sneezing. The bacteria can only survive outside the human body for a few hours and is killed quickly by sunlight (World Health Organization 2018). Consequently, transmission of the disease requires close proximity to infected individuals.

Another explanation is a lack of human capital, which has been proven to have a positive correlation with human height whereby delays in human capital formation act as a hindrance to improvements in standards of living. This effect was observed by Baten et al. (n.d.) and Stolz et al. (2013) who looked at human capital as an explanation for stunting in the Portuguese population, using numeracy as an alternative method to literacy. That is, people who can report their exact age are more likely to be more literate than those who cannot. They also used occupation, where workers and labourers were less likely to have above-average human capital. Their results showed that human capital formation was the primary factor limiting improvements in the biological standard of living in Portugal in the mid- to late-19th century.

According to a United Nations Education, Scientific, and Cultural Organization (UNESCO) publication on the progress of literacy in various countries (1953), by the year 1900 approximately 84.8% of the Portuguese female population was illiterate. Of these, between 70.6% and 81.9% of females of childbearing age (15-54) and 60.6% of labourers were illiterate. The females that make up the Coimbra collection were primarily employed in domestic work, with 96.1% of the sample population having an occupation listed as housewife, housework, or maid (Appendix I). The remaining 3.9% were employed in labour work, either as a farmer or a seamstress, with only one individual from the entire sample of Coimbra females having an unknown occupation. This supports the previous studies because domestic work can be classified as unskilled labour. That is, domestic work does not require a higher educational attainment and generally provides little economic value for the work performed. The percentage of females employed in domestic work in the Coimbra population is consistent with hegemonic gender norms for the time, and this supports human capital explanations for stunting in the Coimbra population.

Vella et al. (1994) and Baig-Ansari et al. (2006) demonstrated that maternal education is critically important for a child's health and nutrition, even more so than raw socioeconomic status. This is so because women tend to be the primary caregivers for children, and educated women are more likely to be aware of things such as nutritional guidelines, hygiene, and health care. Children, particularly those under the age of two, are reliant on adults to ensure they receive adequate care thus are necessarily affected by the knowledge and ability of their caregivers.

Overall, literacy was higher in the United States, but as mentioned previously there were differences between groups that should be explored more carefully. By the year 1900, 11.2% of females in the United States were considered illiterate. This statistic consisted of 4.7% of the “white” female population compared to 45.8% of the “black” female population, with rural dwellers experiencing significantly higher illiteracy rates than urban dwellers (4.8% of “white” females and 36.1% of “black” females compared to 0.8% and 17.6% respectively). Additionally, 4.1%-11.3% of women of childbearing age were considered illiterate (UNESCO 1953).

Occupation was not listed for the majority of the individuals in the Terry collection but of the ones that were, 26.1% of TBF were employed in domestic work compared to only 8% of TWF. This is not surprising considering the systematic inequality between “black” and “white” individuals that has persisted in the American South. Individuals in the Terry collection died during the Great Depression thus were known to be of low socioeconomic status at the time of death, but it cannot be said with any certainty that they were impoverished during their growth period. However, structural racism and the lingering effects of racist legislation in the United States made it so that there were fewer opportunities for African-American individuals to pursue higher education or work in higher paying jobs (Cole and Omari 2003). Therefore, it is likely that TBF experienced poverty differently than TWF, and is evident in the mortality bias wherein poverty is causing certain groups to die younger with compromised growth (TBF/CWF) compared to relatively less stressed groups (TWF). Terry “white” females were the least stressed of all three groups and lived to be significantly older than Terry “black” females or Coimbra females. Not only that, but they also grew to be the largest and had relative limb dimensions that were more highly correlated than the other two groups. This implies a healthier life history for TWF with a greater access to adequate nutrition.

6.3 - Environmental Degradation

Poverty and racism can also affect populations differently based on the rate at which they are exposed to adverse environmental conditions. It has been demonstrated that lower socioeconomic status is linked to increased proximity to the manifestations of environmental degradation. For instance, Evans and Kantrowtiz (2002) provide an extensive analysis of the literature surrounding economic poverty and health. They demonstrate that, globally, the poor are the mostly likely to be exposed to hazardous waste, ambient air pollution, and water contamination. Mackillop et al. (2000) and Donohoe (2003) also demonstrate that Superfund sites, garbage dumps, and waste incinerators are more common in lower socioeconomic status neighbourhoods. Similarly, Ladd and Edward (2002) and Wright (2005) provide further support for this assertion, demonstrating that, in the United States, people of lower socioeconomic status and people of colour are disproportionately exposed to toxic waste from manufacturing and industrial agriculture.

Portugal has a turbulent economic history. While prosperous during the ‘age of discovery,’ between the 15th to 17th centuries, later economic activity was insufficient to sustain the health of the population. Between the late 18th and early 20th centuries, increased population density and urbanisation led to overcrowding, poor hygiene and inadequate medical care that was prioritized for the upper class. It was common for household waste to be discarded in the streets, and the lack of public sanitation measures led to contamination of public water sources and the spread of communicable diseases. Agriculture was the primary industry yet it was a fragile system as landowners failed to adopt new technologies relying too heavily on a deficient supply of peasant labour with inadequate crop rotation practices. Poor crop yields coupled with competition from cheaper foreign products and diversion of resources for overseas expansion led to depressed living conditions for the lower-class with inadequate access to nutritive foods. With its reliance on colonial trade, the Portuguese economy was further destabilized after the loss of Brazil as a colony in 1822 (Carodoso and Gomes 2009; Jones et al. 2011).

Other industries in Portugal during the 19th Century were mining, milling, and textiles, but solutions for hazardous waste disposal were not regulated until the 1990s (Delicado 2014). Due to the huge financial investment needed to build and manage such infrastructure, until Portugal joined the European Union (EU) in 1986 there were no systems or regulations for managing or disposing of industrial waste. Instead chemicals from factories, garbage, and sewers would pile up illegally in open-air dumps or be disposed of in rivers and watercourses (Jerónimo and Garcia 2011; Delicado 2014). As a result, by 1993 only 50% of tap water was safe for human consumption yet 80% of the population was served by public water supply systems. Lisbon, the capital city, did not have consistent access to clean water or efficient sewage treatment until 2006 (Delicado 2014; Schmidt, Saraiva, and Pato 2011). Portugal was also late to invest in food refrigeration, better and cheaper foods, and improvements to housing, welfare, and medical care systems (Carodoso and Gomes, 2009).

These conditions were critical to the health of the Portuguese population. Illness from poor sanitation measures and contaminated food and water sources would have been easily spread in the overcrowded conditions. Nutritive deficits would have led to a divestment in caloric resources to attend to immune function and physical labour leaving skeletal growth as a lower priority investment. These situations were exacerbated by class inequality in the country. Healthcare and food resources were prioritized for the wealthy upper-class while the working class was commodified and relied upon to work to sustain the fragile agricultural system. These issues would have been similar for the Terry collection individuals but highlight stark differences in the nature of poverty.

The geographical location of St. Louis provided considerable access to natural resources. Easy access to mineral ore from the Ozarks provided the basis for a prominent metal industry and St. Louis was the only area in the United States that refined five primary metals: lead, zinc, copper, magnesium, and aluminum. Older geological formations in the Ozarks also provided access to materials used in the petroleum and chemical industries. Rocks in the Illinois Basin provided access to favoured fossil fuels such as coal, oil, and natural gas and St. Louis was built on an area rife with carbonite rocks (limestone and dolomite) that were necessary for building infrastructure (Schroeder 1997).

Since carbonite rocks are water soluble they produce sinkholes and solution basins with caves and streams. These would receive water from surface run-off and city drainage becoming polluted wastewater slumps. Furthermore, the quarries and sinkholes were used for disposal of public and private waste of all kinds and this contamination would eventually spread to pollute the city groundwater. By the year 1910 the water was so contaminated that thousands of cisterns were condemned (Schroeder 1997).

The flood plains from the Missouri, Mississippi, and Illinois rivers were used for industry since they needed flat lands and rivers for shipping and water supply. The flood plains were also used for dumping of toxic waste which led to the soil being impregnated with dioxin and PCB’s. Brick firing produced particulate air pollution, paint making created lead dust, and heavy reliance on coal from factories, railroad traffic, and steam boilers clouded the air with so much coal dust and smoke that St. Louis was infamous by the 1890's for their level of air pollution. The rendering industry was also a heavy presence in the St. Louis area, producing noxious fumes that could be smelt for miles. However, despite the objectively poor environmental quality around St. Louis, legal mechanisms to end the pollution were hindered by the desire to promote economic growth thus leading to issues wherein industry was concentrated in areas with lower property values (Schroeder 1997).

In the United States, the lowest-socioeconomic status areas are often those inhabited by racialized groups. In 1987, the United States commissioned a report that analyzed racial and socioeconomic demographics of communities near hazardous waste sites. This report detailed that toxic waste facilities are predominately situated in working class and low-income communities, primarily of colour, concluding that "race" was the primary factor, over socioeconomic status, which dictated the location of hazardous waste sites (Commission for Racial Justice 1987; Krauss 1993; Warren 1997). As a result, non-"white" individuals in the United States are more likely to be exposed to issues of environmental degradation than "white" individuals (Evans and Kantrowtiz 2002).

As observed by the results of this study, TBF were dying younger than TWF. Environmental degradation from capitalistic pursuits likely contributed to these health disparities within the greater St. Louis area. As mentioned, in St. Louis during the late 19th century, industry was concentrated in the lowest socioeconomic areas. These would primarily have been inhabited by people of colour. Considering the conscious effort by the St. Louis regulatory body to situate industry in areas with lower property values, these issues would have disproportionately affected minority communities. This could explain the mortality bias in the Terry collection. That is, TBF were disproportionately exposed to adverse environmental conditions than TWF thus likely had lower overall health.

While all the individuals in both of these collections would have been considered poor, the conditions of their lives and the environments they were exposed to had different impacts on their skeletal growth. Individuals from the Coimbra collection would have been undernourished and overworked, suffering the effects of generations of poverty. The individuals from the Terry collection were subject to issues of environmental racism. While both TBF and TWF were poor at the time of death there is no guarantee they were poor during their growth period. However, environmental racism in the United States kept industry located to marginalized communities. This exposed TBF to more factors affecting their health while TWF were more protected from these conditions.

CHAPTER 7: CONCLUSION

The Terry and Coimbra collections are two of the most widely studied skeletal reference collections and have been used extensively in developing and testing methods for estimating age, sex, stature and “race/ancestry”. The research potential of these collections stems from the accuracy and quality of the documentary data that are available for each skeleton and for each collection as a whole. Since these collections are considered ‘identified’, many researchers who use these collections have been too quick to ascribe the variation to some of the readily available documentary variables such as “source” of the collection or “race” and ignore other biocultural sources of variation. Individuals in both collections have been considered poor from a socioeconomic standpoint, however “poverty” is complex and its impacts on the skeleton will vary.

This study examined the skeletal and documentary data within a historical context for these two collections using an alternative approach that borrows from Ecofeminist theory. The results from this research suggest that the general patterns of variation are derived from complex socio-economic and political factors that have had different affects by collection. Although people from Portugal are by definition European, the pattern of variation seen on the Coimbra Collection is not consistent with the European-Americans in the Terry Collection. The overall pattern of stunting in the Coimbra Collections is very pronounced, and European-Americans from the Terry Collection consistently cluster with African-Americans from the Terry Collection and not Europeans from the Coimbra Collection. However, the European-Americans from the Terry collection were generally surviving longer and have a pattern of growth that is unique within the three groups. While the individuals from the Terry collection cluster together in terms of overall size, the African-Americans from the Terry collection are more similar to the Coimbra individuals for the pelvic dimensions and relative limb lengths.

Considering that all three groups were considered poor from a socioeconomic standpoint, this demonstrates that there was something besides mere biological variation causing the differences between these three groups. The conditions of their lives and the environments these individuals would have been exposed to would have had different impacts on their skeletal growth. Individuals from the Coimbra collection would have been undernourished and overworked, suffering the effects of generations of poverty. The individuals from the Terry collection were subject to issues of environmental racism. While both TBF and TWF were poor at the time of death there is no guarantee they were poor during their growth period. However, environmental racism in the United States kept industry located to marginalized communities. This exposed TBF to more factors affecting their health while TWF were more protected from these conditions. As a result, there is a mortality bias in the Terry collection that is often misinterpreted as a racial difference and this study presents evidence that can help to better understand the varied impacts of poverty within a greater biocultural context thus challenging the biological reductionist notion that patterns of variation are associated with racialized groups.

These effects on the human body are an Ecofeminist issue because the effects on already marginalized groups are a continuation of systemic racist issues in economic policy. As discussed, “race” is a major factor in the location of hazardous waste in the United States thus, through compounding factors such as socioeconomic status and discrimination, marginalized groups are disproportionately affected by uncontrolled toxic waste. Not only that, but this study also demonstrates that poverty is not simply a lack of financial security but has different effects depending where you live and what you are exposed to. There is evidence that air pollution, food and water contamination and climate change induced scarcity can lead to decreased bone mineral density and other adverse effects. While this study is limited only to analysis of effects on growth, further research could examine other effects of environmental degradation on bone. Understanding how poverty is differentially experienced depending on circumstance can aid in policy and regulation to help the millions of people globally that suffer through extreme poverty every day.

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APPENDIX A: TABLE OF MEASUREMENTS USED

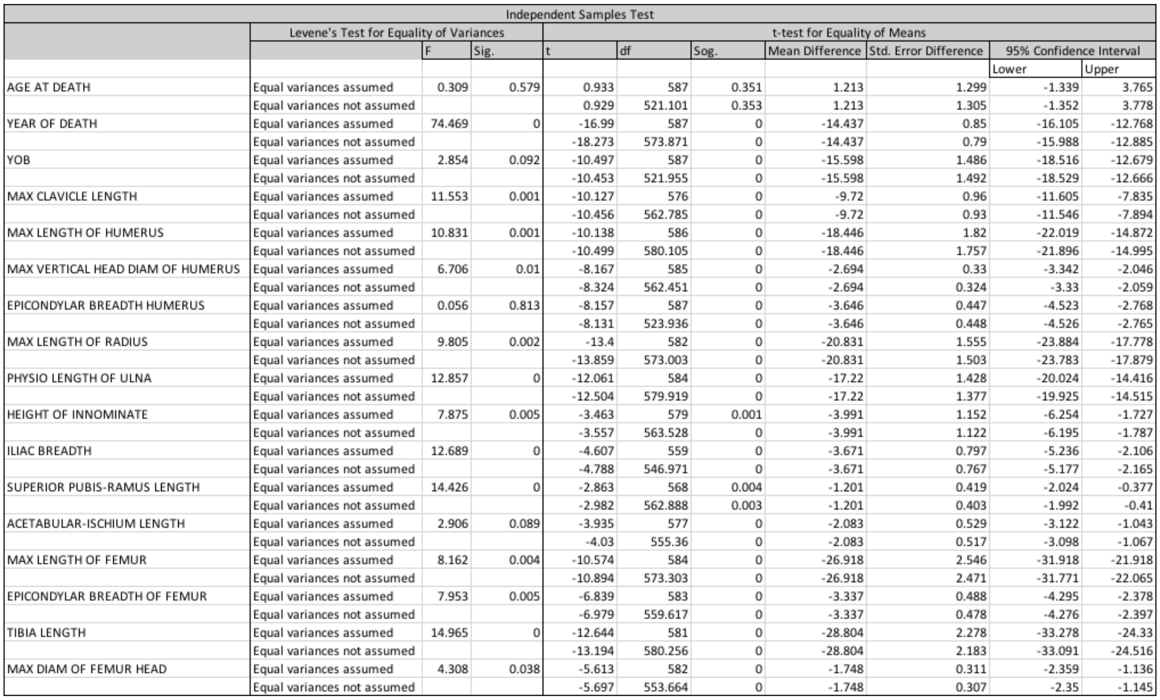
Group	Measurement	Description
Pelvic Measurements	Acetabular-ischium length	Maximum length from the superior-anterior apex of the lunate surface in the acetabulum to the most inferior point on the ischium not perpendicular to the SPRL
	Height of the innominate	The distance from the most superior point on the iliac crest to the most inferior point on the ischial tuberosity
	Iliac breadth	The distance from the anterior superior iliac spine to the posterior superior iliac spine
	Superior pubis-ramus length	The distance from the superior margin of the pubic symphysis to the superior-anterior apex of the lunate surface in the acetabulum.
Joint Measurements	Epicondylar breadth of the femur	The distance between the two most projecting points on the epicondyles
	Epicondylar breadth of the humerus	The distance from the most laterally protruding point on the lateral epicondyle to the corresponding projection on the medial epicondyle
	Maximum vertical diameter of humerus head	The distance between the most superior and inferior points on the border of the articular surface
	Maximum diameter of femur head	The maximum diameter of the femur head measured on the border of the articular surface
Long bone Lengths	Maximum clavicle length	The maximum distance between the most extreme ends of the clavicle
	Maximum femur length	The distance from the most proximal point on the head of the femur to the most distal point on the medial or lateral femoral condyle
	Maximum humerus length	The distance from the most superior point on the head of the humerus to the most inferior point on the trochlea
	Maximum radius length	The distance from the most proximally positioned point on the head of the radius to the tip of the styloid process without regard to the long axis of the bone
	Physiological length of the ulna	The distance between the deepest point on the articular surface of the coronoid process on the guiding ridge and the most inferior point on the distal articular surface of the ulna
	Tibia length	The distance from the superior articular surface of the lateral condyle of the tibia to the tip of the medial malleolus

Table 4. Description of standard osteological measurements (Moore-Janses, Ousley & Jantz, 1994; Albanese, 2003).

APPENDIX B. DESCRIPTIVES

Descriptive Statistics						
Sex/Race	Variable	N	Minimum	Maximum	Mean	Std. Deviation
Coimbra white females	AGE AT DEATH	127	19	78	45.87	16.283
	YEAR OF DEATH	127	1910	1936	1924.76	7.299
	YOB	127	1832	1912	1878.93	18.341
	MAX CLAVICLE LENGTH	123	114	150	130.57	6.941
	MAX LENGTH OF HUMERUS	127	247	326	288.5	13.192
	MAX VERTICAL HEAD DIAM OF HUMERUS	127	34	46	39.07	2.109
	EPICONDYLAR BREADTH HUMERUS	127	44	58	52	3.018
	MAX LENGTH OF RADIUS	126	180	237	209.5	10.754
	PHYSIO LENGTH OF ULNA	127	169	221	199.04	10.212
	HEIGHT OF INNOMINATE	125	163	217	195.4	9.195
	ILIAC BREADTH	116	128	172	150.56	8.294
	SUPERIOR PUBIS-RAMUS LENGTH	121	60	80	69.79	4.48
	ACETABULAR-ISCHIUM LENGTH	124	62	85	74.41	3.838
	Ventral Arc	127	0	4	1.2362	0.8112
	MAX LENGTH OF FEMUR	126	340	457	407.32	20.409
	EPICONDYLAR BREADTH OF FEMUR	125	63	78	71.05	3.223
	TIBIA LENGTH	126	283	369	329.55	17.03
	MAX DIAM OF FEMUR HEAD	126	34	49	40.4	2.315
Terry white females	AGE AT DEATH	75	24	79	53.19	14.403
	YEAR OF DEATH	75	1928	1966	1950.08	11.488
	YOB	75	1858	1933	1896.91	17.849
	MAX CLAVICLE LENGTH	75	113	161	137.37	9.253
	MAX LENGTH OF HUMERUS	75	256	332	302.33	17.158
	MAX VERTICAL HEAD DIAM OF HUMERUS	75	37	49	42.03	2.422
	EPICONDYLAR BREADTH HUMERUS	75	50	65	55.76	2.894
	MAX LENGTH OF RADIUS	74	188	250	222.41	12.944
	PHYSIO LENGTH OF ULNA	74	178	235	208.26	12.263
	HEIGHT OF INNOMINATE	74	183	232	205.19	10.118
	ILIAC BREADTH	69	135	181	158.67	9.435
	SUPERIOR PUBIS-RAMUS LENGTH	72	65	87	74.17	4.738
	ACETABULAR-ISCHIUM LENGTH	74	66	88	78.39	4.707
	Ventral Arc	75	0	4	1.2	0.9444
	MAX LENGTH OF FEMUR	75	359	481	430.55	24.789
	EPICONDYLAR BREADTH OF FEMUR	75	67	86	75.2	3.803
	TIBIA LENGTH	75	290	402	349.84	22.547
	MAX DIAM OF FEMUR HEAD	74	36	48	42.43	2.347
Terry black females	AGE AT DEATH	108	20	78	42.01	14.025
	YEAR OF DEATH	108	1917	1966	1938.96	10.681
	YOB	108	1859	1934	1896.97	13.464
	MAX CLAVICLE LENGTH	108	125	159	141.36	7.184
	MAX LENGTH OF HUMERUS	107	267	342	307.45	15.164
	MAX VERTICAL HEAD DIAM OF HUMERUS	106	37	46	41.21	1.989
	EPICONDYLAR BREADTH HUMERUS	108	50	65	56.43	2.813
	MAX LENGTH OF RADIUS	108	199	262	235.75	11.706
	PHYSIO LENGTH OF ULNA	107	187	251	221.78	11.456
	HEIGHT OF INNOMINATE	108	172	225	195.25	9.981
	ILIAC BREADTH	107	130	175	149.68	8.676
	SUPERIOR PUBIS-RAMUS LENGTH	106	58	83	69.38	4.816
	ACETABULAR-ISCHIUM LENGTH	107	64	89	75.94	4.732
	Ventral Arc	108	0	4	1.0185	0.52918
	MAX LENGTH OF FEMUR	106	387	495	438.31	24.466
	EPICONDYLAR BREADTH OF FEMUR	106	64	85	73.72	3.564
	TIBIA LENGTH	105	312	419	364	20.646
	MAX DIAM OF FEMUR HEAD	105	37	47	41.67	2.079
Coimbra white males	AGE AT DEATH	120	20	79	46.11	15.382
	YEAR OF DEATH	120	1910	1936	1925.09	7.301
	YOB	120	1843	1913	1878.96	17.842
	MAX CLAVICLE LENGTH	117	123	171	144.63	7.528
	MAX LENGTH OF HUMERUS	120	276	351	315.17	13.673
	MAX VERTICAL HEAD DIAM OF HUMERUS	120	39	51	44.83	2.42
	EPICONDYLAR BREADTH HUMERUS	120	52	68	60.76	3.341
	MAX LENGTH OF RADIUS	118	208	262	234	10.604
	PHYSIO LENGTH OF ULNA	120	195	250	220	10.481
	HEIGHT OF INNOMINATE	118	192	235	212.04	9.104
	ILIAC BREADTH	114	134	174	153.3	7.64
	SUPERIOR PUBIS-RAMUS LENGTH	116	60	77	67.76	3.663
	ACETABULAR-ISCHIUM LENGTH	117	73	94	82.85	3.975
	Ventral Arc	120	0	4	1.05	1.222
	MAX LENGTH OF FEMUR	120	401	494	443.91	19.404
	EPICONDYLAR BREADTH OF FEMUR	120	72	88	79.56	3.4
	TIBIA LENGTH	120	326	401	360.07	16.576
	MAX DIAM OF FEMUR HEAD	120	41	51	45.72	2.268
Terry white males	AGE AT DEATH	66	19	79	46.15	16.576
	YEAR OF DEATH	66	1923	1966	1936.33	11.958
	YOB	66	1849	1943	1890.05	24.082
	MAX CLAVICLE LENGTH	63	129	175	154.22	9.683
	MAX LENGTH OF HUMERUS	66	288	375	331.53	20.603
	MAX VERTICAL HEAD DIAM OF HUMERUS	66	41	56	48.21	3.056
	EPICONDYLAR BREADTH HUMERUS	66	52	72	63.3	4.099
	MAX LENGTH OF RADIUS	66	206	281	246.27	15.844
	PHYSIO LENGTH OF ULNA	65	188	260	228.78	15.487
	HEIGHT OF INNOMINATE	64	192	241	222.53	11.389
	ILIAC BREADTH	64	143	185	162.2	8.996
	SUPERIOR PUBIS-RAMUS LENGTH	63	59	81	71.08	4.678
	ACETABULAR-ISCHIUM LENGTH	64	71	100	86.56	5.589
	Ventral Arc	66	0	4	1.0152	1.25872
	MAX LENGTH OF FEMUR	66	387	531	461.45	29.709
	EPICONDYLAR BREADTH OF FEMUR	66	70	95	83.79	4.969
	TIBIA LENGTH	66	323	441	378.76	25.949
	MAX DIAM OF FEMUR HEAD	66	40	54	48	3.083
Terry black males	AGE AT DEATH	93	19	79	40.23	14.044
	YEAR OF DEATH	93	1926	1963	1933.32	6.446
	YOB	93	1850	1929	1893	15.584
	MAX CLAVICLE LENGTH	92	135	176	157.05	10.231
	MAX LENGTH OF HUMERUS	93	299	386	340.15	17.843
	MAX VERTICAL HEAD DIAM OF HUMERUS	93	41	58	47.85	2.926
	EPICONDYLAR BREADTH HUMERUS	93	55	72	64.86	3.908
	MAX LENGTH OF RADIUS	92	230	294	262.7	14.506
	PHYSIO LENGTH OF ULNA	93	212	276	244.65	14.205
	HEIGHT OF INNOMINATE	92	183	236	213.17	11.194
	ILIAC BREADTH	91	136	182	155.55	8.759
	SUPERIOR PUBIS-RAMUS LENGTH	92	55	79	66.7	4.549
	ACETABULAR-ISCHIUM LENGTH	93	71	101	83.57	5.779
	Ventral Arc	93	0	4	1.4194	1.34587
	MAX LENGTH OF FEMUR	93	419	550	478.52	27.52
	EPICONDYLAR BREADTH OF FEMUR	93	73	92	83.05	4.223
	TIBIA LENGTH	91	344	470	399.19	26.563
	MAX DIAM OF FEMUR HEAD	93	41	55	47.73	2.601

APPENDIX C. T-TESTS



Independent Samples Test										
	Levene's Test for Equality of Variances			t-test for Equality of Means						
		F	Sig.	t	df	Sog.	Mean Difference	Std. Error Difference	95% Confidence Interval	
									Lower	Upper
AGE AT DEATH	Equal variances assumed	0.309	0.579	0.933	587	0.351	1.213	1.299	-1.339	3.765
	Equal variances not assumed			0.929	521.101	0.353	1.213	1.305	-1.352	3.778
YEAR OF DEATH	Equal variances assumed	74.469	0	-16.99	587	0	-14.437	0.85	-16.105	-12.768
	Equal variances not assumed			-18.273	573.871	0	-14.437	0.79	-15.988	-12.885
YOB	Equal variances assumed	2.854	0.092	-10.497	587	0	-15.598	1.486	-18.516	-12.679
	Equal variances not assumed			-10.453	521.955	0	-15.598	1.492	-18.529	-12.666
MAX CLAVICLE LENGTH	Equal variances assumed	11.553	0.001	-10.127	576	0	-9.72	0.96	-11.605	-7.835
	Equal variances not assumed			-10.456	562.785	0	-9.72	0.93	-11.546	-7.894
MAX LENGTH OF HUMERUS	Equal variances assumed	10.831	0.001	-10.138	586	0	-18.446	1.82	-22.019	-14.872
	Equal variances not assumed			-10.499	580.105	0	-18.446	1.757	-21.896	-14.995
MAX VERTICAL HEAD DIAM OF HUMERUS	Equal variances assumed	6.706	0.01	-8.167	585	0	-2.694	0.33	-3.342	-2.046
	Equal variances not assumed			-8.324	562.451	0	-2.694	0.324	-3.33	-2.059
EPICONDYLAR BREADTH HUMERUS	Equal variances assumed	0.056	0.813	-8.157	587	0	-3.646	0.447	-4.523	-2.768
	Equal variances not assumed			-8.131	523.936	0	-3.646	0.448	-4.526	-2.765
MAX LENGTH OF RADIUS	Equal variances assumed	9.805	0.002	-13.4	582	0	-20.831	1.555	-23.884	-17.778
	Equal variances not assumed			-13.859	573.003	0	-20.831	1.503	-23.783	-17.879
PHYSIO LENGTH OF ULNA	Equal variances assumed	12.857	0	-12.061	584	0	-17.22	1.428	-20.024	-14.416
	Equal variances not assumed			-12.504	579.919	0	-17.22	1.377	-19.925	-14.515
HEIGHT OF INNOMINATE	Equal variances assumed	7.875	0.005	-3.463	579	0.001	-3.991	1.152	-6.254	-1.727
	Equal variances not assumed			-3.557	563.528	0	-3.991	1.122	-6.195	-1.787
ILIAC BREADTH	Equal variances assumed	12.689	0	-4.607	559	0	-3.671	0.797	-5.236	-2.106
	Equal variances not assumed			-4.788	546.971	0	-3.671	0.767	-5.177	-2.165
SUPERIOR PUBIS-RAMUS LENGTH	Equal variances assumed	14.426	0	-2.863	568	0.004	-1.201	0.419	-2.024	-0.377
	Equal variances not assumed			-2.982	562.888	0.003	-1.201	0.403	-1.992	-0.41
ACETABULAR-ISCHIUM LENGTH	Equal variances assumed	2.906	0.089	-3.935	577	0	-2.083	0.529	-3.122	-1.043
	Equal variances not assumed			-4.03	555.36	0	-2.083	0.517	-3.098	-1.067
MAX LENGTH OF FEMUR	Equal variances assumed	8.162	0.004	-10.574	584	0	-26.918	2.546	-31.918	-21.918
	Equal variances not assumed			-10.894	573.303	0	-26.918	2.471	-31.771	-22.065
EPICONDYLAR BREADTH OF FEMUR	Equal variances assumed	7.953	0.005	-6.839	583	0	-3.337	0.488	-4.295	-2.378
	Equal variances not assumed			-6.979	559.617	0	-3.337	0.478	-4.276	-2.397
TIBIA LENGTH	Equal variances assumed	14.965	0	-12.644	581	0	-28.804	2.278	-33.278	-24.33
	Equal variances not assumed			-13.194	580.256	0	-28.804	2.183	-33.091	-24.516
MAX DIAM OF FEMUR HEAD	Equal variances assumed	4.308	0.038	-5.613	582	0	-1.748	0.311	-2.359	-1.136
	Equal variances not assumed			-5.697	553.664	0	-1.748	0.307	-2.35	-1.145

APPENDIX D. 1-WAY ANOVA

MAX CLAVICLE LENGTH

GROUP	N	1	2	3	4
Coimbra white females	123	130.57			
Terry white females	75		137.37		
Terry black females	108			141.36	
Coimbra white males	117			144.63	
Terry white males	63				154.22
Terry black males	92				157.05
Sig.		1	1	0.087	0.198

MAX LENGTH OF HUMERUS

GROUP	N	1	2	3	4	5
Coimbra white females	127	288.5				
Terry white females	75		302.33			
Terry black females	107		307.45			
Coimbra white males	120			315.17		
Terry white males	66				331.53	
Terry black males	93					340.15
Sig.		1	0.245	1	1	1

EPICONDYLAR BREADTH HUMERUS

GROUP	N	1	2	3	4	5
Coimbra white females	127	52				
Terry white females	75		55.76			
Terry black females	108		56.43			
Coimbra white males	120			60.76		
Terry white males	66				63.3	
Terry black males	93					64.86
Sig.		1	0.748	1	1	1

MAX LENGTH OF RADIUS

GROUP	N	1	2	3	4	5
Coimbra white females	126	209.5				
Terry white females	74		222.41			
Coimbra white males	118			234		
Terry black females	108			235.75		
Terry white males	66				246.27	
Terry black males	92					262.7
Sig.		1	1	0.933	1	1

HEIGHT OF INNOMINATE

GROUP	N	1	2	3	4
Terry black females	108	195.25			
Coimbra white females	125	195.4			
Terry white females	74		205.19		
Coimbra white males	118			212.04	
Terry black males	92			213.17	
Terry white males	64				222.53
Sig.		1	1	0.973	1

ILIAC BREADTH

GROUP	N	1	2	3	4
Terry black females	107	149.68			
Coimbra white females	116	150.56			
Coimbra white males	114	153.3	153.3		
Terry black males	91		155.55	155.55	
Terry white females	69			158.67	158.67
Terry white males	64				162.2
Sig.		0.056	0.501	0.149	0.067

ACETABULAR-ISCHIUM LENGTH

GROUP	N	1	2	3	4
Coimbra white females	124	74.41			
Terry black females	107	75.94			
Terry white females	74		78.39		
Coimbra white males	117			82.85	
Terry black males	93			83.57	
Terry white males	64				86.56
Sig.		0.24	1	0.905	1

MAX LENGTH OF FEMUR

GROUP	N	1	2	3	4	5
Coimbra white females	126	407.32				
Terry white females	75		430.55			
Terry black females	106		438.31	438.31		
Coimbra white males	120			443.91		
Terry white males	66				461.45	
Terry black males	93					478.52
Sig.		1	0.237	0.605	1	1

MAX DIAM OF FEMUR HEAD

GROUP	N	1	2	3	4
Coimbra white females	126	40.4			
Terry black females	105		41.67		
Terry white females	74		42.43		
Coimbra white males	120			45.72	
Terry black males	93				47.73
Terry white males	66				48
Sig.		1	0.263	1	0.975

TIBIA LENGTH

GROUP	N	1	2	3	4	5
Coimbra white females	126	329.55				
Terry white females	75		349.84			
Coimbra white males	120			360.07		
Terry black females	105			364		
Terry white males	66				378.76	
Terry black males	91					399.19
Sig.		1	1	0.807	1	1

MAX VERTICAL HEAD DIAM OF HUMERUS

GROUP	N	1	2	3	4
Coimbra white females	127	39.07			
Terry black females	106		41.21		
Terry white females	75		42.03		
Coimbra white males	120			44.83	
Terry black males	93				47.85
Terry white males	66				48.21
Sig.		1	0.209	1	0.916

PHYSIO LENGTH OF ULNA

GROUP	N	1	2	3	4	5
Coimbra white females	127	199.04				
Terry white females	74		208.26			
Coimbra white males	120			220		
Terry black females	107			221.78		
Terry white males	65				228.78	
Terry black males	93					244.65
Sig.		1	1	0.92	1	1

SUPERIOR PUBIS-RAMUS LENGTH

GROUP	N	1	2	3	4
Terry black males	92	66.7			
Coimbra white males	116	67.76	67.76		
Terry black females	106		69.38	69.38	
Coimbra white females	121			69.79	
Terry white males	63			71.08	
Terry white females	72				74.17
Sig.		0.602	0.148	0.111	1

AGE AT DEATH

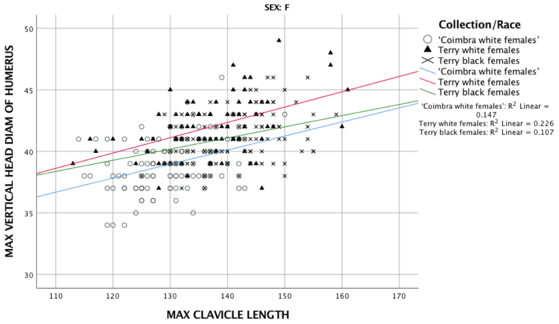
Tukey HSD

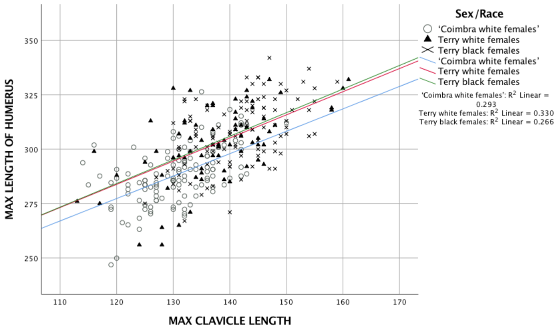
Group	N	1	2
Terry black m	93	40.23	
Terry black f	108	42.01	
Coimbra whi	127	45.87	
Coimbra whi	120	46.11	
Terry white m	66	46.15	
Terry white f	75		53.19
Sig.		0.085	1

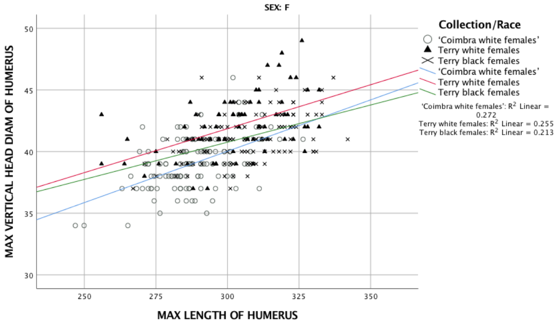
EPICONDYLAR BREADTH OF FEMUR

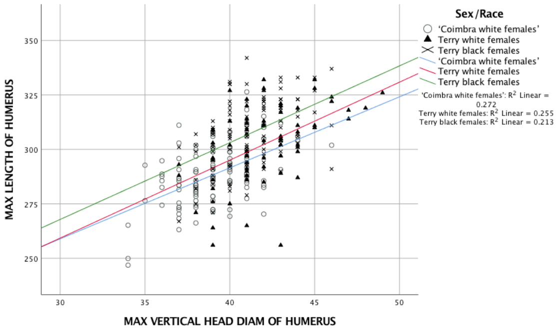
GROUP	N	1	2	3	4
Coimbra white females	125	71.05			
Terry black females	106		73.72		
Terry white females	75		75.2		
Coimbra white males	120			79.56	
Terry black males	93				83.05
Terry white males	66				83.79
Sig.		1	0.085	1	0.776

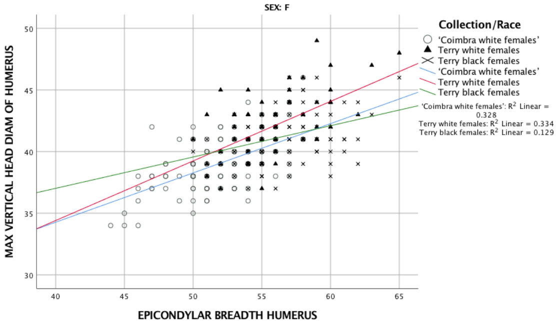
APPENDIX E. SCATTERPLOTS

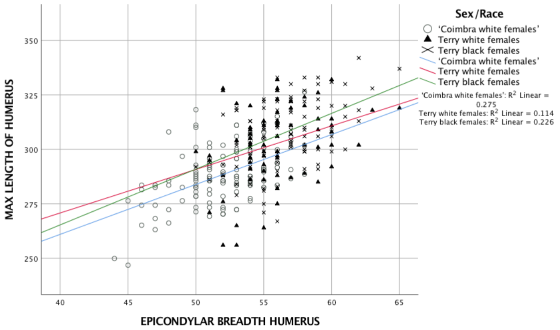


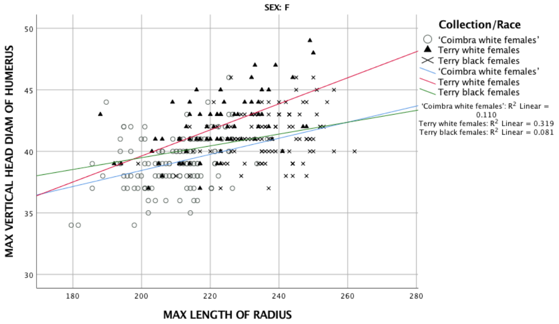


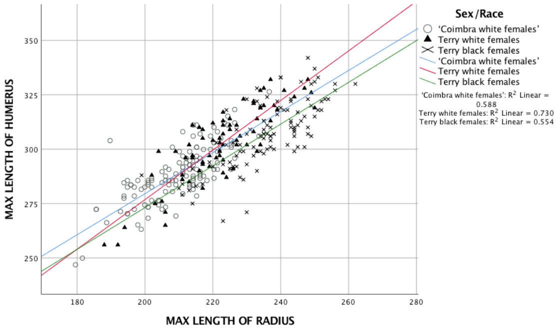


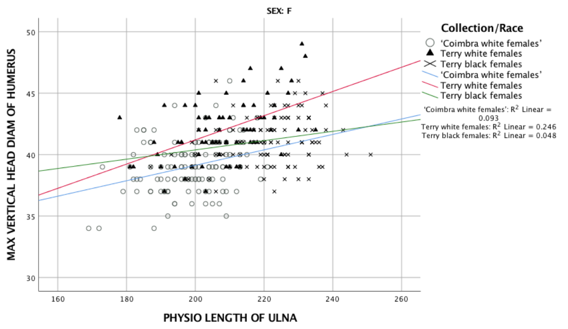


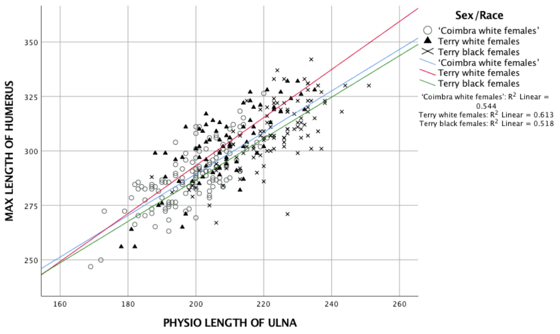


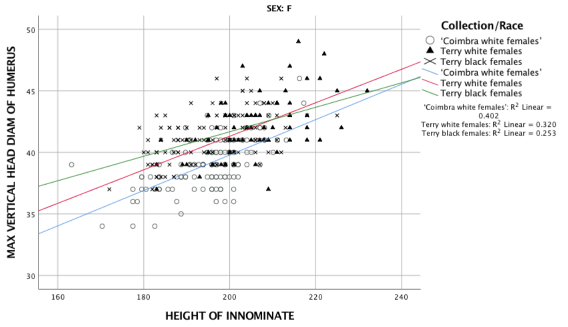


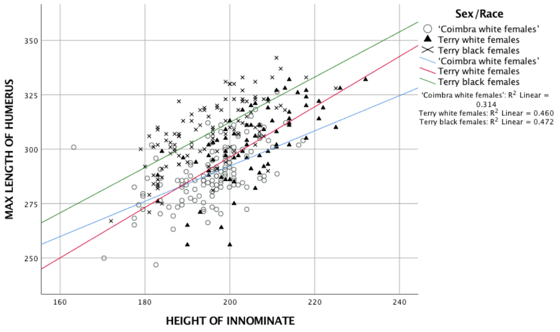


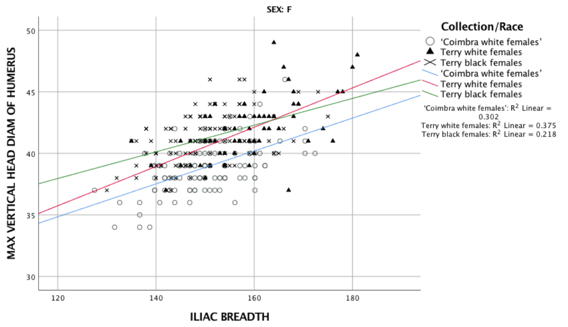


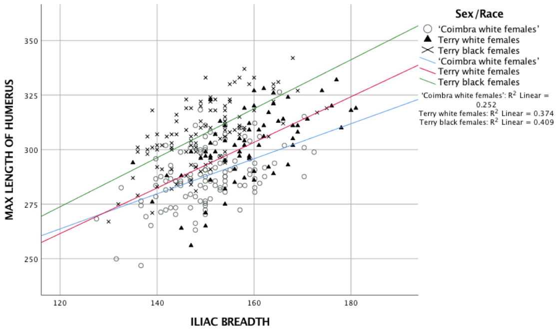

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
50
45
40
35
30
160
180
200
220
240
260
PHYSIO LENGTH OF ULNA
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.093
Terry white females: R² Linear = 0.246
Terry black females: R² Linear = 0.048

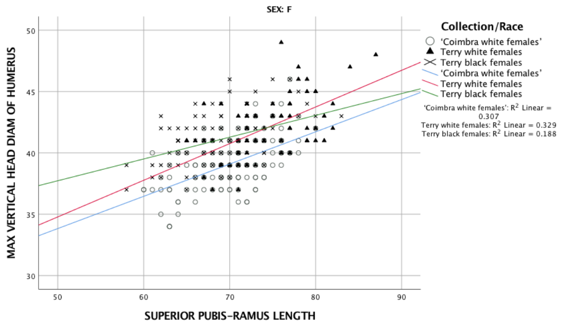

MAX LENGTH OF HUMERUS
350
325
300
275
250
160
180
200
220
240
260
PHYSIO LENGTH OF ULNA
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.544
Terry white females: R² Linear = 0.613
Terry black females: R² Linear = 0.518

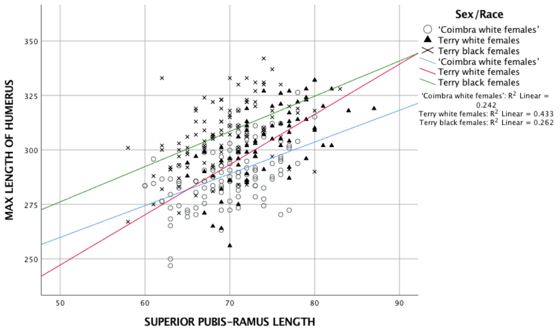

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
50
45
40
35
30
160
180
200
220
240
HEIGHT OF INNOMINATE
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.402
Terry white females: R² Linear = 0.320
Terry black females: R² Linear = 0.253

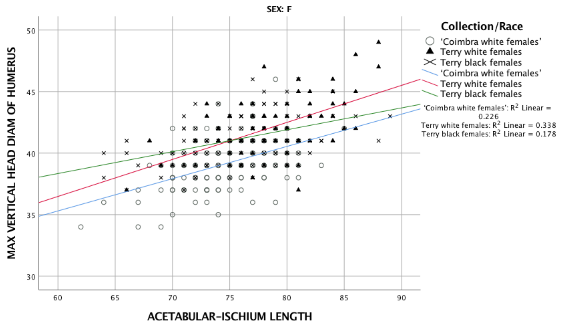

MAX LENGTH OF HUMERUS
350
325
300
275
250
160
180
200
220
240
HEIGHT OF INNOMINATE
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.314
Terry white females: R² Linear = 0.460
Terry black females: R² Linear = 0.472

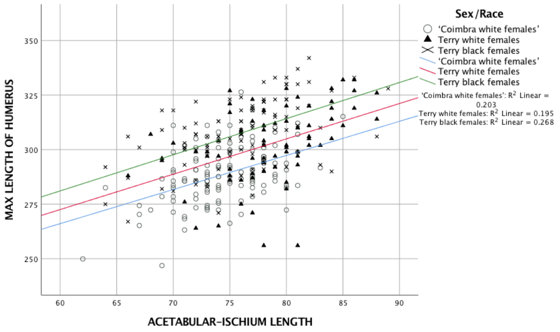

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
50
45
40
35
30
120
140
160
180
ILIAC BREADTH
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.302
Terry white females: R² Linear = 0.375
Terry black females: R² Linear = 0.218

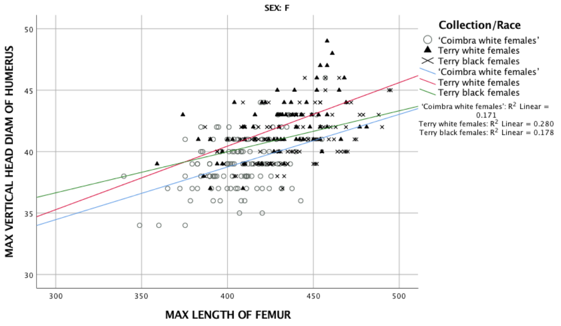

MAX LENGTH OF HUMERUS
350
325
300
275
250
120
140
160
180
ILIAC BREADTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.252
Terry white females: R² Linear = 0.374
Terry black females: R² Linear = 0.409

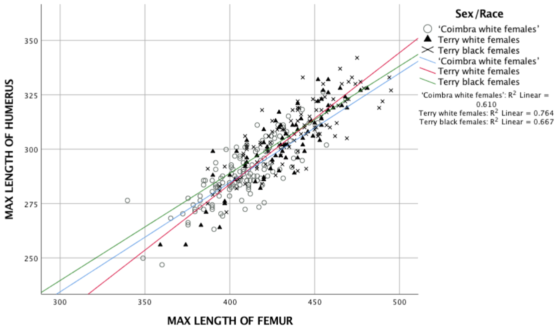

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
50
45
40
35
30
50
60
70
80
90
SUPERIOR PUBIS-RAMUS LENGTH
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.307
Terry white females: R² Linear = 0.329
Terry black females: R² Linear = 0.188

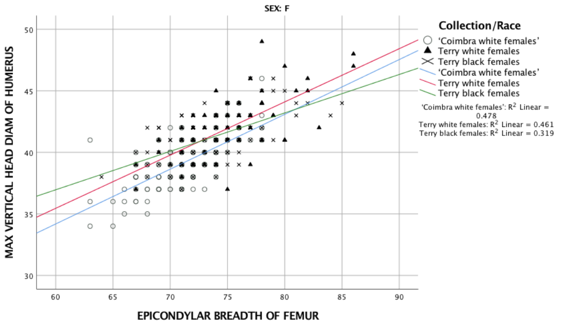

MAX LENGTH OF HUMERUS
350
325
300
275
250
50
60
70
80
90
SUPERIOR PUBIS-RAMUS LENGTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.242
Terry white females: R² Linear = 0.433
Terry black females: R² Linear = 0.262

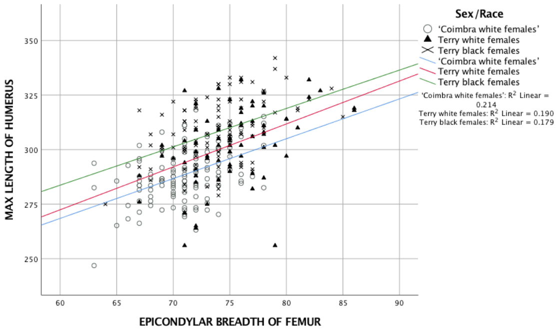

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
50
45
40
35
30
60
65
70
75
80
85
90
ACETABULAR-ISCHIUM LENGTH
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.226
Terry white females: R² Linear = 0.338
Terry black females: R² Linear = 0.178

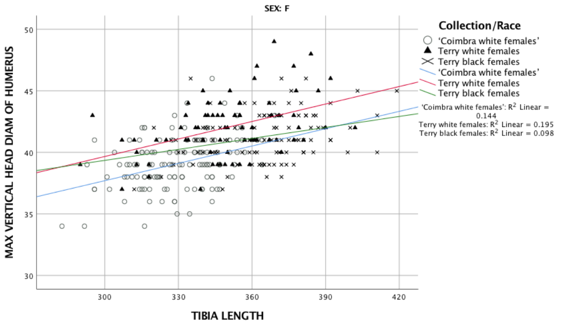

MAX LENGTH OF HUMERUS
350
325
300
275
250
60
65
70
75
80
85
90
ACETABULAR-ISCHIUM LENGTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R² Linear = 0.203
Terry white females: R² Linear = 0.195
Terry black females: R² Linear = 0.268

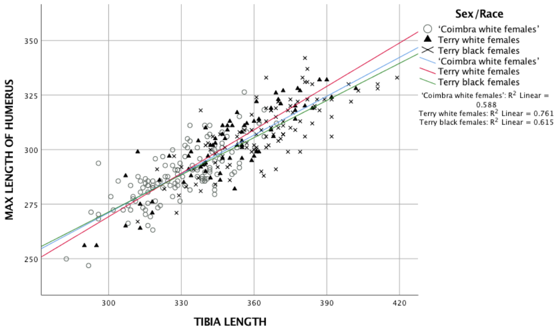

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
30
35
40
45
50
300
350
400
450
500
MAX LENGTH OF FEMUR
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.171
Terry white females: R^2 Linear = 0.280
Terry black females: R^2 Linear = 0.178

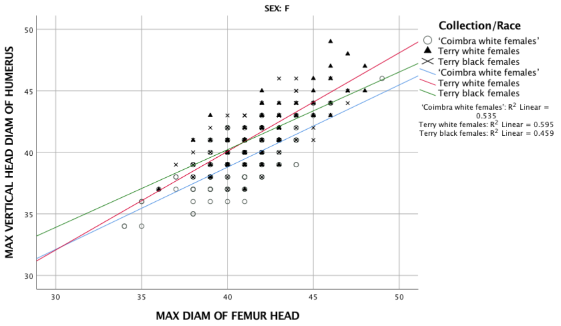

MAX LENGTH OF HUMERUS
250
275
300
325
350
300
350
400
450
500
MAX LENGTH OF FEMUR
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.610
Terry white females: R^2 Linear = 0.764
Terry black females: R^2 Linear = 0.667

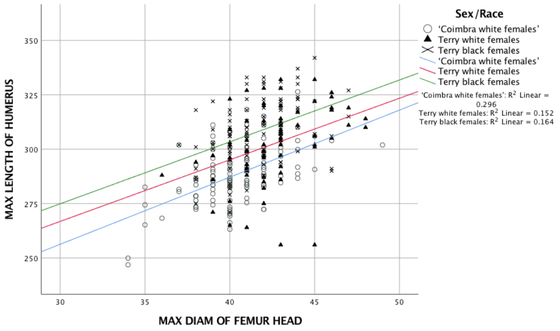

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
30
35
40
45
50
60
65
70
75
80
85
90
EPICONDYLAR BREADTH OF FEMUR
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.478
Terry white females: R^2 Linear = 0.461
Terry black females: R^2 Linear = 0.319

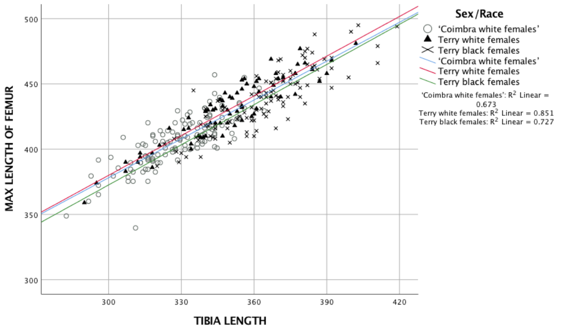

MAX LENGTH OF HUMERUS
250
275
300
325
350
60
65
70
75
80
85
90
EPICONDYLAR BREADTH OF FEMUR
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.214
Terry white females: R^2 Linear = 0.190
Terry black females: R^2 Linear = 0.179

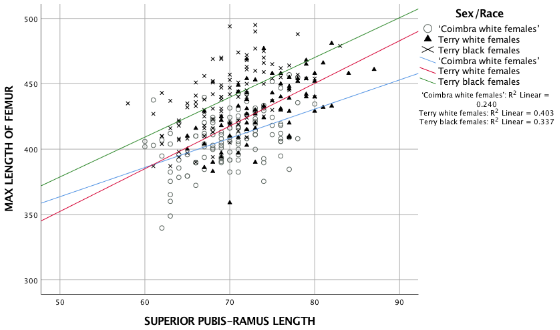

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
30
35
40
45
50
300
330
360
390
420
TIBIA LENGTH
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.144
Terry white females: R^2 Linear = 0.195
Terry black females: R^2 Linear = 0.098

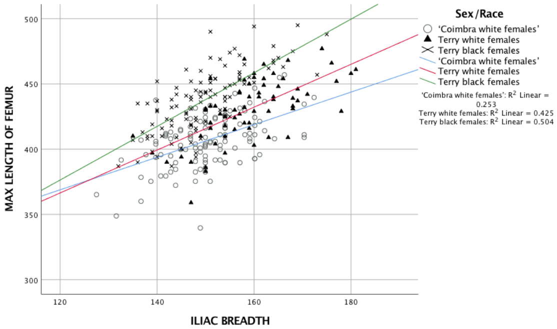

MAX LENGTH OF HUMERUS
250
275
300
325
350
300
330
360
390
420
TIBIA LENGTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.588
Terry white females: R^2 Linear = 0.761
Terry black females: R^2 Linear = 0.615

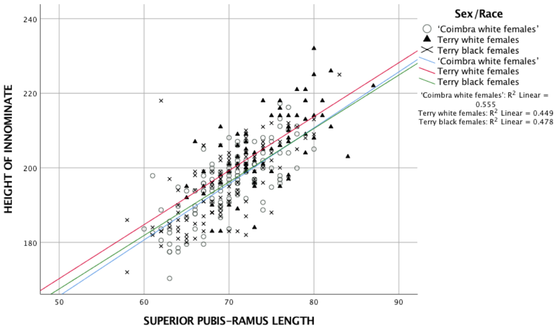

SEX: F
MAX VERTICAL HEAD DIAM OF HUMERUS
30
35
40
45
50
30
35
40
45
50
MAX DIAM OF FEMUR HEAD
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.535
Terry white females: R^2 Linear = 0.595
Terry black females: R^2 Linear = 0.459

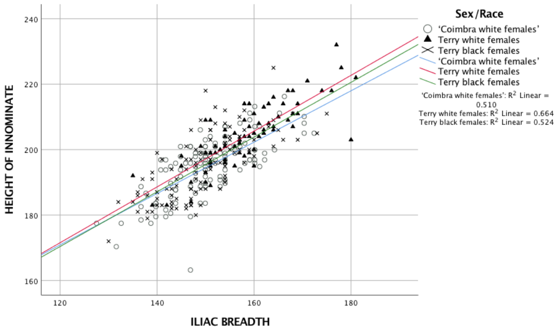

MAX LENGTH OF HUMERUS
250
275
300
325
350
30
35
40
45
50
MAX DIAM OF FEMUR HEAD
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.296
Terry white females: R^2 Linear = 0.152
Terry black females: R^2 Linear = 0.164


MAX LENGTH OF FEMUR
300
350
400
450
500
300
330
360
390
420
TIBIA LENGTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.673
Terry white females: R^2 Linear = 0.851
Terry black females: R^2 Linear = 0.727

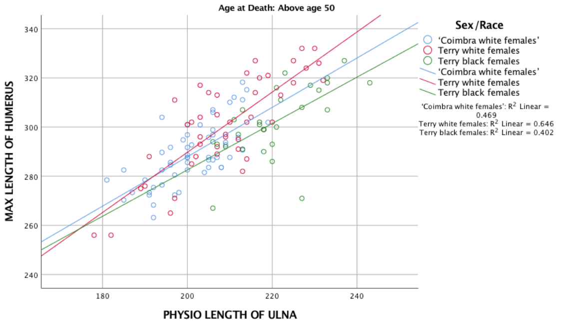

MAX LENGTH OF FEMUR
300
350
400
450
500
50
60
70
80
90
SUPERIOR PUBIS-RAMUS LENGTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.240
Terry white females: R^2 Linear = 0.403
Terry black females: R^2 Linear = 0.337

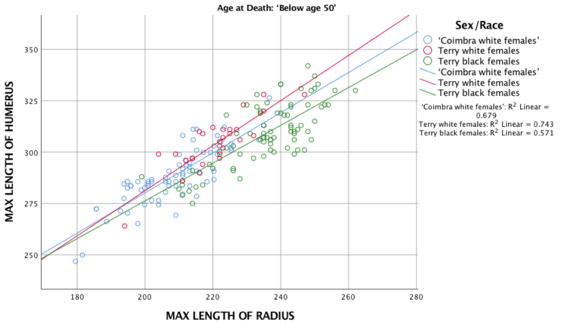

MAX LENGTH OF FEMUR
500
450
400
350
300
120
140
160
180
ILIAC BREADTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
× Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.253
Terry white females: R^2 Linear = 0.425
Terry black females: R^2 Linear = 0.504

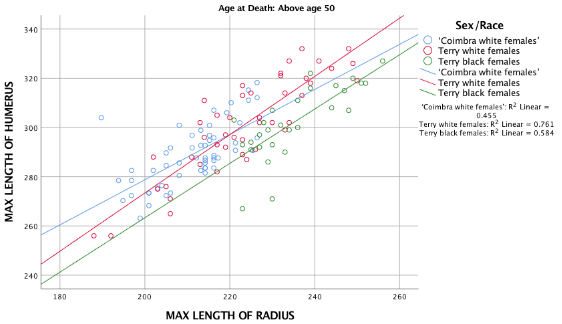

HEIGHT OF INNOMINATE
240
220
200
180
50
60
70
80
90
SUPERIOR PUBIS-RAMUS LENGTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
× Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.555
Terry white females: R^2 Linear = 0.449
Terry black females: R^2 Linear = 0.478

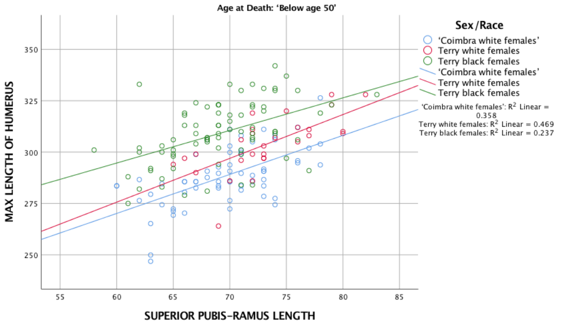

HEIGHT OF INNOMINATE
240
220
200
180
160
120
140
160
180
ILIAC BREADTH
Sex/Race
○ 'Coimbra white females'
▲ Terry white females
× Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.510
Terry white females: R^2 Linear = 0.664
Terry black females: R^2 Linear = 0.524

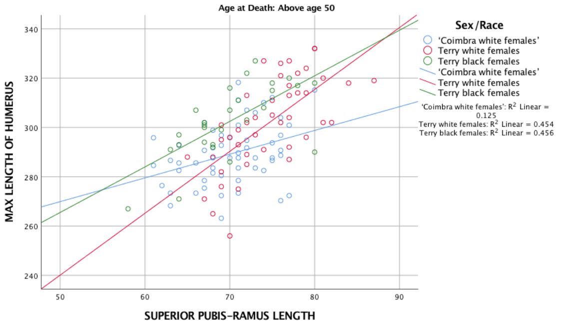
APPENDIX F. SCATTERPLOTS ABOVE/BELOW 50 YEARS OF AGE

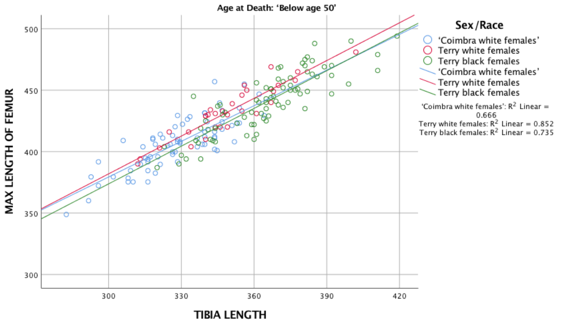


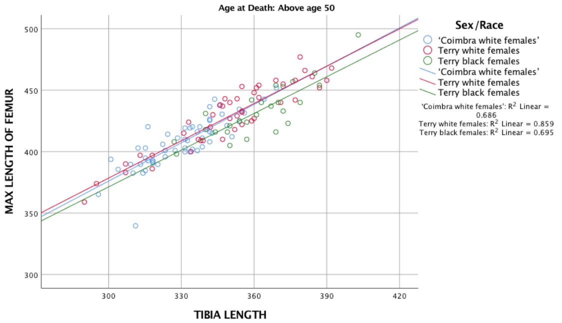


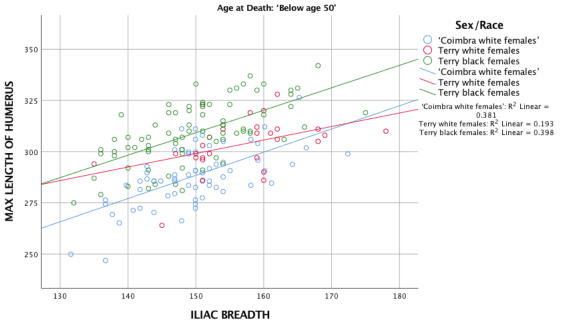


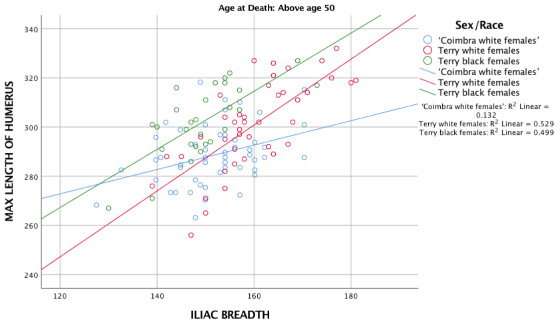




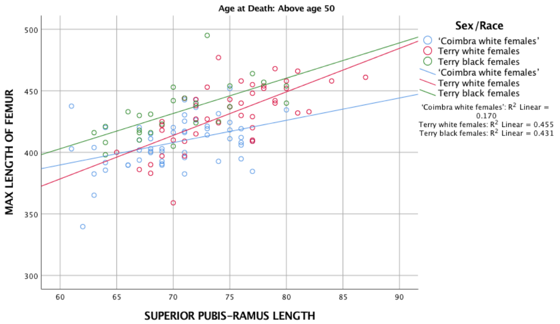


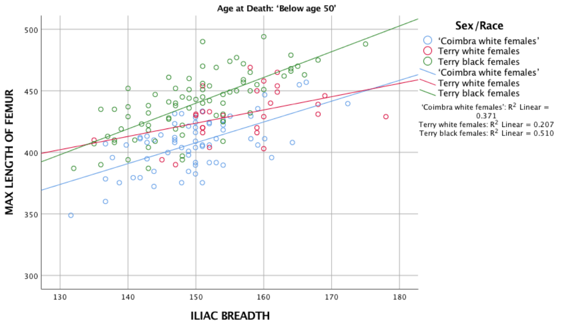


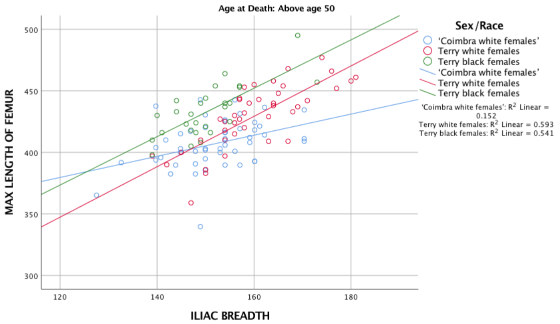

Age at Death: 'Below age 50'
MAX LENGTH OF HUMERUS
250
275
300
325
350
130
140
150
160
170
180
ILIAC BREADTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.381
Terry white females: R2 Linear = 0.193
Terry black females: R2 Linear = 0.398


Age at Death: Above age 50
MAX LENGTH OF HUMERUS
240
260
280
300
320
340
120
140
160
180
ILIAC BREADTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.132
Terry white females: R2 Linear = 0.529
Terry black females: R2 Linear = 0.499


Age at Death: 'Below age 50'
MAX LENGTH OF FEMUR
300
350
400
450
500
55
60
65
70
75
80
85
SUPERIOR PUBIS-RAMUS LENGTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.308
Terry white females: R2 Linear = 0.354
Terry black females: R2 Linear = 0.350

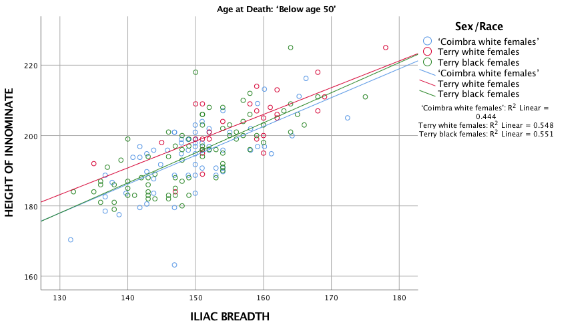

Age at Death: Above age 50
MAX LENGTH OF FEMUR
300
350
400
450
500
60
65
70
75
80
85
90
SUPERIOR PUBIS-RAMUS LENGTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.170
Terry white females: R2 Linear = 0.455
Terry black females: R2 Linear = 0.431

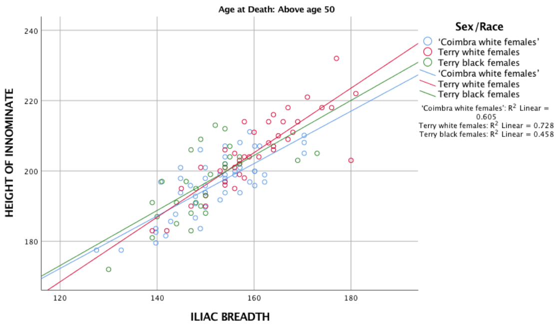

Age at Death: 'Below age 50'
MAX LENGTH OF FEMUR
300
350
400
450
500
130
140
150
160
170
180
ILIAC BREADTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.371
Terry white females: R2 Linear = 0.207
Terry black females: R2 Linear = 0.510


Age at Death: Above age 50
MAX LENGTH OF FEMUR
300
350
400
450
500
120
140
160
180
ILIAC BREADTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.152
Terry white females: R2 Linear = 0.593
Terry black females: R2 Linear = 0.541

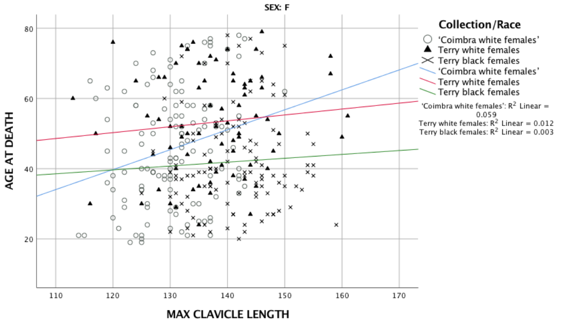

Age at Death: 'Below age 50'
HEIGHT OF INNOMINATE
170
180
190
200
210
220
230
55
60
65
70
75
80
85
SUPERIOR PUBIS-RAMUS LENGTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.538
Terry white females: R2 Linear = 0.450
Terry black females: R2 Linear = 0.422

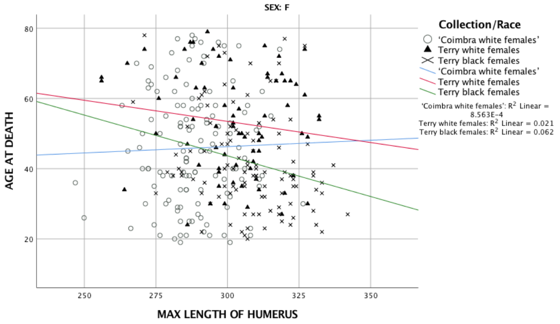

Age at Death: Above age 50
HEIGHT OF INNOMINATE
180
200
220
240
50
60
70
80
90
SUPERIOR PUBIS-RAMUS LENGTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.575
Terry white females: R2 Linear = 0.442
Terry black females: R2 Linear = 0.636

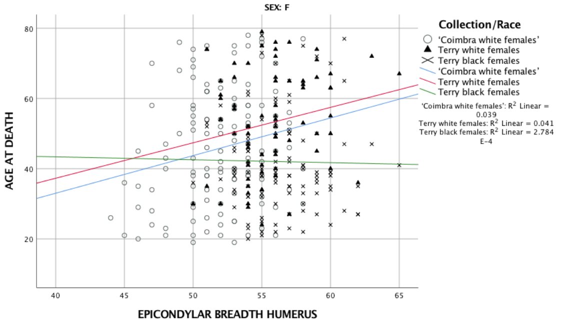

Age at Death: 'Below age 50'
HEIGHT OF INNOMINATE
160
180
200
220
130
140
150
160
170
180
ILIAC BREADTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.444
Terry white females: R2 Linear = 0.548
Terry black females: R2 Linear = 0.551

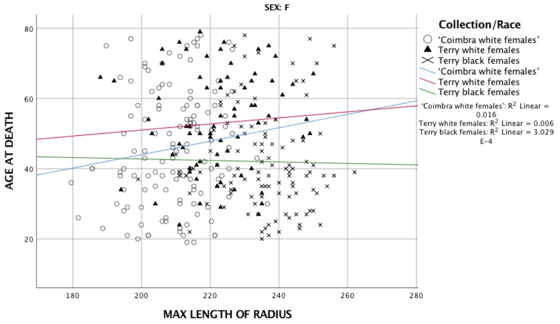

Age at Death: Above age 50
HEIGHT OF INNOMINATE
180
200
220
240
120
140
160
180
ILIAC BREADTH
Sex/Race
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R2 Linear = 0.605
Terry white females: R2 Linear = 0.728
Terry black females: R2 Linear = 0.458

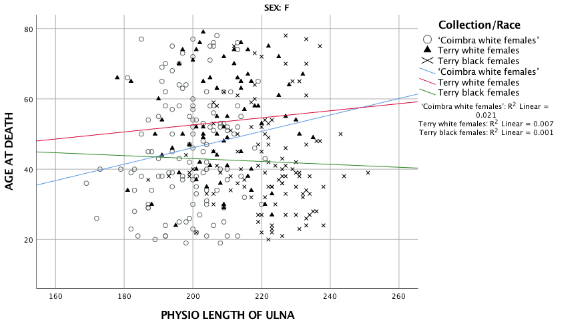
APPENDIX G. SCATTERPLOTS – AGE AT DEATH

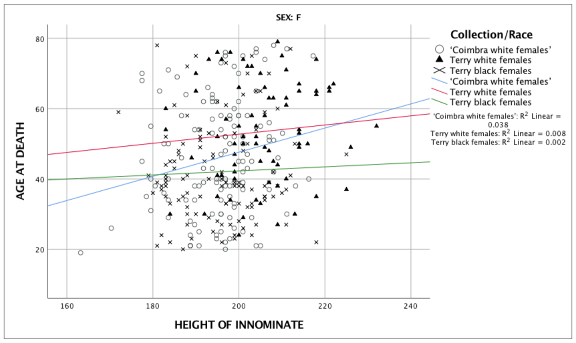


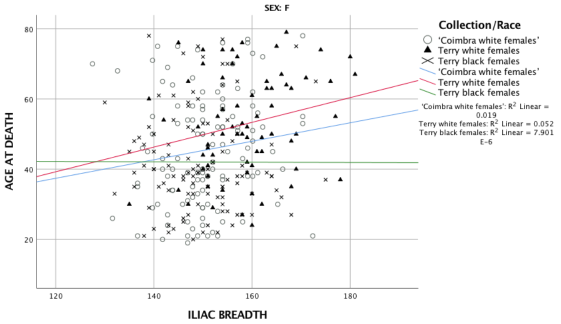


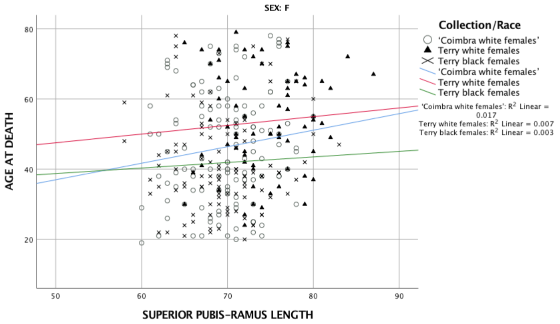


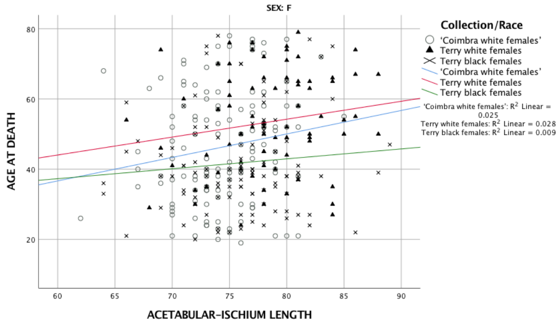


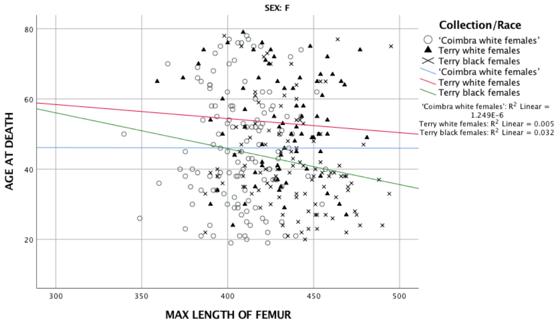


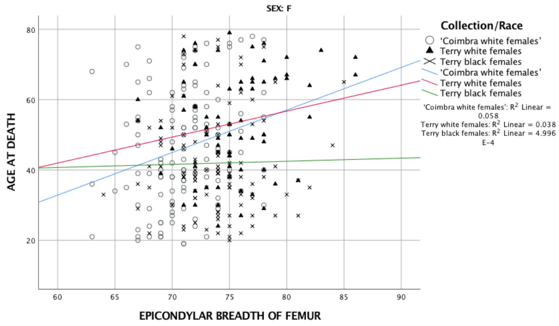


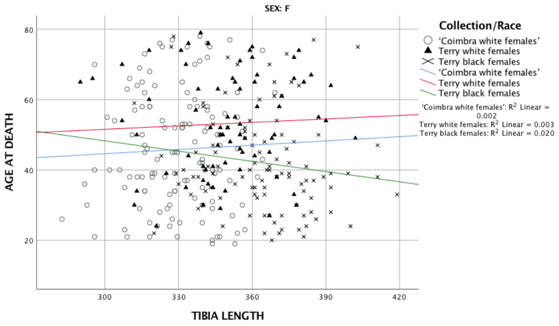


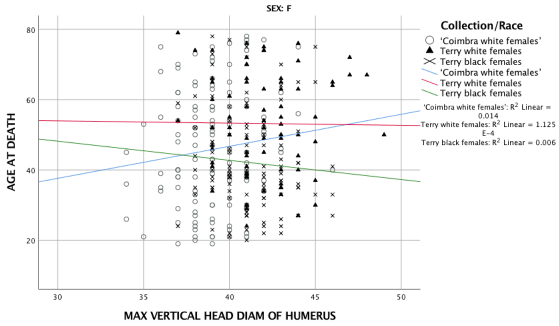


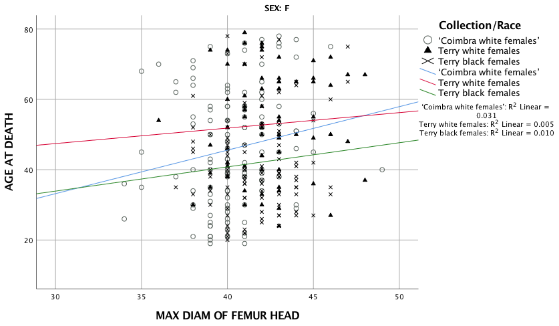

SEX: F
AGE AT DEATH
80
60
40
20
60
65
70
75
80
85
90
ACETABULAR-ISCHIUM LENGTH
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.025
Terry white females: R^2 Linear = 0.028
Terry black females: R^2 Linear = 0.009


SEX: F
AGE AT DEATH
80
60
40
20
300
350
400
450
500
MAX LENGTH OF FEMUR
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 1.249E-6
Terry white females: R^2 Linear = 0.005
Terry black females: R^2 Linear = 0.032


SEX: F
AGE AT DEATH
80
60
40
20
60
65
70
75
80
85
90
EPICONDYLAR BREADTH OF FEMUR
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.058
Terry white females: R^2 Linear = 0.038
Terry black females: R^2 Linear = 4.996 E-4


SEX: F
AGE AT DEATH
80
60
40
20
300
330
360
390
420
TIBIA LENGTH
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.002
Terry white females: R^2 Linear = 0.003
Terry black females: R^2 Linear = 0.020


SEX: F
AGE AT DEATH
80
60
40
20
30
35
40
45
50
MAX VERTICAL HEAD DIAM OF HUMERUS
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.014
Terry white females: R^2 Linear = 1.125 E-4
Terry black females: R^2 Linear = 0.006


SEX: F
AGE AT DEATH
80
60
40
20
30
35
40
45
50
MAX DIAM OF FEMUR HEAD
Collection/Race
○ 'Coimbra white females'
▲ Terry white females
✕ Terry black females
'Coimbra white females'
Terry white females
Terry black females
'Coimbra white females': R^2 Linear = 0.031
Terry white females: R^2 Linear = 0.005
Terry black females: R^2 Linear = 0.010

APPENDIX H. FREQUENCIES – CAUSE OF DEATH

Frequencies - Cause of Death				
	CWF	TWF	TBF	Total
Cause of Death	8	8	11	27
ABSCESS	0	1	0	1
ACCIDENT	0	0	2	2
ALCOHOLISM	0	1	2	3
ANEMIA	2	0	0	2
ANEURYSM	0	1	2	3
ANURIA	1	0	0	1
APOPLEXY	0	1	0	1
APPENDICITIS	1	0	0	1
ARTERIOSCLEROSIS	0	1	2	3
BRAIN PULMONARY	0	1	0	1
CAHEXIA	1	0	0	1
CANCER	17	9	5	31
CEREBRAL HEMORRHAGE	7	3	2	12
CIRRHOSIS	2	4	2	8
CIRRHOSIS - HEPATITIS	1	0	0	1
DEMENTIA	0	0	1	1
DIABETES	0	1	2	3
DILATION OF THE STOMACH	3	0	0	3
ECLAMPSIA	0	0	1	1
EMBOLISM	0	0	1	1
ENDOCARDITIS	3	0	0	3
EPILEPSY	0	0	2	2
FISTULA, DRUG ABUSE	0	1	0	1
FRACTURE	0	1	0	1
GANGRENE	2	0	0	2
GASTRITIS	0	1	0	1
HEART / KIDNEY DISEASE	0	0	2	2
HEART DISEASE	20	21	23	64
HEART DISEASE, SYPHILIS	0	0	1	1
HEAT EXHAUSTION	0	0	1	1
HEMIPLEGIA	0	0	2	2
HEMORRHAGE	1	0	2	3
HERNIA	2	0	0	2
HYPERTENSION	0	1	1	2
INTESTINAL OBSTRUCTION	2	0	1	3

INTESTINAL OBSTRUCTION, PERITONITIS	1	0	0	1
MALNUTRITION	0	1	0	1
MEASLES	1	0	0	1
MENINGITIS	2	0	0	2
NEPHRITIS	3	2	3	8
NEURASTHENIA	0	0	1	1
PARALYSIS	0	1	0	1
PARESIS	0	1	0	1
PELVIC INFLAMMATION	0	0	1	1
PERITONITIS	2	0	0	2
PLACENTA PREVIA	1	0	0	1
PNEUMONIA	14	5	8	27
POISON	0	1	1	2
PSYCHOSIS	0	0	1	1
PUNCTURE	1	0	0	1
RETROVERTED UTERUS	1	0	1	2
SALPINGECTOMY	0	0	1	1
SEPTICEMIA	1	0	0	1
SMALL POX	1	0	0	1
STARVATION	1	0	0	1
SUICIDE	0	2	0	2
SYPHILIS	0	1	2	3
TB	24	4	15	43
TB, PNEUMONIA	0	0	1	1
TOXEMIA OF PREGNANCY	0	0	1	1
TOXIC GOITER	0	1	0	1
TYPHOID FEVER	1	0	0	1
UREMIA	0	0	1	1
WOUND - GUNSHOT	0	0	2	2
WOUND - STAB	0	0	1	1
Total	127	75	108	310

APPENDIX I. FREQUENCIES – OCCUPATION

OCCUPATION	CWF	TWF	TBF
Cook	0	0	1
Domestic	0	0	5
Factory Worker	0	1	1
Farmer	1	0	0
Hairdresser	0	0	1
Housewife	0	4	8
Housewife/Housework	109	0	0
Housework	0	2	16
Janitress	0	0	1
Laundress	0	0	1
Maid	13	0	0
Nil	0	0	2
Saleswoman	0	1	0
Seamstress	3	0	0
Unknown	1	67	72
Total Population	127	75	108

VITA AUCTORIS

Jennifer Halliday was born in 1989 in Nanaimo, British Columbia. She graduated from Salmon Arm Secondary School in 2007. From there she attended the University of Victoria and Okanagan College before obtaining her B.A. Honours in Archaeology, with certificates in Cultural Resource Management and Forensic Studies, from Simon Fraser University in 2016. She is currently a candidate for the Master’s Degree in Criminology at the University of Windsor and hopes to graduate in Spring 2019.