

“HIPS DON’T LIE”: A VALIDATION STUDY OF THE
ALBANESE METRIC SEX ESTIMATION METHOD FOR THE
PROXIMAL FEMUR ON A MODERN NORTH AMERICAN POPULATION

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ABSTRACT

When estimating the sex of a skeletonized individual, the pubic bone of the os coxae is considered the best source of information due to its sexually dimorphic traits. However, as the pubic bone can be easily damaged in both bioarchaeological and forensic anthropological contexts, the development of non-pelvic sex estimation methods has become crucial. Albanese (2008) introduced an alternative method of sex estimation that involves measurements from the proximal femur (thigh bone). The use of three newly defined landmarks and measurements between these landmarks create a triangle on the proximal femur and reflects the angle of the femoral neck. The greater width of the female pelvis necessary for childbirth requires concomitant adaptations in other bones including the proximal femur. Albanese's method aims to capture the variation in the angle of the femoral neck as a result of the sex-based differences in the pubic bone. The original study generated logistic regression equations for sex estimation that are not population specific and Albanese achieved a 95-97% allocation accuracy when distinguishing between males and females. The purpose of the current study was to apply Albanese's metric sex estimation method to a sample of identified individuals from the Texas State University Donated Skeletal Collection ($n = 100$, including 50 males and 50 females) in order to validate or negate his method as a universally applicable approach.

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PREFACE

In writing and conducting research for the Honors College, it has been my hope to make this quantitative thesis report as comprehensible to any reader as it would be to other researchers in the field of biological anthropology. As a result, an effort has been made to include more detail in terms of jargon and anatomical references.

INTRODUCTION

Modern and Historical Significance

The current motto of the Paleopathology Association, “*mortui viventes docent*”, initially became popularized in the 19th and 20th centuries. It was used as an endeavor by biological scientists to justify the dissections of human cadavers in order to better understand cause of death. Translated literally from Latin, it reads “the dead teach the living”, and within the field of biological anthropology, this phrase applies to nothing better than the study of human skeletal remains. As the most durable tissue that our bodies leave behind, bones can survive for thousands of years after an individual’s death. In an archaeological context, bioarchaeologists study the skeletal remains of individuals to piece together the demography of a community, including the diet of individuals, the diseases evident from skeletal markers, and even the biological distance between societies (Figure 1.1). In contrast to bioarchaeologists, forensic anthropologists use the same methods of skeletal research to aid in the recovery and identification of modern skeletal remains, often through missing person databases (Figure 1.2). Although working under different temporal contexts, forensic anthropologists, bioarchaeologists, osteologists and all other biological anthropologists understand that the experiences we

endure in life echo in death through the organic and material remains we leave behind. Through proper training and a keen eye, it is the skeletal evidence of these experiences that enable us to piece together the key characteristics of an individual. Over the years, all biological anthropologists and osteologists alike, have worked to establish and perfect the estimation of these key characteristics in what is known as the biological profile.



Figure 1.1. Human skeletal remains in a bioarchaeological context.
(Photo Credit: Alan Wilmshurst, <http://archaeology.co.uk>.)



Figure 1.2. Human skeletal remains in a forensic anthropological context.

The Biological Profile

Currently, four predominant pillars of the biological profile exist: sex, age, ancestry, and stature. Methods estimating age help classify skeletal remains as infants, juveniles, sub-adults or adults. Stature estimation methods determine how tall an individual was while alive. The visual assessment of ancestry, while sometimes controversial, is crucial in regards to forensic cases and aims to determine between individuals of White, Hispanic, African, and Asian descent. Lastly, and integral to this study, sex estimation is the assessment between males and females.

For decades, scholars and scientists well-versed in the understanding of human osteology have researched and tested various methods of estimation for these intrinsic characteristics. Currently, there are multiple methods that yield useful information when establishing a biological profile. These techniques were created and designed specifically for a particular pillar and only a few have withstood the test of time through countless validation studies by researchers within the field.

The current validation study is focused on a previously tested method of metric sex estimation. When the careful analysis of human skeletal remains yields a correct estimation of sex, this can effectively eliminate 50% of the population from further consideration. As such, accurate estimations of sex rely completely on the testing and validation of sex estimation methods, especially in forensic anthropological cases involving missing people. It is also important to understand that other pillars, such as age and ancestry, are sex-specific. This makes sex estimation a crucial element of the biological profile, especially in the early stages of an investigation (Christensen, 2014).

Sex Estimation Methods

There are two fundamental techniques for the estimation of sex on human skeletal remains: visual assessment and metric estimation. Visual assessment is a way of using acquired knowledge of bones and their sexually dimorphic features to make a gross analysis of skeletal remains. Although useful in field excavation settings, this practice is discouraged when it comes to making final estimations due to the high probability of inter- and intra-observer error. Metric estimation is the measurement of and between various indicators on the bone that can be used in determining sex through the application of a properly tested method. Though these measurements can still be subject to error through the level of skill and knowledge of the observer, metric estimation is far more reliable when constructing a biological profile (DiGangi and Moore, 2013).

When estimating the sex of a skeletonized individual, the pubic bone of the os coxae is considered the best source of information due to its sexually dimorphic traits (Figure 1.3). These traits, distinguishing between males and females, is the direct product of evolutionary pressures that forced the female pelvis to widen for childbirth over time (Figure 1.4), and has required other bones, including the proximal femur, to reflect concomitant adaptations (Figure 1.5). Unfortunately, in both bioarchaeological and forensic cases, deceased individuals are typically subjected to various taphonomic factors including environmental, individual, or cultural variants (Nawrocki, 1995). It is in regards to these factors that the pelvic girdle, and the pubic bone in particular, is at more of a disadvantage than other bones of the skeleton. As a fragile part of the skeleton that lies uppermost in typical supine (face-upward) burials, the pubic bone is highly

susceptible to damage during excavation (Mays, 1998). In cases where the pubis has been damaged or destroyed, the development of non-pelvic sex estimation methods becomes crucial.

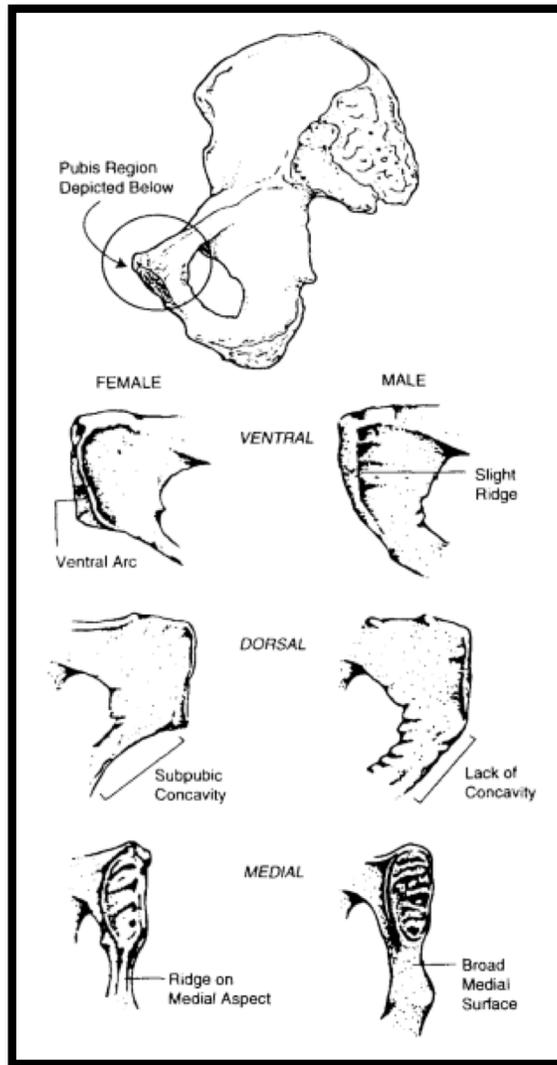


Figure 1.3. Sexually dimorphic traits of the os coxae (Buikstra and Ubelaker, 1994:17, after Phenice, 1969).

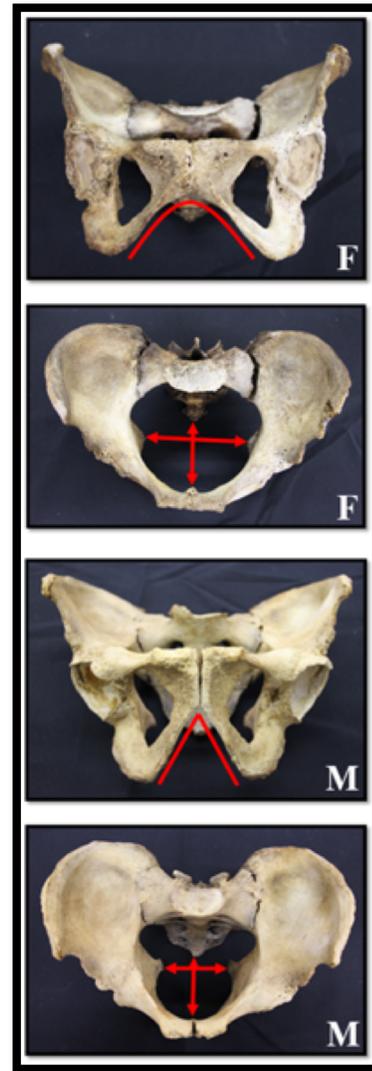


Figure 1.4. Sexual dimorphism on the fused pelvis; female pelvis (top), male pelvis (bottom).

The skull, for example, has several features that can be visually assessed and scored to determine between males and females (Acsádi and Nemeskéri, 1970), where lower scores indicate the gracile features of females and higher scores denote the robust

features of males (Figure 1.6). However, many skeletal elements, including long bones, are typically far more accurate than the skull in terms of sex estimation. The humerus (upper arm bone) and the femur (thigh bone) are excellent for sex estimation because of the functional morphological differences in their “ball-and-socket” joints. Measurements for both the humeral head and the femoral head have proven accuracy rates of approximately 86% on their own. When these measurements are combined with others that reflect the functional dimorphism between males and females, these accuracy rates have been known to improve (DiGangi and Moore, 2013).

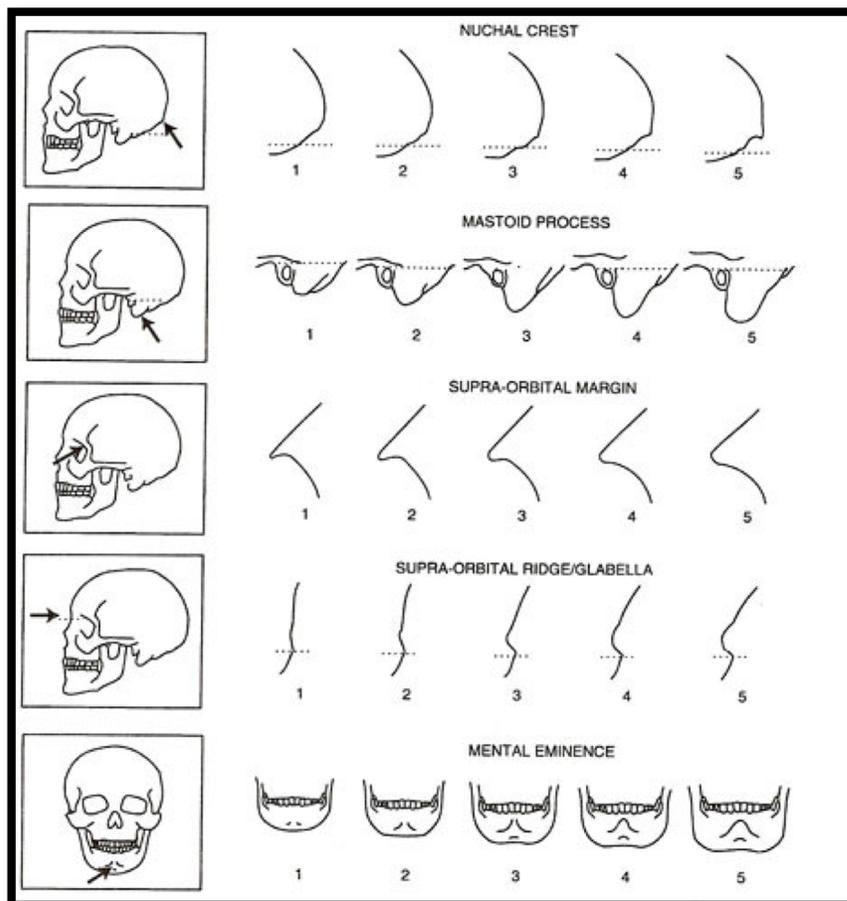


Figure 1.6. Sexually dimorphic traits of the skull (Acsádi & Nemeskéri, 1970).

Purpose of the Study

In 2008, physical anthropologist Dr. John Albanese introduced another alternative method of sex estimation that focused on the proximal portion of the femur and in particular the angle of the femoral neck. This part of the femur, which articulates directly with the ossa coxae (pelvic bones), is highly sexually dimorphic due to the angle of the femoral neck that has adapted to the width of the pelvis. Through the use of three newly defined landmarks, and measurements between these landmarks, the Albanese (2008) method creates a triangle on the posterior proximal femur that establishes the angle of the femoral neck and reflects its adaptation to the pubic bone of the os coxae (Figure 1.7). Taphonomically, this portion of the femur holds up well in multiple contexts due to its high bone mineral density and can be used when the pubis bone is either too damaged or unavailable.

Albanese's method aims to capture the variation in the angle of the femoral neck as a result of the sex-based differences in the pubic bone. The original study generated logistic regression equations for sex estimation that are not population specific and Albanese achieved a 95-97% allocation accuracy when distinguishing between males and females. The purpose of the current study was to apply Albanese's metric sex estimation method to a sample of identified individuals from the Texas State University Donated Skeletal Collection ($n = 100$, including 50 males and 50 females) in order to validate the utility of his method as a universally applicable approach.

METHODS

Previous Studies on the Proximal Femur

There have been several methods in the last two decades that helped Albanese to form and refine his method of sex estimation on the proximal femur. In 2005, Ruma Purkait, a physical anthropologist from India, was another in a long line of osteologists to conduct research on the femur. Concentrating on only the proximal femur, Purkait suggested that this would be useful in cases where you are left with only fragmentary remains. She hypothesized that the proximal femur's functional adaptation would be reflective of sexual dimorphism in the body weight of an individual. In her method, Purkait establishes a triangle on the posterior surface of the proximal femur that she believes will display this dimorphism of body weight. This triangle, like Albanese's, consists of three feature landmarks and measurements between those landmarks. The three points of Purkait's triangle include the apex of the lesser trochanter, the apex of the greater trochanter, and the most lateral point on the posterior femoral head (Figure 2.1). In her study, a skeletal collection of 280 dry adult femora from the Medico-Legal Institute at Bhopal in Central India was used. Of this sample, 200 were male and 80 were female. For her methodology, Purkait established a set of 20 femora to conduct t-tests as well as applying stepwise discriminant function analysis to determine the combination of variables for sexing the femur. In her results, an average percentage classification was ranked at 87.5%. Unfortunately, this percentage rate was no better than the results of other methods when compared with accuracy rates of a single measurement such as the femoral head diameter (Purkait, 2005).

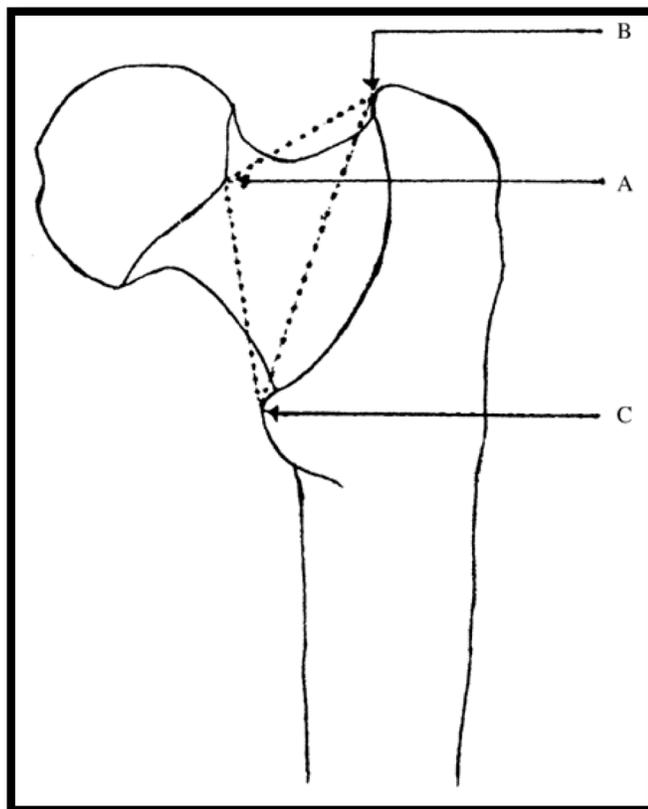


Figure 2.1. The Purkait method triangle (Purkait, 2005:136).

In 2007, physical anthropologists Robert Brown and Douglas Ubelaker decided to retest the Purkait method on a skeletal sample from the Terry Collection at the Smithsonian. In this sample, only Indo-European and African American adults from the United States were used. Their results using Purkait's triangle were proportional to her outcome at 85.5% which was roughly the same accuracy they received from measuring the femoral head diameter alone (87%). To better their accuracy rates, Brown and his colleagues decided to combine one measurement from the femoral head to the triangle. This resulted in the discriminant function analysis increasing to 90% accuracy. After this, they determined that adding a sectioning point between the apices of the lesser and greater trochanter further increased the accuracy rate to 93.4% (Brown et al., 2007).

John Albanese et al. (2008) Method

In 2008, John Albanese and colleagues prepared a research project combining aspects from both the Purkait and Brown studies that included their own modifications to better the sex estimation of the proximal femur. The skeletal sample ($n > 300$) was taken from the Terry Collection at the Smithsonian. In order to create a non-population specific method, Albanese structured his sample by selecting individuals that varied greatly in both age-at-death and year of birth. This high level of variation was used to echo the variation seen in the biomechanical morphology of the proximal femur. While modeling his triangle measurements after Purkait's method, Albanese instead used it to reflect the functional morphology for childbirth rather than body weight dimorphism. In his efforts to better the allocation accuracy of the triangle measurements and ratios, Albanese, like Brown, included a measurement from the femoral head: the maximum head diameter. Unlike Purkait and Brown, Albanese's method utilizes his own logistic regression formula rather than a discriminant function approach believing that, while it performs just as well as the discriminant function, it results in less conjecture.

Altogether, four measurements are required for the Albanese (2008) method of sex estimation (Figure 2.2). The three newly defined landmarks that Albanese established for these measurements are the greater trochanter, the lesser trochanter, and the fovea capitis. The landmark at the greater trochanter (GT) is located at "the most lateral apex on the greater trochanter" (p.1284). The location of the lesser trochanter landmark (LT) is found at the "superior margin of the lesser trochanter" at the "most proximal point on the dense compact bone around the base" (p.1284-1285). Lastly, the landmark at the fovea

capitis (FC) is located at the “superior margin of the fovea capitis” (p.1284), avoiding lipping or depressions around the feature. The three inter-landmark measurements are taken from the greater trochanter landmark to the fovea capitis landmark (GT to FC), from the greater trochanter landmark to the lesser trochanter landmark (GT to LT), and from the lesser trochanter landmark to the fovea capitis landmark (LT to FC) (Albanese, 2008). The addition measurement of the maximum femoral head diameter (FHD) is measured at the maximum diameter of the head, wherever it occurs (Buikstra, 1994).

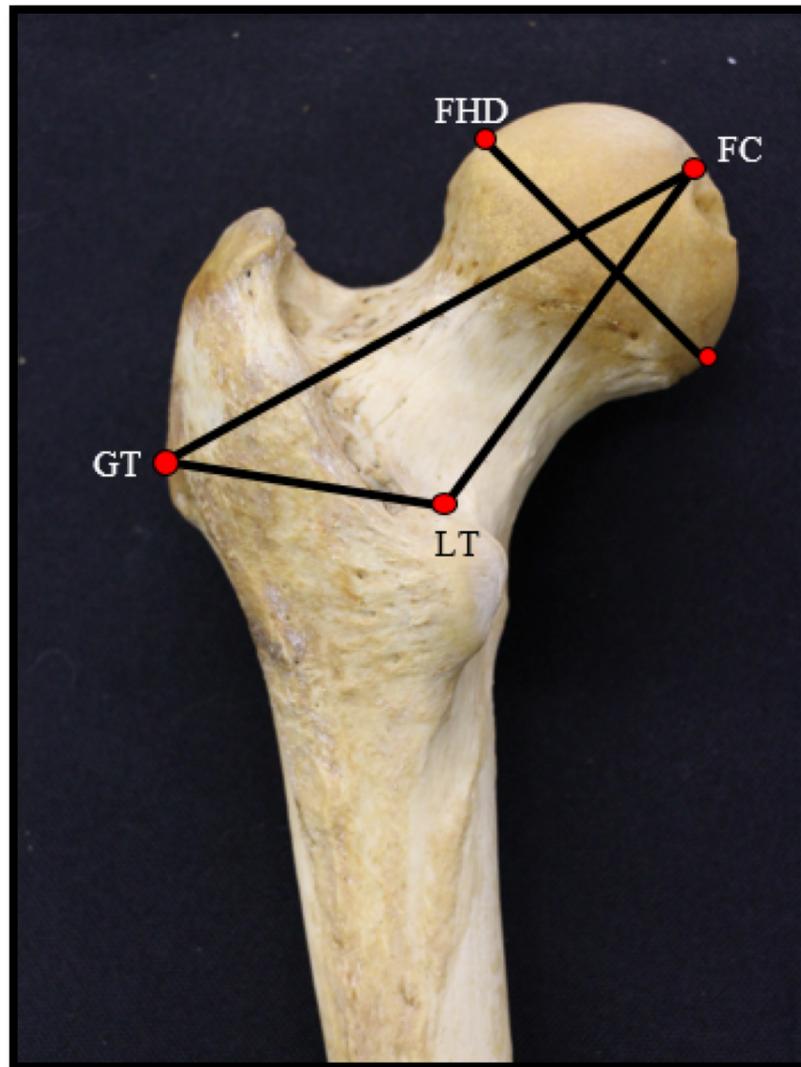


Figure 2.2. Albanese triangle with inter-landmark measurements and the maximum femoral head measurement.

Albanese (2008:1285) used the general equation for the Law of Cosines –

$$A_{\text{angle}} = \text{Cos}^{-1} \frac{b^2 + c^2 - a^2}{2bc}$$

– to calculate the angles of the oblique triangle formed from the inter-landmark measurements (Figure 2.3). Where A, B, and C represent the angles of the triangle, a, b, and c represent the sides of the triangle established from the inter-landmark measurements. The following is the same formula with the landmark distances expressed:

$$\text{AGT} = \text{Cos}^{-1} \frac{(\text{GT to LT})^2 + (\text{GT to FC})^2 - (\text{LT to FC})^2}{2(\text{GT to FC}) \times (\text{GT to LT})}$$

After calculating the angles of the triangle, Albanese used three newly developed ratios to apply to his logistic regression formula. The first ratio took the angle at the GT landmark (AGT) and divided it by the inter-landmark distance between the GT and FC landmarks (c). The second ratio took the angle at the lesser trochanter landmark (CLT) and divided it by the measurement of the maximum femoral head diameter (FHD). The last ratio was calculated by dividing the angle at the lesser trochanter (CLT) by the inter-landmark distance between the LT and FC landmarks (a) (Figure 2.4).

Once all of the inter-landmark measurements and ratios were calculated, and the co-efficient values from his original study were accounted for, Albanese’s logistic regression equation produced a *p*-value. According to Albanese (2008), the “*p*-value (always between 0 and 1) is used to classify an unknown individual and also provides a probability value for the allocation. Scores greater than 0.5 are classified as male and scores less than 0.5 are classified as female” (p.1285). Individuals that had a *p*-value

classifying them as the opposite sex were marked as misallocated. The number of individuals that are misallocated in turn produces the allocation accuracy rate.

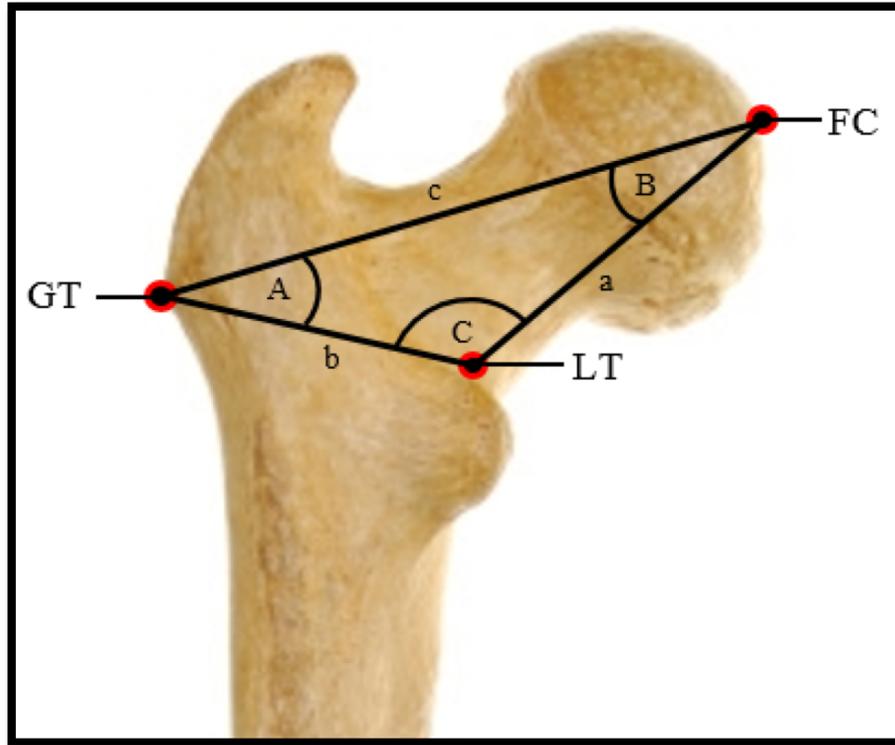


Figure 2.3. Albanese triangle depicting landmarks (GT, LT, FC), angles (A, B, C), and inter-landmark distances (a, b, c).

$$\begin{array}{c} \text{Ratio \#1} \\ \frac{AGT}{c (GT \text{ to } FC)} \times 100 \end{array}$$

$$\begin{array}{c} \text{Ratio \#2} \\ \frac{CLT}{FHD} \times 100 \end{array}$$

$$\begin{array}{c} \text{Ratio \#3} \\ \frac{CLT}{a (LT \text{ to } FC)} \times 100 \end{array}$$

Figure 2.4. The three ratios Albanese describes using logistic regression formulas (p.1285).

In Albanese's results, the allocation accuracy rate ranged from 95-97%. In order to confirm their method as non-population specific, Albanese and colleagues encourage the use of validation studies in various geographical regions to either verify or negate their research.

MATERIALS

Donated Skeletal Collection Sample

For the purpose of this study, a research proposal was written and applied to the Forensic Anthropology Center at Texas State (FACTS) requesting permission to use the Texas State University Donated Skeletal Collection (TXSTDSC). The donation program at FACTS is one of their most important operations and includes the intake, processing and storage of deceased individuals that donated themselves to the facility before their death. FACTS is primarily divided into three sub-facilities, each of which carry out an aspect of this donation process. The first of these facilities is the Forensic Anthropology Research Facility (FARF). At FARF, donated individuals are placed outside, on the land, in varying conditions. These conditions are usually dependent on what researchers are wanting to study, for example, decomposition rates in and/or out of clothing, weathering of bones due to environmental factors, and even vulture scavenging distribution. After the individuals at FARF are more-or-less completely skeletonized, they are moved to processing. This second facility is the Osteological Research and Processing Laboratory (ORPL). It is here that the skeletal remains from FARF are taken. This process, which is primarily carried out by undergraduate volunteers, involves the cleaning of the entire skeleton including the removal of residual soft tissue. Once the remains have been

cleaned and each individual bone has been labeled with its donation number (i.e., D04-2014), the individual is then moved to the final facility. At the Grady Early Forensic Anthropology Research Laboratory (GEFARL), all of the donated skeletal remains are curated, photographed, and housed for later research. These housed remains are what make up the Texas State University Donated Skeletal Collection (TXSTDSC) and are the source of this study's sample collection.

Of the nearly 300 donated individuals in the collection that have been fully processed and curated, data was taken from a sample size of 100. In this sample, 50 white females and 50 white males were analyzed. Only individuals that identified themselves as “white” were used in this study. This restriction was deemed necessary because only 29 applicable individuals identified themselves as non-white. With so few, the inclusion of these individuals would have likely skewed the data. As an osteological research standard, only the left femora were measured in an effort to avoid sexual biases.

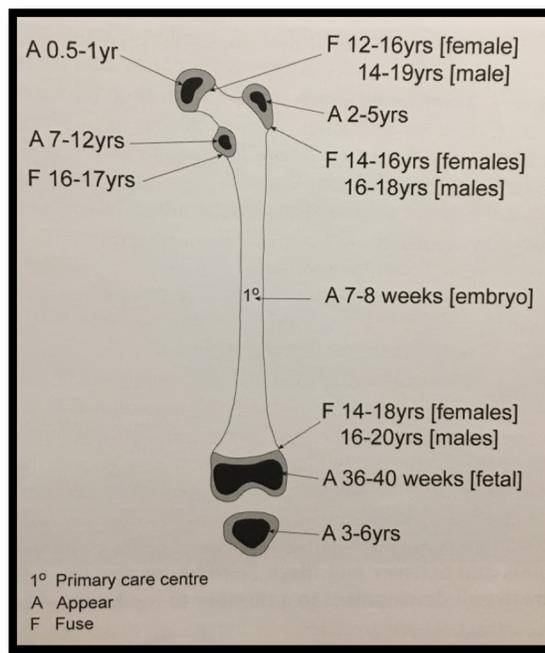


Figure 3.1. Sequence of epiphyseal fusion on the femur (Roberts, 2009).

Just as Albanese required variation through age-at-death and year of birth, the individuals selected for the current study ranged from 20 to 94 years old at the time of death. Individuals below the age of 20 were not used as the sequence of epiphyseal fusion for the trochanters and femoral head (Figure 3.1) would likely have impacted the measurements (Roberts, 2009).

Osteological Equipment

The only equipment used for this study was an osteometric board and a pair of digital sliding calipers (Figure 3.2). Inter-landmark and all other measurements were taken to the nearest millimeter. The osteometric board was used to help locate the GT landmark and also to take the maximum femur length measurements of both the left and right femurs (Figure 3.3). This was done for each individual to compare the maximum length of the left and right femur and distinguish any traumatic or pathological condition that might alter the measurements. For example, in the early stages of data collection, one female individual showed a difference of 13mm between the lengths of her left and right femur. Noticing this large margin, the ossa coxae and sacrum (pelvic girdle) were rearticulated to look for anomalies that would explain the difference in femoral length. The result showed that the woman had a condition that caused her pelvic girdle to be misaligned. This shift in alignment affected the length of the femur and the angles of the femoral necks, and resulted in that individual being deemed unviable. Conclusively, any individual whose left and right femur lengths differed by more than eight millimeters was omitted from the current validation study.



Figure 3.3. The maximum femur length being taken using an osteometric board.

Landmark Interpretations

Before data collection began, a considerable amount of work went into the interpretation of Albanese's landmark definitions which, once put to practice, were found to be worded rather ambiguously. For the current study, the GT landmark was established using both an osteometric board and a pair of digital sliding calipers. Placing the proximal femur on the osteometric board in anatomical position (Figure 3.4), as well as using visual assessment (Figure 3.5), the "most lateral apex on the greater trochanter" (p.1284) was identified and marked. The LT landmark was entirely established using visual assessment. Facing the flat oval surface of the lesser trochanter straight on, a mark was placed directly on the superior margin (Figure 3.6). This mark was cross-checked by turning the femur horizontally and observing it from an inferior-medial angle (Figure 3.7). The mark at the superior margin had to coincide with the "most proximal point on the dense compact bone around the base" in order to be established as the LT landmark. Lastly, the FC landmark was the easiest to distinguish and was done so by viewing the

femoral head directly and marking the superior margin of the fovea capitis. Although, the mark was not entirely uniform in order to avoid areas of lipping and depressions (Figure 3.8), the FC landmark proved to be fairly straight-forward (Albanese, 2008).

Figure 3.4. Locating the GT landmark by using an osteometric board.



Figure 3.6. The LT landmark marking the superior margin of the less trochanter.

RESULTS

Final Results

After all necessary measurements were collected from the current study's donated sample, the raw data was analyzed and interpreted. Of the 100 donated individuals, only eleven were misallocated as the incorrect sex resulting in an allocation accuracy rate of 89%. Out of these eleven individuals, three were male and eight were female and all of them ranged in age from 53 to 91 years old at the time of death. A breakdown of individuals assessed by sex, age, and allocation accuracy can be found in Table 4.1.

Age Range	FEMALES			MALES			TOTAL		
	Assessed	Correct	%	Assessed	Correct	%	Assessed	Correct	%
20 - 29	1	1	100	2	2	100	3	3	100
30 - 39	1	1	100	3	3	100	4	4	100
40 - 49	5	5	100	3	3	100	8	8	100
50 - 59	12	10	83.3	12	10	83.3	24	20	83.3
60 - 69	14	13	92.9	13	13	100	27	26	96.3
70 - 79	8	7	87.5	9	9	100	17	16	94.1
80 - 89	6	3	50	7	6	85.7	13	9	69.2
90 - 99	3	2	66.7	1	1	100	4	3	75
TOTAL	50	42	84	50	47	94	100	89	89
Allocation Accuracy	84%			94%			89%		

Table 4.1. Final data assesses individuals by age, sex, and allocation accuracy.

Intra-Observer Error Test

Once the initial stage of data collection had been completed, a group of 20 individuals were randomly selected from the current sample ($n = 100$) and were measured again in an effort to establish an intra-observer average error in millimeters and percentage. The purpose of any intra-observer error test is to determine the consistency with which a researcher collects their data. Hence, the lower the average error in millimeters and percentage, the more accurate and uniform they were at collecting data. Table 4.2 denotes both the average error in millimeters (mm) and percentage (%) for both the current study and Albanese's original study. These error rates were calculated using the three main landmark measurements (GT to LT, GT to FC, and LT to FC) as well as the femoral head diameter (FHD) measurement from the current study.

Study	Current Validation Study				Albanese (2008)			
	GT - FC	GT - LT	LT - FC	FHD	GT - FC	GT - LT	LT - FC	FHD
Error (mm)	0.35	0.75	0.55	0.25	0.15	0.95	1.2	n/a
Error (%)	0.37	1.35	0.80	0.52	0.16	1.99	1.7	n/a

Table 4.2. Intra-Observer Error Statistics and Comparison.

DISCUSSION

Data Analysis

As stated above, the current validation study resulted in an allocation accuracy rate of 89% with only 11 individuals (3 males; 8 females) from the sample ($n = 100$) being incorrectly assigned to the wrong sex. The age of these individuals, ranging from 53 to 91 years old at the time of death, is significant in regards to the effect that age has on sex estimation. Possible factors contributing to the misallocation of those eleven individuals strongly correspond to the age-at-death of each individual. A trend that can be seen in Table 4.1, shows that the allocation accuracy percentage of both sexes only begins to drop between the ages of 50 and 59. This age group coincides with both the beginning of menopause in females as well as general skeletal decline in both genders. These hormonal and morphological changes have a direct impact on bone's sexually dimorphic traits. As a person ages, bone loses density and becomes more fragile. This bone loss can be viewed on the skeleton often through pathologies, trauma, and the requirements of surgical modifications (Figure 5.1 and 5.2).

Misallocated Individuals

Of the eight females (aged 53 to 91) that were misallocated, two had no pathology or trauma upon donation; four exhibited some form of spinal surgery, injury or fusion; one individual had replacement surgery on both knee joints (see Figure 5.2); and the last female had bone cancer of the hip. Spinal conditions, whether it be fusion, surgery, or injury, can have a significant effect on the pelvic girdle which in turn affects the femoral neck. The double knee replacement on one of the females likely would not have affected the femoral neck angle but could have been a result of osteoporosis and eburnation of the joint.

Of the three males (aged 53 to 87) that were misallocated, two claimed no pathology or trauma upon donation; and the last male denoted a fracture to his right leg that eventually healed. Records did not specify which bone of the leg was broken (tibia, fibula, or femur), but this injury may have skewed the allocation of the individual.

Intra-Observer Error Test Analysis

In Albanese's original study, he and his colleagues found that "when determining sex using metric approaches, misallocation is possible when measurement error exceeds c. 2-2.5%" (Albanese 2008:1285, after Albanese, 2003). The intra-observer error test that was conducted on the original study resulted in rates of the lowest mean error 0.16% (0.15mm) for the GT to FC measurement and the highest mean error 1.99% (0.95mm) on the GT to LT inter-landmark measurement. Albanese notes that their "intra-observer values for all three measurements" are below this threshold (see Table 4.2) (Albanese, 2003).

The intra-observer error test sample ($n = 20$) conducted on the current study also resulted in values that stayed safely below Albanese's threshold of 2-2.5% error. Similarly to Albanese's error test, the GT to LT inter-landmark measurement had the highest mean error and the GT to FC measurement, along with the isolated FHD measurement, had the lowest mean error.

The intra-observer error results of the current validation study not only remained below the misallocation threshold, but were also significantly lower than the original study's average error rate. This signifies that the current study's interpretation of the original landmark definitions and measurements were taken with accuracy and, more importantly, consistency.

Landmark Definitions Revisited

The three newly defined landmarks from Albanese's original study, although able to provide a high accuracy rate, were found to be ambiguously worded. The vague definitions of these landmarks force other researchers conducting similar validation studies to subject the method to a significant amount of interpretation. The omission of clear and detailed definitions is likely an attributing factor to the margin between the original study's accuracy rate of 95-97% and the current validation study's rate of 89%.

CONCLUSION

The purpose of this study was to apply Albanese's metric sex estimation method to a sample of identified individuals from the Texas State University Donated Skeletal Collection ($n = 100$; 50 females, 50 males) in order to validate or negate his method as a universally applicable approach. Taking into account the allocation accuracy rates as well as the intra-observer error percentage, it can be stated that the Albanese (2008) method of sex estimation holds potential as a universally applicable approach when the pubic bone or os coxae are unavailable. However, the method would strongly benefit from more concrete landmark definitions in order to correct and account for the differences in allocation accuracy percentages. This revision of landmark definitions, as well as further validation studies in other geographical regions, are required if this method is to be universally accepted.

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