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Transgender identification: gender and sex estimation in forensic casework

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Thesis

TRANSGENDER IDENTIFICATION:

GENDER AND SEX ESTIMATION IN FORENSIC CASEWORK

by

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ABSTRACT

Societal knowledge about issues faced by transgender and gender-diverse individuals has increased; however, the field of forensic anthropology has struggled to keep abreast with ever-evolving perceptions of sex and gender. Specifically, forensic anthropology lacks a codified approach to identifying transgender decedents due to binary assigned sex estimation methods that lack a biocultural approach and divergent perspectives on the role of gender. Using an anonymous survey of forensic anthropologists (n=130), the present research explores the processes of biological profile deployment in forensic casework, along with current perspectives on sex and gender and associated methods, language, and reporting. Regarding the role of gender in casework, most (51.5%) believe identifying gender improves the odds of identification, and many (40.8%) would include such information in a forensic anthropological report, with 59.0% uncertain about testifying to gender. Additionally, 55.4% of respondents report that skeletal sex estimation does not represent a decedent's gender, and most would cite signs of gender-affirming surgery (59.2%) or material evidence (47.7%) for use in reporting gender despite uncertainties about Daubert compliance (38.5%). Regarding terminology, respondents prefer "sex" (52.3%) or "biological sex" (34.6%) over other arguably more apt descriptors such as "assigned sex" (19.2%). While forensic anthropologists acknowledge the need for clarity in gender-inclusive definitions and

mostly maintain that skeletal sex is not equivalent to gender, further studies for a truly biocultural forensic anthropology should focus on the role of sequential evidentiary unmasking and material evidence alongside assigned skeletal sex analyses.

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LIST OF ABBREVIATIONS

AAFS .... American Academy of Forensic Sciences

AMAB .... Assigned Male at Birth

CSH .... Cross-sex Hormone Therapy

FA .... Forensic Anthropology

FDB .... Forensic Data Bank

FFS .... Facial Feminization Surgery

FMS .... Facial Masculinization Surgery

GAHT .... Gender-affirming Hormone Treatment

GAT(S) .... Gender-affirming Treatment(s)

GnRHa .... Gonadotropin-releasing hormone agonist

GnRH .... Gonadotropin-releasing Hormone

HRC .... Human Rights Campaign

HT .... Hormone Therapy

ISNA .... Intersex Society of North America

LGBTQIA .... lesbian, gay, bisexual, transgender, queer and/or questioning, intersex, asexual/aromantic/agender.

OSAC .... Organization of Scientific Area Committees for Forensic Science

Pf .... Probability Female

Pm .... Probability Male

PMI .... Postmortem interval

TDTF .... Trans Doe Task Force

SOC..Standards of Care

SWGANTH..................................Scientific Working Group for Forensic Anthropology

WPATH ....World Professional Association for Transgender Health

INTRODUCTION

The year 2021 was one of the deadliest years on record for transgender and non-binary individuals, and 2022 had up to 38 known transgender-involved fatalities (Human Rights Campaign, 2022a; 2022b). Although this record represents a fraction of the entire transgender and LGBTQIA community, they are at higher risk of hate crimes, with approximately 20% of hate crimes being motivated by gender and 24% motivated by sexual orientation during the 2010s (Kena and Thompson, 2021:5; Flores *et al.*, 2021). As of 2017-2018, transgender individuals experienced 86.2 victimizations per 1000 people, while cis-gender individuals experienced 21.7 victimizations per 1000 persons (Flores *et al.*, 2021). The increasing number of transgender and non-binary individuals involved in violent crimes means there will be an increasing proportion of unidentified decedents from these communities within the forensic context. The present knowledge within the forensic field in regard to transgender identification is lacking, particularly in methods of identifying gender identity via sex estimations and material context (Bartholdy, 2020; Tallman *et al.*, 2022; Schall *et al.*, 2020). Some studies have shown that while gender is not necessarily involved in forensic anthropological identifications, several practitioners acknowledge the need for identifying gender in these contexts (Tallman *et al.*, 2022). The present research aims to explore the perspectives of sex and gender in forensic anthropology, specifically as it pertains to transgender and intersex individuals, while also assessing the current knowledge of gender-affirming treatments and means of identifying these individuals.

Utilizing anonymous survey data compiled over three months (June 13th, 2022, through September 16th, 2022), this study contextualized the relevance of gender, gender identity, and sex identity in forensic contexts. By analyzing and contextualizing the data from this survey, we also highlight the significance of intersex and transgender individuals in the field of forensics, its potential relevance in the courtrooms, and the lacking knowledge and the lacking resources available and/or those known to practitioners available for aiding identifications was highlighted. Throughout the survey, respondents maintained that sex is something that can be assessed and estimated via the skeleton, while gender, including transgender and intersex, cannot be estimated via the skeleton alone. Furthermore, when confronted with suggestive material context (sequential unmasking) contrary to a skeletal sex estimation provided by scientific methods (*FORDISC 3.1* [Jantz and Ousley, 2005]; Klales *et al.*, 2012; Walker, 2008), most respondents are hesitant to include such information in their forensic anthropological reports but would mention in their notes. Furthermore, when faced with supportive material context regarding the sex estimation methods, many forensic anthropologists showed selective bias to the sex estimation methods.

Regarding gender-affirming treatments, there is some recognition within the field that some signs of may show within the facial skeleton via facial feminization surgery (FFS) and facial masculinization surgery (FMS); however, the evidence is limited and forensic anthropologists may only be able to say that the individual may not have identified as the sex they were born (Buchanon, 2014; Tallman *et al.*, 2022; Schall *et al.*, 2020). To be explicit facial feminization surgery and masculinization surgery are two of the gender-affirming surgeries available to non-binary individuals which change both skeletal and non-skeletal traits of the face. Overall, forensic anthropologists acknowledge the lack of materials able to be studied for developing methods to discern if an individual is intersex, transgender, or cisgender. This research, while highlighting the lacking information, suggests a biocultural approach as a means of identifying and reporting potential transgender and intersex individuals using inclusive language, methods, and suggestions derived from this survey, Tallman *et al.* (2021), Bartholdy (2020), and Schall *et al.* (2020).

PREVIOUS RESEARCH

Overview

Transgender studies in forensic casework and the medico-legal systems are relatively limited. However, efforts have been made to expand sex estimations beyond the binary of male and female. Furthermore, there has also been a growing interest in expanding the current knowledge on the effects of gender-affirming drugs, hormones, and surgical therapies, used for gender-affirming treatments (GAT) within the field (Buchanan, 2014; Schall *et al.*, 2020; Kincer, 2020; Márquez-Grant *et al.*, 2022). There has been some, but minimal, research on the effects of gender-affirming surgeries (GAS) on sex estimation methods, specifically metric methods (Schall *et al.*, 2020; Buchanon, 2014). Ultimately, for both GAS and gender-affirming hormone treatments (GAHT), there is very limited data, and the number of individuals pursuing these treatments is also limited, which limits the ability to establish a solid means of identifying non-binary individuals (James *et al.*, 2015). Furthermore, there is a lack of support for utilizing material context as a means for identification purposes; however, when applied for identifying immigrants along the U.S.-Mexico border, the utility of these items is appreciated (Anderson, 2008; Birkby 2008; Hess and Winston, 2014; Martínez *et al.*, 2014).

Generally, in the medicolegal system, forensic practitioners make estimations regarding the assigned sex at birth of an individual through metric and nonmetric traits of the skeleton utilizing several methods (Buikstra and Ubelaker, 1994; Walker, 2005, 2008; Klales *et al*., 2012; Spradley and Jantz, 2011; Jantz and Ousley, 2005). While these methods provide seemingly adequate results, these methods can be subjective to the observer's interpretations and experiences; other methods may provide erroneous results because they are population-specific or lack sufficient data to be universally accurate for unknown decedents (Walker 2008; Hartley *et al.*, 2021; Buikstra and Ubelaker 1994). Nevertheless, many practitioners employ these methods for sex estimation to focus on the nuances between the extremes of the skeletal sex characteristics derived from an individual's chromosomal sex. Out of all potential methods, *FORDISC 3.1*, a cranial and postcranial metric analyses (Jantz and Ousley, 2005) using defined measurements in Langley *et al.*, (2016); Walker (2008), a nonmetric cranial analysis, Klales *et al.*, (2012), a nonmetric pelvis analysis; and Buikstra and Ubelaker (1994), which has several metric and nonmetric methods considered "standard," are a few established methods that are regularly used in the field. The following will provide brief overviews of the metric and nonmetric analyses, the transgender and non-binary community, gender identity and gender dysphoria, methods of gender-affirming treatments, and lastly, previous studies within forensic anthropology.

Metric and Nonmetric Analyses

Generally, forensic practitioners utilize two main approaches with varying degrees of success when estimating the sex of an individual, that are broadly categorized as metric and nonmetric techniques. Additionally, some of these techniques require that stature, age, and even population or ancestry affiliation are known to provide accurate results (Albanese, 2006; Klales *et al.*, 2022). While estimating ancestry and stature may be pertinent to accurate sex estimation, they are not the focus of this work and will briefly be mentioned. More often than not, metric methods encompass analyzing inter-landmark distances from cranial and postcranial landmarks (Jantz and Ousley, 2005; Langley *et al.*, 2016; Giles and Elliot, 1963, Buikstra and Ubelaker, 1994). Additionally, a comprehensive metric assessment requires a vast background in osteology, human anatomy, knowledge of osteological landmarks, and established measurements. In addition to these measurements, metric methods may utilize statistical analyses, such as discriminant function analyses (DFA), logistic regression (logR), and cross-tabulations, to improve their sex estimations (Ousley and Jantz, 2005; 2013).

Contrary to metric analyses, nonmetric techniques utilize the general shape and size of specific portions on the skeletal elements to estimate the sex of an individual, which may also capture the generalized changes and differences between populations and individuals. Furthermore, nonmetric analyses are seemingly more subjective to an observer's visual opinion and experiences; however, nonmetric analyses benefit the observer with a quick, qualitative analysis that provides reasonable sex estimations with generally high (>80%) correct classification ratings. Additionally, some nonmetric methods use discriminant function analyses, or stepwise classifications, to provide statistical analyses to their estimations (Walker, 2005, 2008; Klales *et al.* 2012; Stevenson 2009; Murphy and Garvin, 2009; Patterson and Tallman, 2019; Tallman, 2019). In both metric and nonmetric methods, statistical analyses provide comparable results that, when applied within the judicial system, can be replicated and tested, providing compliance with the Daubert standard upheld in the federal court system (“Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993)”).

One of the statistical approaches to conducting sex estimations are discriminant function analyses which can be attributed to the work of R. A. Fisher, Giles, and Elliot, who revolutionized the use of discriminant function equations for sex estimations (Giles and Elliot, 1968; Albanese, 2006). They claimed that while visual methods allow for interpretation and observational opinions, metric methods with discriminatory analyses "will assign an individual to one group based on the available information" (Giles and Elliot, 1968:53). In their work, Giles and Elliot (1964) utilized nine cranial measurements of 408 known sex individuals; of which 21 combinations were used to create several discriminant function equations with an accuracy ranging from 82 to 89% (Giles and Elliot, 1964: 67). In short, this method uses measurements of skeletal traits to discern between groups or populations, allowing for best guess conclusions. Although this approach was revolutionary in identifying unknown decedents, this approach forces an unknown decedent into the sex binary of male and female; and its samples, though abundant, are population specific, limiting its utility amongst all populations (Albanese, 2006). However, Giles and Elliot do conclude that if used, the "bimodality with which the scores distribute themselves" will provide an appropriate dividing point (Giles and Elliot, 1964:67)

Similar to other metric methods using discriminant function analysis, *FORDISC 3.1* uses known skeletal samples from the Forensic Data Bank (FDB) for its comparative analysis (Jantz and Ousley, 2005; Ousley and Jantz, 2012). The FDB, developed in the 1980s-1990s, compiles data on place of birth, occupation, stature, weight, and cranial and postcranial measurements from identified forensic cases providing several points of comparison (Ousley and Jantz, 2013: 98). In totality, the discriminant function analyses used in *FORDISC 3.1* are multivariate statistical classifications that utilize groups or samples of known traits, the FDB, and compare a single variable or subject, the unknown decedent, to those groups to determine if the subject fit or closely align. A benefit of *FORDISC 3.1* is that it calculates classification functions based on any combination of measurements so that if skeletal remains are incomplete, estimating sex and ancestry may still be possible (Ousley and Jantz, 2013).

In *FORDISC 3.1*, a combination of up to 57 postcranial and 27 cranial skeletal measurements may be utilized for sex estimations. Furthermore, *FORDISC 3.1* uses thirteen populations consisting of American Blacks (224 males, 137 females), American Indians (59 males, 32 females), American Whites (737 males, 454 females), Chinese males (80), Guatemalans males (83), Hispanics (281 males, 74 females), Japanese (84 males, 58 females), Vietnamese males (51), and two 19th century groups American Blacks and Whites (174 males, 150 females) (Jantz and Ousley 2005). Overall, the *FORDISC 3.*1 populations are predominately male (n= 1773 including 19th-century populations) with only 873 women. When conducting these estimations, the available measurements are inputted into the program, which are then compared to the thirteen populations or suspected populations. The cranial outputs provide practitioners with a list of closest populations with population affinity followed by the male or female group of that population, while the postcranial output provides practitioners with male/female conclusions using Black and White populations.

When conducting a FORDISC assessment, practitioners should consider the various pathological conditions present in the skeleton, as well as other hindering factors. Additionally, some of the populations were assigned race and sex using soft tissue structure rather than skeletal. These soft tissue structures may not reflect the individual identities accurately. Ultimately, practitioners should consider and include posterior probabilities, typicality probabilities, pathologies, taphonomic damage, and other observations to assess the true likelihood of an individual belonging to a population using *FORDISC 3.1*.

Other metric analyses which can produce an estimation of the sex of individuals with varying degrees of success include those found in Albanese, Eklics, and Tuck (2008), France (1998), Holland (1991), Spradley and Jantz (2011), Spradley *et al.* (2015), Stewart (1979), Tise (2010), and Tise *et al.* (2013); however, they fail to extend final conclusions beyond the binary sexes. There is or has not been any metric or nonmetric method that can accurately describe the sex of an unknown individual in all cases due to human variations. In the work of Stewart (1979), they noted that despite any number of attributes applied [in discriminant functions], there will always be a small fraction of the unknown sample, which to some regard, is an absolute truth (Stewart, 1979). For this reason, a discussion of the methods is necessary to enhance our understanding of the variability that occurs in the human population regarding the sex of humans.

Since there is considerable variability in estimating sex with postcranial and cranial elements, Spradley and Jantz (2011) analyzed and tested the hypothesis that the skull was the second-best estimator for sex estimation while measuring the success of other postcranial skeletal elements in sex estimation. During this, they conducted an analysis of variance (ANOVA) to not only compare the relationship of ancestry and sex between American Whites and American Blacks but to discern if classification functions for sex estimation should be separate or joined for these populations. They produced results like most methods, which have an indeterminate category; specifically, any values from the discriminant function analyses that are equivalent to the sectioning points are indeterminant (Spradley and Jantz, 2011).

Ultimately, the ANOVA analysis showed significant differences between the skeletal elements and the populations, which encouraged the development and use of different classification functions, each with a sectioning point between males and females. The only skeletal element which showed an “interaction” of ancestry and sex between the populations is the radius, while the major differences between these ancestries and sex occurred in the cranium and mandible (Spradley and Jantz, 2011). These results likely occurred because one population displayed larger skeletal elements than the other due to variables such as environment, genetics, sex, and nutrition. This result from their study undoubtedly provides us reason to emphasize the significance in skeletal variation amongst individuals. Ultimately, the element with the highest classification for American Blacks is the humerus, while the radius provides the best for American Whites on an individual population basis (Spradley and Jantz, 2011). Since these classification functions use confirmed cases from the FDB, it is with reasonable certainty that they are accurate when applied for individuals within those populations. One limitation, which arose as a fault of the FDB, is the lacking information for Hispanic and American Indian populations, as these populations lack sufficient population size to provide a substantial evaluation. If sufficient sample data existed for all of the populations in the FDB, a “global” population classification function could be created like the one attempted by Kenyhercz *et al.* (2017). However, it is likely that a study producing a global population classification function would likely utilize a sectioning point method, which limits the observer to really two conclusions, “male” and “female,” and limits the observations to a set number of metric measurements when the entire skeleton should be observed.

While *FORDISC 3.1* and some other metric methods allow forensic practitioners to conduct complex analyses of the skeleton, the cranium, individual postcranial elements, or any combination thereof, nonmetric methods can provide sex estimates using the cranium or singular postcranial elements, with relatively high-classifications and speedy results. Specifically, two popular skeletal elements utilized in nonmetrics are the cranium and the pelvis, as these elements tend to be sexually dimorphic, show population (phenotypic) traits, and are generally presenting forensic context (Garvin *et al.*, 2014; Klales *et al.*, 2012; Klales *et al.*, 2020; Klales 2020; Phenice, 1969; Spradley and Jantz,, 2011; Schall *et al.*, 2020; Ubelaker and Buikstra, 1994; Walker, 2005; 2008). As shown by previous studies, the pelvis and several other postcranial elements are superior in their abilities to estimate the sex of an individual than the cranium alone (Geller, 2018; Patterson and Tallman, 2019; Pokines *et al.*, 2022; Spradley and Jantz, 2011). Arguably, these nonmetric methods highlight the patterned sexual dimorphism which occurs in many populations, primarily highlighting the male and female skeletal characteristics. For example, Klales *et al.* (2012) expanded upon Phenice's (1969) method for pelvis characteristics expanding the scale from three to five and including logistic regressions equations, with the end results of "male," "female," and "ambiguous/indeterminant."

One of the key post-cranial skeletal elements for sex estimations is the pelvis, with the sex differences in pelvis morphology having been discussed in both forensic and bioarcheological approaches for skeletal analysis for some time (Phenice, 1969; Krogman and İşcan,1986). Some of the more notable traits of the pelvis include the breath of the sciatic notch, the presence or lack of a ventral arc, and an absence or presence of the sub-pubic concavity (Buikstra and Ubelaker, 1994;; Klales *et al.*, 2012; Klales 2020; Krogman and İşcan, 1986; Phenice, 1969; Rogers and Saunders, 1994). Using three of these skeletal features of the pelvis, Phenice (1969) developed a visual method for estimating sex with an accuracy rating of 96% for both sexes (Phenice, 1969). Although using this method is relatively accurate for the population it was derived, it has been heavily utilized by anthropologists and subsequently revised and expanded by Klales *et al.* (2012) to allow for some ambiguity while maintaining a male or female sex estimation (Klales *et al.*, 2012).

Phenice's (1969) method uses three criteria which, when compared and selected, indicates the individual's sex, with the understanding that even with two ambiguous results, one feature will "obviously indi[cate] male or female" (Phenice, 1969:300). These criteria considered are the ventral arc, subpubic concavity, and the medial aspect of the ischio-pubic ramus, with a heavy reliance on the latter of the traits when the first two traits are absent. The author noted that some variability is to be expected between the sexes, but the ultimate conclusions of this analysis are “male” and “female.” In Buikstra and Ubelaker (1994), when presenting this method as a standard for data collection, the authors expanded the conclusions of the three criteria to be “Unobservable,” “Female,” “Ambiguous,” and “Male.” Using these scored criteria, forensic anthropologists are then able to provide a conclusion as to the estimated sex of the decedent.

Several validation studies have been conducted on Phenice’s method, with variability ranging between the high 50s to 90%s. For example, Kelley’s validation study (1978) produced a 90% accuracy rating, MacLaughlin and Bruce (1990) procured a 59-83% accuracy rate, and Lovell (1989) produced an 83% accuracy rating. Kelley’s analysis focused on 362 innominate Native American; they found a lower accuracy and that females tend to have more indeterminate scorings (Kelley, 1978). Lovell’s study supports Kelley’s critique in that females produced more indeterminate scorings. However, their sample consisted of 36 “presumed white individuals" from medical school cadavers. Using students and one professional, their study consisted of an accuracy rating of 83%, with the notion that age differences in sample populations may be the reason for the lower accuracy (Lovell, 1989).

Furthermore, MacLaughlin and Bruce (1990) procured a lower accuracy rating than most other validation studies, using 273 skeletons of documented sex. These individuals are of English ancestry, Dutch ancestry, and Scottish ancestry; the English sample produced an 83% accuracy rating, and 59% for the Scottish sample, while the Dutch sample produced an accuracy rating of 68%. These accuracy ratings are lower than

Phenice (1969) and are likely a result of the methodology and population differences during the study. Specifically, if an os pubis resulted in two ambiguous traits, then the individual was classified as ambiguous rather than considering the medial aspect of the ischiopubic ramus; this disregards Phenice’s statement that even with two ambiguous traits, one will likely aid in estimating the sex of an individual. While disregarding Phenice (1969), MacLaughlin and Bruce’s approach considers sex as a continuous variable rather than categorical male or female. In somewhat opposition to the continuous approach, McFadden and Oxenham (2016) revisited MacLaughlin and Bruce’s approach and removed the ambiguous results when reevaluating the innominates. Upon doing this, accuracy results from MacLaughlin and Bruce increased to a range of 83% to 95%. From these validation studies, it appears that when approaching sex estimations from a categorical standpoint, this method is reasonably accurate in differentiating male and female pelves at the extremes.

One additional study by Rogers and Saunders (1994) evaluated the three traits of the pelvis and their accuracy in sex estimations. In their evaluation, they produced a similar ranking of traits to Phenice (1969), with the ventral arc producing accuracy of 86.9% and the ischiopubic ramus producing results of 80% accuracy (Rogers and Saunders, 1994). Additionally, when the three traits are combined in their study, they produced an accuracy of 88% which is 8% lower than Phenice’s original study (Rogers and Saunders, 1994: 1054). Overall, these studies and critiques of Phenice's (1969) work highlight two problems. First, population and age are significant in conducting sex estimations using the pelvis; and second, when considering the ambiguous nature of the sexes, or those that may identify as intersex or non-binary, accuracy ratings drop significantly.

To date, the most significant update to the method proposed by Phenice (1969) was by Klales *et al.* (2012), who compared, analyzed, and modified the three trait criteria (descriptions) using 310 left os coxae from the Hamann-Todd Human Osteological Collection (19th century) and the W.M. Bass Donated Skeletal Collection at the University of Tennessee, Knoxville (20th century); and logistic regression statistical analyses. The sample (310) comprised 173 males and 137 females, and Black, White, Mexican, Asian, Hispanic, and Japanese individuals. Klales *et al.* (2012) then expanded the three-point scale of Phenice's method to a five-point system and applied several regression analyses, which produced accuracies up to 86.2% for several traits of the os coxae (F=98.0%, M=74.4%) (Klales *et al.*, 2012). The subpubic contour provided the best indicator for males u (82.8%), while the ventral arc provided the best indicator for females (96.4%), the best trait for assessing a pelvis of unknown sex is the ventral arc using logistic regression, providing an 88.5% accuracy. The best classification results with the lowest sex bias are produced when all three traits of the pelvis are combined. A low sex bias occurs when there is little overlap in trait expressions between the groups. For instance, the high sex bias for the ventral arc would suggest that this trait is seen within both male and female pelves, and when used, a linear regression model will likely classify an individual with that trait to the majority population despite the ventral arc providing the best classification accuracy for separating the sexes (Klales *et al.*, 2012:111).

Though sex bias indicates that a specific trait will categorically place an individual into one group, or another based on the sample population, it highlights the issue encompassing most sexing methods. Unlike stature, perceived and analyzed as a continuous variable, sex is often perceived as a categorical dichotomy: male or female, with skeletal traits representing each. When there is an overlap of these traits, or an individual cannot be discerned as being one of the two sexes, the regression analysis assumes that the individual is of the larger sample size rather than a third category: ambiguous. This result of this assumption is a higher classification accuracy for the logistic regression equation built on the sample population as well as an increased rate of misclassification of individuals.

There are several avenues which one might take to avoid such issues, such as synthetic minority oversample, and random oversampling which attempts to create equal sample populations which the regression equations can then be built (Rahim *et al.*, 2019). However, when conducting such techniques, one merely creates a false sample based on actual data, rather than actual samples which may influence the statistical results as well as any products in terms of estimating the sex of an individual. For instance, if random oversampling is conducted, it will create a larger sample size of the minority in the sample but may also create a scenario of overfitting for the model (Brownlee, 2020). If under-sampling is conducted, the algorithm may delete valuable data from the sample of the majority (Brownlee, 2020). Ultimately, the Klales *et al.* (2012) method provides one of the best contemporary methods using the three pelvic traits with a low sex bias despite conclusions being "male," "female," and "ambiguous" with associated male and female probabilities.

In a similar manner to Klales *et al.* (2012), Walker (2008) proposed advancements on Buikstra and Ubelaker's method (1994) for estimating the sex of individuals, which compared the robusticity of five cranial traits. These five cranial traits include the supra-orbital margin, nuchal crest, mastoid process, supra-orbital ridge/glabella, and mental eminence (Walker, 2008:41). The method highlighted in Buikstra and Ubelaker's (1994) lacks the quantitative means that Daubert standards encourage and is subjective to the observer's experiences and opinions. Walker (2008) extended the use of these five cranial traits by analyzing 304 European American skulls and 156 Native American skulls from the Haman-Todd collection and the Saint Bride's church in London of the latter half of the 18^{th} and 19^{th} centuries (Walker, 2008). Using several discriminant function analyses, this method can estimate the sex of an individual with high correct classification rates. A correct classification rate of 88% with a low sex bias can be performed when applying logistic regression discriminant analyses to all five cranial traits, with mental eminence proving significant (Walker, 2008). One dilemma noted by Walker (2008) and others is that while correct classification rates are high, this approach merely provides a method for estimating the sex of European Americans and Native Americans (Walker, 2008; Garvin *et al.*, 2014). That is not to say this method is incorrect when applied to individuals outside of these populations, but the method was developed on and should be limited to these groups.

For example, in some Asian populations, individuals may present characteristics that fall under classifications opposite of the individual's sex when using methods for European Americans (Garvin, 2012: 240; Tallman and Go, 2018). This result is because some Asian populations appear morphologically different than European Americans and Native Americans because of genetics, environment, nutrition, and general development. Some Asian populations, such as Japanese individuals, show less sexual dimorphism within a homogenous population, which would suggest specific sexing methods for that population or an in-depth analysis of the effects of morphological differences within a global population (Tallman and Go, 2018). However, the ultimate conclusions of Walker (2008) are “male,” “female,” and “ambiguous” with associated male and female probabilities. Furthermore, like other sexing methods, it highlights the extremes of the two sexes, with three examples of the variation between the two.

Various sex estimation methods highlight skeletal differences, termed sexual dimorphism, with varying degrees of prominence. These differences create a "bimodal continuum" of sex, yet many methods categorize individuals strictly as "male," "female," or "ambiguous" (Blackless et al., 2000; Stewart, 1979). For instance, when graphing the metric measurements of the scapula, humerus, and femoral head diameters of males and females, a bimodal distribution emerges, with two local maximums representing females (lower measurement) and males (higher measurement). The global minimum, where the measurements overlap, indicates the variability between the two major sex groups (Stewart, 1979:101). In the context of binary sex estimations, the local minimum between these peaks represents the overlap or individuals without distinct male or female skeletal characteristics, are often termed "ambiguous" or "indeterminant." When independently graphed for males and females, clear modes are visible, following a parametric distribution. In other methods, observers may use sectioning points like "if it measures ≥ 45 mm, it is a male to a practical certainty" (Stewart, 1979: 99) to define male and female sexes. However, these sectioning points, like many other sex estimation methods, focus on extremes and may overlook the variability between the two local maximums.

Lastly, the Scientific Working Group for Forensic Anthropology suggests that applying methods for large or more robust groups to smaller, more gracile populations may produce erroneous results (SWGANTH, 2010:1). Forensic practitioners should employ population-specific analyses when the decedent belongs to a known population, while those of an unknown population should be analyzed using methods for global or heterogeneous populations (SWGANTH, 2010). Though generalized population methods appear to have a great deal of variability in accuracy and sex bias, the generalized methods may be of more use than population-specific methods in transgender and non-binary identification.

The transgender community, documentation, and the medico-legal system

Transgender individuals worldwide, including an estimated two million in the United States alone, have a personal identity and gender that differs from their assigned sex at birth (Human Rights Campaign, 2020a). Transwomen are estimated at 1:30,000, and transmen at 1:100,000, but these figures could be underestimated (Counting Trans Populations | Division of Prevention Science, 2023). The Trans Doe Task Force defines transgender as relating to individuals whose personal identity and gender do not align with their assigned sex at birth (Redgrave and Redgrave, 2022). Associated terminology with transgender includes "personal/gender identity," "gender expression," and "opposite or different from assigned sex at birth" (Merriam-Webster, 2022; dictionary.com, 2022; oxfordlearnersdictionary.com, 2022; webmd.com, 2022).

Like other minority communities, several individuals within the LGBTQIA community face hardships and discrimination, which appear as a lack of legal protections, poverty, and stigma, and many face an increased risk of violence (Human Rights Campaign, 2020a; 2020b, Kincer, 2020; James *et al.*, 2016). Transgender individuals, in particular, experience higher victimization rates compared to cisgender individuals, which is further compounded for those belonging to Black, Latino, and minority groups (Williams Institute at UCLA School of Law, 2020). This escalation of violence has led to increasing transgender deaths since 2013, as tracked by the Human Rights Campaign (HRC) (Human Rights Campaign, 2022B). In 2015 and 2016, at least 21 transgender individuals of color were killed because of fatal violence; in 2020, that number rose to 35, as of the most recent reporting by the HRC, 57 individuals have been killed due to fatal violence (Human Rights Campaign, 2015; 2016; 2020A; 2022B). However, it’s crucial to recognize that these statistics likely represent only a portion of all transgender deaths resulting from fatal violence in the United States. The underreporting of transgender deaths, coupled with the lack of acknowledgment, may be attributed to legal and medicolegal identifications. As the number of transgender and non-binary individuals involved in violent crimes increases, forensic anthropology has yet to fully define a method for identifying these individuals. Some work has been previously done

(Buchannan, 2014; Schall *et al.*, 2020; Tallman *et al.*, 2020).but the identification of these individuals may be largely dependent upon material and cultural context rather than skeletal traits.

The misidentification and misrepresentation of transgender and intersex individuals often resides in the formal identification provided by the U.S. government, U.S. medical system, the police, and the binary sexing methods employed in forensic work. Most transgender individuals lack the ability to change identifying documentation such as passports, driver's licenses, and social security records, while some states offer some ability to make changes to formal documentation (National Center for Transequality, 2022; Lambda Legal, 2022). Identification based on documents can be of great assistance, especially in facilitating the identification of next of kin, guiding investigators, and the overall ID. More specifically, gender-based identifications utilizing these documents can narrow search efforts in NamUs; consequently, the database has yet to update its system to be non-binary inclusive, and when the reporting party reports the assigned sex at birth rather than lived sex or gender, the information may be misleading. Overall, the misidentification of nonbinary individuals is a systemic issue arising from governmental, medical, law enforcement, and forensic practices.

The legal changing of documents, and recognition of transgender individuals within the United States, is often state-specific, and regulations are highly variable, though in most states, individuals can change the sex on their driver's license to their preferred sex or have it represented by the letter "X" (National Center for Transgender Equality, 2020). However, legal changes in birth certificates vary depending on the individual's state of transition and require several signatures from attending physicians and other medical administrators. For example, in Florida, several documents, including an affidavit from the attending surgeon, must be compiled for legal changes on birth certificates (Lambda Legal, 2018). Although changes to birth certificates occur, birth certificates are the least likely to be changed compared to other forms of documentation, with only 18% of the U.S. Trans Survey (USTS) respondents having a legal name change and 9% having gender updates on governmental documents (James *et al.*, 2016:9).

As of 2022, only seventeen states allow a change of gender markers on birth certificates; compared to 2014, only three states allowed changes of gender/sex on birth certificates; within those states, sex reassignment surgery is a requirement (Van Anders *et al.*, 2014; Migdon 2023). As of 2022, up to twenty-two states were allowing residents to update gender markers to "X" on driver's licenses. While there is a remarkable improvement in the facilitation of identification documentation changes, the legal maneuvering and cost of changing documentation can be detrimental to transgender individuals in two ways. In some instances, individuals often face harassment, are denied benefits, or are assaulted when presenting identification that does not necessarily match their presenting gender and sex (James *et al.*, 2016).

Many governing bodies, local and state legislation, prefer a medical licensed or surgical medical authority over an individual's lived experiences or therapist for legal changes in documentation and are only now beginning to accept these changes; and despite these changes, the judicial systems may take several more years to accept non-traditional biological sexes and non-conforming genders (van Anders *et al.*, 2014). For example, in NamUs, the National Missing and Unidentified Persons System, when searching reports and missing person files, they have “sex” as one of the criteria; however, the options for selection are “Male,” “Female,” “Unsure,” “Not Provided,” and “Other.” Although this may benefit the traditional sexes/genders or those whose sex and gender are unknown; it may cause “othering.” Othering, as defined by the Oxford Reference Dictionary, is a process whereby individuals and groups are treated and marked as different and inferior from the dominant social group (Griffin, 2017). If NamUs and other missing person systems could update the gender and sex categories to include Transmale and Transfemale, it may be better suited for assisting the public, police, and governmental agencies when criteria or categories of sex include Transmale, Transfemale, and even intersex. Additionally, documenting specific sex and gender is essential, as DNA matching alone may not suffice, especially if the individual or their family is not in CODIS or another DNA database, and when only biological sex is available, it does not encompass gender or lived experiences (Federal Bureau of Investigation, 2023).

Additionally, as documentation fails to accurately reflect the transgender and non-binary communities, forensic anthropologists may also employ the use of material context to aid in the identification of sex and gender (Tallman *et al.*, 2022). While employing material context may influence skeletal sex estimations, in some instances, the “bias” is beneficial for making a conclusion as to population or community belonging (Hartley *et al.*, 2021; Winburn and Clemons, 2021). For example, decedents are often found along the U.S-Mexico border with minimal means of identification. However, the medical examiner's office has employed the use of tattoos, material effects such as phone numbers, religious artifacts, and other items found with the decedent to identify them as a border crosser (Anderson, 2008; Anderson and Spradley, 2016; Birkby *et al.*, 2008; Hess and Watson 2014; Martínez *et al*, 2014). If this approach is appropriate for U.S-Mexico border crossers, the theoretical use of material context in identifying transgender and non-binary decedents is applicable.

Forensic practitioners, including medical examiners participate in a crucial role in providing accurate identifications. An advancement in the medicolegal system occurred in 20150 with the "Respect After Death Act" (Assembly Bill No. 1577 ch.631). The legislation mandates that decedent's sex must be recorded as a reflection of their gender within the state (Bill No. 1577 Ch. 631, 2015:93). Accordingly, those completing death certificates must assigned the gender and sex based on the individual's preferred gender/sex, which forces the consideration of federal documentation and material context. Moreover, this act grants the authority to those with rights of disposition to identify the gender and sex of the decedent. While this act ensures that decedents who have transitioned or are transitioning will have their preferred gender and sex designation after death, it only applied to the state. If this grant could be applied nationally, the medicolegal system could enhance their means of identification by including material context with the skeletal sex estimation.

Although, this could prove problematic especially within the medicolegal system, as there are some discrepancies of who has the power to decide a decedent's sex and gender, or even if a decedent's gender can be estimated. For example, a forensic anthropologist is often employed by medical examiner's offices as a means of performing skeletal-based assessments, but they lack the authority to designate a manner and cause of death; similarly; would the decision of sex fall to the medical examiner's office rather than the skeletal analysis provided by the forensic anthropologist? If so, to what degree is a sex estimation from a forensic anthropologist considered, and would their designation appropriately describe the individual? These disparities within the medico-legal system need to be assessed when evaluating the gender/sex of a potential transgender or non-binary decedent, as each aspect of the system will have different elements of the evidence which may provide insights into the decedent's gender and sex.

Gender Identity, Gender-nonconforming, and Gender Dysphoria

There are some complexities in understanding an individual's sex and gender; in our society, we often use the two interchangeably to represent the same concept. When we see a person or individual, we can use social cues to ascertain an opinion about an individual's sexual identity and gender identity. These social cues may include clothing, hairstyle, and other aspects of gender expression (GLAAD, 2022; NPR, 2022). To be explicit, gender identity is how a person identifies their lived experiences as related to their sex, cultural affiliations, social affiliations, and even material items; however, it does not equate to an individual's gender expression, nor does it equate to their biological (genetic) sex (Fraser 2015; Kreukels *et al.*, 2014; Tallman *et al.* 2022). In some respects, gender identity begins in the early stages of their life and continually changes (Kreukels *et al.*, 2014; Geller, 2009; 2018; Lev, 2004). Essentially, one's belonging, or sense of belonging to a specific gender, constitutes their gender identity, and this is an ongoing lifelong process.

To simplify the difference between gender identity and gender expression, gender identity can be considered an internal expression of gender, while gender expression is an external expression that can be seen by others. Sex, or biological sex, is the biological manifestation of the sexes from chromosomes (Male, Intersex, and Female), and, generally, it is determined on the basis of genitalia and determined at birth by a medical professional.

When an individual's gender identity is different from their biological sex, or to some degree, their gender expression, they are said to have gender dysphoria. Definitions of gender dysphoria include the psychological state whereby a person demonstrates dissatisfaction, distress, or discomfort with their assigned sex at birth, the gender and sex roles assigned with their sex at birth, and the general behaviors of that particular sex (Fraser, 2015: 19; WPATH, 2012:5). Dysphoria, a psychiatric condition, is defined by a state of feeling very unhappy, uneasy, or dissatisfied; however, dysphoria does not necessarily have to be specific to cognitive uneasiness but can be related to the physical body, and in these instances, an individual may pursue means of changing their body (Merriam-Webster, 2022). Treatment options for gender dysphoria vary from one individual to the next but may generally include changes in gender expression, psychotherapy, hormone replacement therapy, and to an extent, gender confirmation surgery or facial feminization surgery and facial masculinization surgery (WPATH, 2012:9-10). Since gender dysphoria is multifaceted, no medical specialties can fully provide complete care for transgender and intersex patients (Kreukels *et al.*, 2014).

In a similar manner of differentiating sex and gender, gender-nonconforming is the state of one's gender being different from their assigned sex. Individuals who perform or behave outside the expected societal roles for their biological sex may be labeled as gender nonconforming (WPATH, 2012:5). In other words, when an individual's gender expression differs from the gender norms, that is what many consider as gender non-conforming.

Methods for Gender-affirming Transition

Treatment options for gender dysphoria, gender-affirming treatments (GAT), can be multifaceted and complex. Some patients may seek out psychotherapy, cross-sex hormone therapy (CSH), gender-affirming hormone therapy (GAHT) or hormone replacement therapy (HRT), gender reassignment surgery (GRS), and some may choose to facial feminization surgery (FFS) or facial masculinization surgery (FMS) (Buchanon 2014; Tallman *et al.* 2022). The latter options, FFS and FMS, are often one of the last options to be selected by transgender individuals and physicians as it is expensive, require a long recovery, and may require that GAHT has begun or is in process. While hormone therapy aims to obtain and maintain a concentration of normal hormone levels of specific sex, while improving the well-being and quality of life of gender non-conforming individuals. FFS and FMS focus on achieving the facial characteristics of the desired gender (Buchanan, 2014; Deschamps-Braly, 2018; Deschamps-Braly *et al.*, 2017; Fabris *et al.*, 2015).

In osteological contexts, hormones are known to change bone mineral density, body composition, and can lead to several long-term complications such as venous thrombosis and heart complications (Fabris *et al.*, 2015; Unger, 2016; Lobo, 2017; and Fighera *et al.*, 2019). Additionally, the presence and amount of hormones can fluctuate as individual ages and can be influenced by genetics, environment, and several extrinsic factors, which could be seen in a post-mortem skeletal analysis (Márquez-Grant *et al.*, 2022). While the effects of hormones on the skeletal system are generally known, there are several aspects of GAHT that have yet to be fully explored, such as age-related changes when starting hormone therapy during puberty, prolonged exposure to GnRHa, and prolonged cross-sex hormone therapy. The following subsections of this introduction will primarily focus on hormones and gender-affirming care procedures.

Hormones and Skeletal Development: Testosterone and Estrogen

As Scheuer and Black (2004) suggest, growth and development will vary not only between populations but between individuals within those populations. As part of the biological mechanisms that render primary and secondary sex characteristics, hormones are a significant factor in the development of humans. During prenatal development, hormones, in conjunction with maternal nutrition, environment, and additional extrinsic factors, develop some of the primary characteristics the medical system regards as defining markers for sex (Kruekel *et al.*, 2014). During our development, we go through different stages of growth (Tanner Stages), which vary between the sexes and were defined by Tanner and utilized by doctors to assess the development of children (Coleman *et al*, 2022; Scheuer and Black, 2004). During the pubertal phase of development, individuals will go through growth spurts which increase sexual dimorphism through differential hormone secretion, with a result of peak bone mass (Scheuer and Black, 2004).

Hormones are developed, secreted, and respond through the complex bodily system known as the endocrine system; this system helps regulate and maintain homeostasis while also affecting reproduction, growth, and development (Betts *et al.*, 2017: 734). All hormones within the human system are divided into four classes based on their chemical structure: amine, peptide, protein, and steroid, with the last representing the chemical structure of testosterone, estrogen, and progesterone (Betts *et al.*, 2017). Many extrinsic and intrinsic factors and chemicals affect homeostasis and the hormones which produce primary and secondary sex characteristics. The primary sex hormones produced through the endocrine system are testosterone, estrogen, and progesterone, with additional hormones such as thyroid and growth hormones that influence secondary sex characteristics.

Testosterone and estrogen are associated with both sexes, respectively; however, both sexes produce these hormones, each playing critical roles in the development of secondary sex characteristics in soft tissue and skeletal tissue. Primarily produced in the testes for males is testosterone, which acts as a developmental and regulatory steroid (Betts *et al.*, 2017). Estrogen and progesterone are produced by the ovaries and also serve as a developmental and regulatory steroids for women (Betts *et al.*, 2017). Both biological sexes rely on estrogen to support bone development through osteocalcin, which plays a significant role in the development of peak bone mass (Davis and Wahlin-

Jacobson, 2016). GH causes an increased uptake of amino acids from the blood, enhances cellular proliferation, and reduces apoptosis (Betts et al., 2017). It appears to influence gender-related differences in pubertal growth, particularly in bone mass, when combined with an insulin-like growth factor (Mauras et al., 1996; Callewaert et al., 2010). FSH stimulates the production of gametes in both men and women, and it also promotes follicular growth (Betts et al., 2017: 749). LH stimulates androgen production by the gonads. In women, LH triggers ovulation and the production of estrogen and progesterone, while in men, it triggers testosterone production in the testes (Betts et al., 2017)

Growth Hormone also plays a direct role in the development of skeletal tissue compared to testosterone and estrogen. However, some individuals, such as intersex individuals, may naturally have lower amounts of GH and other gonadotropin hormones, which may lead to a slowed development or absence of secondary sex characteristics (Astorino, 2015; Balasubramanian and Crowley, 1993; Bassett and Williams, 2016, Gunter and Rosen, 2014; Nicks *et al.*, 2010; Wiepjes *et al.*, 2020). As intersex individuals age, they may produce lower amounts of these essential hormones needed for skeletal maintenance. For example, in postmenopausal women and some older men, when FSH or testosterone fails, there is a lack of osteoblast development, leading to increased bone resorption, also known as osteoporosis (Nicks *et al.*, 2010; Ortner, 2010). Understanding hormone production and development is crucial during the transition and intersex individuals, especially those who have yet to reach peak bone mass or those who are losing bone mass.

Another hormone deficiency-related issue with an overall deficiency in GH, that is influenced by factors, such as congenital deficiency, mutations, birth trauma, or congenital malformations/tumors, which affect the hypothalamic-pituitary function (Kato *et al.*, 2002). Those with GH tend to have short stature (dwarfism) and with normal body proportions (John Hopkins Medicine, 2023). Children with signs of GH deficiency will show symptoms early on, and they can be treated with recombinant human GH. Treatment results in an increased average lean body mass, and bone mineral density, while also enhancing muscular development and mental well-being (Kato *et al.*, 2002).

For young nonbinary individuals with normal hormone levels GAHT provides a non-permanent method of transition. By using Gonadotropin-Releasing Hormone Agonist (GnRHa); they can inhibit GH which slows the growth and development of secondary sex characteristics until an individual decides to commence sex hormones. This is one method proposed for the subadult and younger non-binary population (WPATH, 2012; Coleman *et al.*, 2022). Generally, male individuals with a delay of GnRH can lead to a lack of secondary sex characteristics, which can be treated with testosterone hormone therapy (Balasubramanian *et al*., 2022) Similarly, women with GnRH deficiency display similar issues and can seek estrogen hormone therapy for pubertal development and maintenance. In the absence of GnRH and the development of sex hormones, the bones in these individuals may fail to fuse and grow normally (Balasubramanian *et al.*, 2022). While a lack of skeletal development is avoided by the general population, for transitioning individuals GnRH deficiency is one method for gender-affirming care.

Some individuals naturally produce a low amount of testosterone and estrogen and are diagnosed as having hypogonadism. Hypogonadism is divided into primary and secondary hypogonadism, and both result in hormone deficiency for males and females (Richard-Eaglin, 2018). Primary hypogonadism is the failure or deficiency of the hormones produced by the gonads, while secondary hypogonadism is characterized by identifying isolated GnRH deficiency (Richard-Eaglin, 2018). As individuals age, they can enter a state of hypogonadism in the general population, leading to bone loss, otherwise known as osteoporosis, which is generally treated with HT. In individuals transitioning, if proper maintenance of hormones is not upheld, they may enter a hypogonadal state which could lead to osteoporosis. Biologically, skeletal development is essential to the health and well-being of an individual, and hormones play an integral role in skeletal development and act as a source of both primary and secondary sex characteristics.

Gender-affirming Care: Hormone Medical Treatment

Several avenues are considered for individuals wishing to transition or affirm their gender for both intersex and transgender individuals. One of the first pursuits for transition beyond counseling and changing external signs of gender is gender-affirming hormone treatment or cross-sex hormone therapy. According to the 2015 U.S. Transgender Survey, more than three-quarters want GAHT, but only 49% have ever received it (James *et al.*, 2016). The hormones used in GAHT aid in alleviating gender dysphoria and are generally accessible via physicians and the internet (Tallman *et al.*, 2022, Mepham *et al.*, 2014; WPATH, 2012). According to the standards of care provided by the World Professional Association for Transgender Health (WPATH), individuals experiencing gender dysphoria may be referred to this treatment when: there is persistent gender dysphoria; patients can make informed consent, are the age of majority, and other medical or mental concerns are controlled if present (WPATH, 2012: 34). As with all medical interventions, there are associated risks; with both forms of hormone therapy (masculinization and feminization), in conjunction with comorbidities and predisposed illness. In addition to these risks, there have been reports of increased risk of venous thrombosis, elevated liver enzymes, and even increased depression (Mueller *et al*, 2010:95).

Individuals pursuing treatment may be at an increased risk of hypertension, Type II diabetes, cancer, weight gain, or weight loss, and possibly psychiatric changes (WPATH, 2012:40). In essence, ongoing care and consultation with physicians and therapists are essential and are a means of preventative care for these risks, and screening before the initiation of hormone therapy may highlight additional risk factors before initiation of treatment (WPATH, 2012:42). Several studies show that individuals may become prone to osteoporosis and develop a lower bone mineral density, may have an increase, or decrease, in lean mass and fat mass, which may inhibit overall bone development (Delgado-Ruiz *et al.*, 2019; Fighera *et al.*, 2019; Kreukels, 2014; Lapauw, 2008; Márquez-Grant *et al.* 2022; Mueller *et al.* 2010).

In hormone therapy, Gonadotropin-Releasing Hormone agonist (GnRHa) is commonly used for various medical conditions including endometriosis, precocious puberty and breast cancer (Márquez-Grant *et al.* 2022). As a reversible method for

GAHT, GnRHa may decrease bone mineral density in the hip and lumbar spine for transmen, while leading to an increased rate of long bone fractures in transwomen (Márquez-Grant *et al.* 2022). Younger individuals typically undergo two phases of Gender-affirming Hormone Therapy (GAHT) using GnRHa. Phase one involved suppressing naturally produced hormones (pubertal suppression), and phase two includes the addition and increase of sex hormones (Coleman *et al.*, 2022) This method achieves enhanced results with improved physical outcomes (Hembree *et al.*, 20090

As aforementioned, during puberty, GnRH plays a significant role in the release of hormones such as FSH, GH, and LH, which are vital for spermatogenesis, testosterone secretion, and ovarian steroid secretion, directly influencing bone mineral density and bone mass (Betts *et al.*, 2017; Hembree *et al.*, 2009; Mirza *et al.*, 2012). During phase one, analogs for GnRH are employed to cease or lower the amount of FSH, GH, LH development. During phase two, testosterone or estrogen are initiated to induce the development of secondary sex characteristics of the individual's gender identity. Estrogen is a significant hormone in skeletal maintenance, GnRHa for transwomen can potentially lead to osteoporosis or inhibit peak bone mass development (Mirza *et al.*, 2012) and may affect skeletal growth and overall stature if initiated during puberty. For transmen, GnRha may be used to stop menses and uterine bleeding before starting additional testosterone hormone (Hembree *et al.*, 2009; Delgado-Ruiz *et al.*, 2019)

Although GAHT is generally available in the medical system, about one in four individuals choose to conduct self-prescribed hormone therapy (Unger, 2016). As with all medical pursuits, there are associated risks, and when self-prescribed, these risks increase. When someone is conducting self-prescribed hormone therapy, they may put themselves in a prolonged hypogonadal state, and those with comorbidities or are predisposed to certain illnesses such as diabetes (Type II) may escalate their chances of entering and maintaining a hypogonadal state (Unger, 2016; WPATH, 2012). This hypogonadal gonadal state can lead to several changes in the skeleton over a period of time, and only with proper care and attention these and other problems can be avoided, and individuals may successfully alleviate gender dysphoria. However, the reason many choose to conduct these treatments outside of a doctor's care is cost, insurance, and discrimination (James *et al.,* 2016).

Gender-affirming Hormone Therapy for Intersex and Nonbinary Individuals

About one percent of births have associated gonadal dysgenesis (ambiguity), which at birth may inhibit a doctor’s ability to sex an individual as male and female and are considered intersex (Astorino, 2015; Kumar and Sharma, 2017). According to Kumar and Sharma (2017), there are several sex differences that some may consider as “abnormal,” some of which are defined as syndromes, including Turner’s syndrome, Klinefelter’s syndrome, Swyer Syndrome, and sex-reversed male, all of which are influenced by an individual’s chromosomal pattern (Table 2.1). The diagnosis of intersex conditions is based on the five main types of intersex disorders and the histology of the bilateral gonads (Kumar and Sharma, 2017: 441). At birth parents may decide to intervene medically; however, the Intersex Society of North America (ISNA), advocates for no surgery on infants and children who display these abnormal characteristics unless necessary and to wait till the individual can provide informed consent and accept the associated risks

(Anthony and Aspinal, 2006). Regarding hormonal therapy, the ISNA suggests that treatments wait until the child is approaching the age of puberty, as the administration of these can induce both physiologic and behavioral changes (Intersex Society of North America (Anthony and Aspinal, 2006).

Table 2.1: "Abnormal" chromosomal sex differences. (Kumar and Sharma, 2017))

Sexes and Syndrome	Chromosomal Pairing and definition
Female Karyotype	XX
Male Karyotype	XY
Turner's Syndrome	XO is the normal autosomal complement with one 1-X chromosome and ovary
Klinefelter's Syndrome	XXY is the Normal autosomal complement of chromosomes with 47, XXY karyotype.
Swyer Syndrome	Complete gonadal dysgenesis because of mutations.
Sex-reversed male	The translocation of SRY gene to autosomes or X chromosome.

Nonbinary refers to individuals who experience their gender outside of the male-female binary, including individuals who do identify as bigender, demiboy, demigirl, and those whose gender changes over time (Coleman *et al.*, 2022). Nonbinary individuals comprise roughly 25-50% of the larger transgender population, with youths representing the highest percentages; however, the exact percentage of those seeking GAHT and Gender affirming surgery (GAS) is unknown (Coleman *et al.* 2022). According to the WPATH, non-binary individuals may specifically pursue a specific treatment to alleviate their gender dysphoria and increase their body satisfaction or additional gender-affirming goals (Coleman *et al*., 2022).

Some of the highlighted effects of gender-affirming hormone therapy which encompass the body to develop secondary sex characteristics and bone mineralization. If a nonbinary individual suppresses their naturally occurring sex hormones during puberty, skeletal development is somewhat halted using GnRHa. When GAHT using testosterone or estrogen begins, authors have noted that a growth spurt, with skeletal maturation and growth will continue or begin (Coleman *et al.*, 2022:S115). The impacts of Gender-affirming hormone therapy on skeletal development of nonbinary individuals including trans and intersex individuals is complex and understudied. There are several pathways for GAHT when considering genetics, environment, physical health, and hormone levels at initiation.

As a method for GAHT, using GnRHa to delay secondary sex characteristics may lead to delayed skeletal growth and development challenging skeletal sex and skeletal age assessments. This is further complicated by any analyses for bone density as inhibited estrogen and testosterone may mimic signs of osteoporosis. Osteoporosis and bone mineral density changes are associated with hormone therapy and are influenced by various health and social factors. Transwomen under fifty show higher rates of fracturing and lower bone mineral density while transmen have a similar fracture risk to women (AFAB) but lowe than age-matched men (AMAB). Body composition differences are evident during transitioning, with transwomen having a lower lean mass, higher fat mass and smaller bone size and lower bone turnover.

It is essential that nonbinary individuals seek proper aftercare, with a thorough patient history assessment at the initiation of GAH. Youth seeking GnRHa treatments may experience delayed growth, specifically in skeletal development, leading to delayed peak bone mass and potentially osteoporosis. Larger, ethically situated cohort studies are necessary to understand the impacts of GAT on skeletal development in nonbinary individuals.

Gender-affirming Surgeries: FFS, FMS

FFS and FMS are the last options pursued by individuals during their transition process (Figure 2.1). In the 1980s Dr. Douglas Ousterhout developed facial/cosmetic surgery as a method for gender-affirming care, which can include a combination of browplasty, genioplasty., rhinoplasty, and face lifting (Ousterhout, 1987; Schall *et al.*, 2020; Deschamps-Braly, 2022). And while hormone therapy for gender-affirming care had been utilized in the 1960s, it wasn't until after the 1980s that facial feminization surgery was pioneered in the United States (Deschamps-Braly, 2022). Dr. Douglas Ousterhout was trained by Dr. Ed Falces and Dr. Paul Tessier (1972-1973) in craniofacial and plastic surgeries, particularly correcting birth defects and accidents, and it wasn't until 1982 that he was asked to conduct a consult on his first transition surgery (Deschamps-Braly, 2022; Ousterhout, 2011).

As with all Gender-affirming surgeries, aftercare and understanding the postoperative needs for optimizing the best result is essential (Coleman *et al.*, 2022). Though specific gender-affirming surgeries were not specifically inquired about in this survey, understanding the types of surgeries which can be pursued gives insights into what one might anticipate when working cases with potential transgender decedents. At present, some studies have studied the effects of facial gender-affirming surgeries, with generally positive outlooks. Furthermore, even fewer studies have analyzed the extent GAS, specifically FFS, influences *FORDISC 3.1* sex estimations or if remodeling is visible within the skeleton (Schall *et al.*, 2020; Buchanon, 2014).

FACIAL SURGERY	
Brow	• Brow reduction • Brow augmentation • Brow lift
Hair line advancement and/or hair transplant	
Facelift/mid-face lift (following alteration of the underlying skeletal structures)	
Facelift/mid-face lift (following alteration of the underlying skeletal structures)	• Platysmaplasty
Blepharoplasty	• Lipofilling
Rhinoplasty (+/- fillers)	
Cheek	• Implant • Lipofilling
Lip	• Upper lip shortening • Lip augmentation (includes autologous and non-autologous)
Lower jaw	• Reduction of mandibular angle • Augmentation
Chin reshaping	• Osteoplastic • Alloplastic (implant-based)
Chondrolaryngoplasty	• Vocal cord surgery (see voice chapter)
BREAST/CHEST SURGERY	
Mastectomy	• Mastectomy with nipple-areola preservation/reconstruction as determined medically necessary for the specific patient • Mastectomy without nipple-areola preservation/reconstruction as determined medically necessary for the specific patient
Liposuction	
Breast reconstruction (augmentation)	• Implant and/or tissue expander • Autologous (includes flap-based and lipofilling)
GENITAL SURGERY	
Phalloplasty (with/without scrotoplasty)	• With/without urethral lengthening • With/without prosthesis (penile and/or testicular) • With/without colpectomy/colpocleisis
Metoidioplasty (with/without scrotoplasty)	• With/without urethral lengthening • With/without prosthesis (penile and/or testicular) • With/without colpectomy/colpocleisis
Vaginoplasty (inversion, peritoneal, intestinal)	• May include retention of penis and/or testicle
Vulvoplasty	• May include procedures described as "flat front"
GONADECTOMY	
Orchiectomy	
Hysterectomy and/or salpingo-oophorectomy	
BODY CONTOURING	
Liposuction	
Lipofilling	
Implants	• Pectoral, hip, gluteal, calf
Monsplasty/mons reduction	
ADDITIONAL PROCEDURES	
Hair removal: Hair removal from the face, body, and genital areas for gender affirmation or as part of a preoperative preparation process. (see Statement 15.14 regarding hair removal)	• Electrolysis • Laser epilation
Tattoo (i.e., nipple-areola)	
Uterine transplantation	
Penile transplantation	

Figure 2.1: Gender-affirming surgical procedures that are listed by the WPATH (Coleman *et al.* 2022: S136).

During an individual's transition, most of the GASs available have little to no involvement with the skeleton (Coleman *et al.*, 2022). Both FFS and FMS focus on the craniofacial features, with an emphasis on those traits which are sexually dimorphic (mental eminence, brow ridge, and zygomatics) which are seen throughout populations (Buikstra and Ubelaker, 1994; Garvin *et al.*, 2014; Walker 2008). Like the sex estimation methods used by forensic anthropologists, the origins of FFS and FMS are very typological, focusing on the extreme masculine and feminine physique. Considering Buikstra and Ubelaker (1994), Garvin *et al.* (2014), and Walker (2008), cranial traits show some sexual dimorphism which can be attributed to an individual from AFAB, AMAB, or "indeterminate" or "ambiguous."

As described by Ousterhout (1987), facial feminization surgery combines forehead contouring, rhinoplasty, chin contouring (genioplasty), and various surgical techniques performed in conjunction with hormone replacement therapy to achieve facial characteristics aligned with the female sex. While rare, FMSs generally enlarge some facial features and make some features more angular to match those of the male embodiment and consist of similar procedures/techniques to FFS (Deschamps-Braly, 2022). On the contrary, FFSs generally shorten or round out some of the angular shapes of the facial skeleton in males to achieve a feminine appearance. Although each doctor will perform these surgeries with slightly different techniques, they all generally follow the same purpose. Some of these techniques are described in *Facial Bone Contouring Surgery: A Practical Guide*, and are briefly described below (Park, 2018).

Forehead reduction/augmentation for FFS involves combining hairline lowering and reducing the size of the brow ridge by approximately 1.6mm of the frontal bone (Becking, de Graaf, and Tuinzing, 1996; Deschamps-Braly, 2022; Vila et al., 2022).

Possible complications of this surgery include alopecia, scarring, persistent paresthesia, and hematoma (Vila et al., 2022). Rhinoplasty, used for cosmetic and functional purposes, reshapes the nose and can be done through the nose (internally) or via a small incision at the base of the nose, potentially involving the nasal bones, nasal conchae, and hyaline cartilage (Becker, 2003; Berli and Loyo, 2019; Salgado et al., 2018; Mayo Clinic, 2022). Genioplasties have the ability to significantly alter the appearance of the lower third of the face and can be controlled in multiple dimensions (Baker and Weinzweig, 2022). The general procedure includes a labial incision to expose the mandible below the mental foramen; the anterior-inferior portion of the mandible is removed, "mobilized," and then fixed in place using plates and screws (Park, 2018:67). While these surgeries may impact cranial metrics and non-metric analyses in forensic anthropology, there have been lacking studies due to limited data. Schall et al. (2020) focused on FORDISC 3.1 metric sex estimations and found that gender-affirming facial surgeries had a minimal impact.

Genioplasty

Genioplasty is a significant factor in the facial feminization process; they significantly influence an individual’s facial identity, specifically the lower face. On occasion, an osseous genioplasty is performed, focusing on the bony elements of the chin for aesthetic purposes. In certain cases, genioplasties can be done alongside mandibular angle reductions; overall, the procedures involving the chin encompass various aspects, including the height, width, prominence, and asymmetry of the chin (Deschamps-Braly, 2019; Van Boerum *et al.*, 2019). While a small percentage of transgender individuals undergoing a genioplasty require changes to chin height, it can be achieved using a T-shape maneuver, lowering a portion of the mandible, followed by stabilization using plates (Deschamps-Braly, 2019).

The use of plates during a genioplasty also provides the benefit of inhibiting bone resorption, a common concern when using implants (Deschamps-Braly, 2019). Furthermore, while the bony elements heal, during radiographic analysis, the elements may appear as a nonunion (Deschamps-Braly, 2019). Alternatively, some patients seeking genioplasties may opt for implant-based procedures. This approach involves making incisions through the periosteum, especially along the inferior border of the mandible, in preparation for the implant wings while ensuring the preservation of the mental nerve (Harris and Raggio, 2023). The implants are securely attached to the periosteum in the midline, and the wound is closed using absorbable sutures for the subcutaneous tissue and non-absorbable sutures for the skin (Harris and Raggio, 2023). Additionally, certain patients may choose a similar procedure through the oral cavity using a gingivolabial incision, which yields comparable results to the submental transcutaneous approach mentioned earlier (Harris and Raggio, 2023).

Frontal Bossing and Forehead Reduction and Contouring

According to Hohman and Teixeira (2023) feminization of the upper-third of the face can require several techniques, including reduction of frontal bossing, brow lifting/reduction, and hair transplant. The reasoning behind frontal bossing is due to the fact that men, generally speaking, have more prominent supraorbital ridges, The procedure for frontal bossing is done by exposing the supraorbital ridge, followed by burring down the bone from the region of the zygomaticofrontal suture medially to the lateral border of the frontal sinus (Hohman and Teixeira, 2023). Once the extent of the sinus has been identified, the anterior table is removed and thinned along the endocranial table in preparation for replacement, with recessing requiring that the inter-sinus septum is removed (Hohman and Teixeira, 2023). The bone flap is then replaced in its new position and then fixated using low-profile titanium plates and short screws (Hohman and Teixeira, 2023). Another method that could be used when the frontal sinus is absent includes burring down the anterior plates of the supraorbital ridge, with some surgeons opting to bur the inferior regions of the supraorbital rims (Hohman and Teixeira, 2023). Lastly, upon closure of the incisions, some surgeons may elect to include absorbable implants, which can be visible below the skin until they dissolve (Hohman and Teixeira, 2023).

Rhinoplasty

A rhinoplasty can be crucial in the facial feminization process, as a central landmark of the face, the nasal shape can be significant for individuals. Rhinoplasties can be used for non-transitioning patients for the purpose of dorsal hump reduction, upward rotation, cephalic trimming of the lateral cartilage, and lateral crura divisions (Hohman and Teixeira, 2023). Considerations when conducting a rhinoplasty should include improvement of the nasal passages for airflow so that during the skeletal reduction, there is no airway obstruction (Hohman and Teixeira, 2023). To prevent an air obstruction, a turbinectomy may be performed, as well as turbinate outfractures if valvular issues or septal deviations are addressed (Fichman and Piedra Buena, 2023). For a rhinoplasty, specifically, the reduction of the bony dorsum can be made by trimming the cartilage using a rasp, osteotome, or another device which is preferred by the surgeon (Fichman and Piedra Buena, 2023). Other procedures within the classification of rhinoplasty can include augmentation of the dorsum, septoplasty, and tip modifications (Fichman and Piedra Buena, 2023).

Previous Studies Related to Forensic Anthropology

Research specifically focused on transgender decedents in forensic anthropology is limited. In a study by Schall et al. (2020), FORDISC 3.1 was used to conduct pre- and postoperative sex estimations for transgender women undergoing facial feminization surgery (FFS) based on CT scans. The analysis following the FFS procedure resulted in differing cranial measurements; however, the FORDISC 3.1 output still indicated a male sex estimation for transwomen (Schall et al., 2020). The authors suggest that while individuals after FFS may exhibit culturally defined feminine traits macroscopically, metric methods like FORDISC 3.1 might still indicate a male sex estimation (Schall et al., 2020). Therefore, practitioners should exercise caution when using both macromorphoscopic and metric methods for sex estimations in postoperative FFS patients. However, it’s reasonable for practitioners to consider that facial masculinization surgery (FMS) may produce similar effects, wherein metric analysis may suggest a feminine cranium for transgender males who have undergone FMS (Schall et al., 2020).

Further attempts to determine if FFS and FMS surgeries impact craniometrics may include determining the average differences added or removed during these procedures and determining how many standard deviations from the mean these postoperative measures fall. If certain measurements are consistently falling within certain standard deviations from the mean, then these measurements in *FORDISC*, if highlighted, might indicate an individual underwent these surgical procedures. However, conducting such a study is limited as very few individuals within the trans community actually undergo these procedures (James *et al.*, 2016).

Buchanon (2014) examined the effects of gender-affirming facial surgery on pig heads to explore potential evidence for male-to-female transitioning surgeries. Alongside the skeletal analysis, a survey was conducted at the Southern Comfort Conference in Atlanta, Georgia, involving 72 transgender respondents, mostly White, middle-aged, and assumed to have a higher socioeconomic status. While some individuals pursued rhinoplasty and forehead reduction surgery, soft tissue surgeries were more popular than full feminization processes (Buchanan, 2014). In another survey by Buchanon (2014), most forensic practitioners with less than ten years of experience reported not having encountered signs of facial feminization surgery, suggesting that experience may influence the identification of transgender decedents. To improve sex estimations for decedents from the intersex and transgender community, Buchanon and other authors recommend utilizing all available material references, such as clothing, jewelry, and medications (Buchanan, 2014:61). Though material context and evidence do not necessarily equate to one's gender or sexual identity; and are not a reliable source of information, these items may provide additional insights into the individual's identity (Buchanon, 2014; Tallman *et al.*, 2022).

In 2020, Tallman *et al.* (2022) conducted a survey to explore the collective knowledge of and experience working with trans individuals and their perceptions of sex and gender. Their survey results show that some forensic practitioners have worked with transgender individuals (28.9%) although there is some unfamiliarity with the signs of gender-affirming treatments. Furthermore, their survey showed that some forensic practitioners were opposed to providing gender in their casework, with the majority in their survey reporting gender (39.5%) (Tallman *et al.*, 2022). Lastly, the authors call for the expansion of conducting sex and gender estimations beyond the rigid binaries using biocultural and queer theoretical approaches. This would have forensic practitioners extend their sex estimations beyond the biologically derived skeleton, exploring material and cultural effects and "breaking" the universal male-female sex binary.

Based on the surveys conducted by Buchanan (2014) and Tallman *et al.* (2022), there is a need for further research in methods for identifying transgender, intersex, and non-binary individuals, and while almost 40% of respondents would say "female" and "male" is the most accurate descriptor for sex, there is presently a need for expanding the descriptors in sex reporting (Buchanon, 2014; Schall *et al.*, 2020; Tallman *et al.*, 2022). While this thesis does not address any of the long-term effects of FFS/FMS or GAHT, it does expand the work of Buchanon (2014) and Tallman *et al.* (2022) by exploring the perspectives of forensic anthropologists on sex and gender while also exploring the terminology utilized in forensic anthropological reporting. This thesis also calls attention to the fact that while material context is utilized for the identification of decedents along the U.S-Mexico border, many would not utilize these materials for sex and gender estimations.

METHODS

Materials and Methodology

To evaluate the methods, procedures, and knowledge of sex estimation of transgender and intersex individuals of forensic practitioners, an anonymous survey consisting of 70 questions was developed using Qualtrics Survey Suite and distributed via email listserv, Twitter, and directly to forensic anthropology graduate students. The survey includes participant demographics, questions on gender, sex, sex identification terminology, courtroom testimony, methodology, and reporting (Tables 3.1-3.6). The last portion of the survey asks for interpretations on two sets of *FORDISC 3.1*, Walker (2008) and Klales *et al.* (2012) analyses of two willed-bodied individuals from the Forensic Anthropology program Skeletal Collection at the Boston University Aram V. Chobanian and Edward Avedisian School of Medicine. These skeletons are from individuals of known sex and ancestry and are completely skeletonized. At the time that the sex and ancestry assessments were conducted, the sex and ancestry of these individuals were unknown to the author to limit bias. These individuals were selected for their skeletal characteristics, and both individuals were measured using standardized equipment and recorded on standard recording forms (Langley *et al.*, 2016: 96-97). Complete forensic anthropological reports are not included within this document; however, description of the *FORDISC 3.1* outputs, Klales *et al.* (2012), and Walker (2008) analyses are laid out in this section.

A goal of the survey is to highlight the preferred methods and terminology in conducting a sex estimation; therefore, a major portion of the survey inquiries about methods for sex estimation of an individual and the terminology used in forensic anthropological reporting. These inquiries will provide insights and call attention to the participants' preferred methods and terminology in the field, such as FORDISC 3.1 (Jantz and Ousley, 2005), Klales *et al.* (2012), and Walker (2008). Additionally, a comparison of the preferred methods outlined in this survey to the methods Klales *et al*. (2020) will provide insights into changing or unchanging preferences and use of methods and language within the field.

The survey was submitted to the Boston University's Institutional Review Board (IRB) for approval, and due to the anonymity of the survey, this survey was classified as exempt (IRB #: H-42391). The survey link remained active for three months (June 13th, 2022, through September 16th, 2022). All responses were gathered via Qualtrics Survey Suite and analyzed using IBM SPSS software and Microsoft Excel. The responses were qualitatively and quantitatively analyzed using this software and Tagcrowd.com. The following subsections will describe each survey section, list the questions associated with the survey sections, and the methods of analysis for each, while the survey results are described in the Results section of this thesis and subsequently discussed.

Survey Sections and Descriptions

The entire survey consists of 70 questions, taking a minimum of 20 minutes for participants to complete in its entirety. The survey comprised of six sections, including demographic information (of participants), sex-related questions, gender-related questions, transgender-related questions, courtroom testimony, and interpretation and reporting of Individuals 1 and 2. The majority of the survey was comprised of sex-related questions and the interpretation and reporting of Individuals 1 and 2. Additionally, we ask participants to offer any additional insights and information they would like to add. These open-ended questions allow participants to describe, explain, or address any aspects of gender and sex-related information we fail to address by asking our questions. A summary and analysis of these responses will likely lead to further inquiries in future studies, especially when respondents discuss a topic not prompted by our questions.

Survey Section 1: Demographics

The first section of the survey is the demographic section which is focused on the participant and includes questions on social race, gender, and sex (Table 3.1). In addition to this demographic information, information on the years of experience, the number of scene recoveries they participate in, and how often they participate in forensic skeletal analyses was also collected. The purpose of these questions is to understand the background and potential influences which arise from an individual's years of experience, work context, education level, social race, gender, and sex. Additionally, the information will provide insights into the trends within the field. Previous surveys have gathered similar demographic information, which has shown a rise in female participants in the field while also showing additional trends in race, LGBTQIA community, and education level (Antón and Fuentes 2018; Tallman *et al.* 2022; Marks 2010). Although a direct comparison cannot be made to all previous studies as their surveys were distributed to different groups within the field, the joint efforts of the surveys show overall trends within the field. The following tables list the demographic questions in section one of the survey.

Table 3.1: Demographic questions included in the survey.

Survey Section 1: Demographic Information	
What is your gender identity?	Open ended
What is your sex identity?	Open ended
What are your preferred pronouns?	Open ended
What is your social race?	Open ended
Do you identify as LGBTQ+?	Yes; No; Prefer not to say.
What is your age?	Slide bar (open ended)
What is your highest level of education? (Select one)	High school diploma or equivalent; Associates (AA, AAS); Bachelor's (BA/BS); Master's (MA/MS); PhD; MD; JD; Other (specify below).
Do you have a certification from the American Board of Forensic Anthropology?	Yes; No.
What is your work context? (Select all that apply)	Student, Academia; Archaeology; ME/Coroner's Office; Government agency/lab; NGO; Museum; Other (specify below).
What is your profession? (Select all that apply).	Student; Professor/Instructor/Educator; Post-doc; Forensic Anthropologist; Medicolegal Death Investigator; Archaeologist, Bioarchaeologist; Administrator; Curator; Retired, and Other (specify below).
How many years of forensic anthropology experience (i.e., casework, academic, coursework, laboratory analysis, fieldwork, or field experience) do you have?	0, 1-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30+
How often do you currently participate in scene recoveries?	Never; rarely (0-5 per year); regularly (>5 per year)
How often do you currently participate in forensic skeletal analyses?	Never; rarely (0-5 per year); regularly (>5 per year)

Methods of Analysis for Demographic Questions

To facilitate a demographic comparison with other surveys within the field, respondent's was organized by gender identity, sex identity, social race, age, level of education, work context, and profession (see Table 3.1). This methods of tabulation revealed some of the trends seen within the field, including an increase in women, the limited racial and educational diversity. Open ended questions were used for the gender identity, sex identity, and social race survey questions; however, others had predetermined choices with an "Other" option.

Considering that each response for the self-identified questions are unique to an individual, and although the majority belong to one group or another, it is this author's opinion that a respondent first identifies with the word they placed first in their response, then every word after the first. For instance, 'Hispanic/Latino-White' respondents were categorized under 'Hispanic,' following the U.S. census bureau's definition (US Census Bureau, 2023). Exceptions included 'cis-female' and 'cis-male,' which were categorized simply as 'female' and 'male,' respectively. 'Cis' without specific gender denotation was grouped under 'Cis' as it indicates individuals presenting the same gender as assigned at birth (ACON, 2021).

Total counts for all genders, sex, and social races were tallied, cross-tabulations and frequency distributions were conducted and graphically displayed using SPSS/Excel. The cross-tabulations were done to numerically visualize the relationships between the respondents' genders, sex, social races, and education. Additionally, cross-tabulations were done to see the numerical relationship between education level, profession, part of the LGBTQIA community, and whether the respondent had a certification from the American Board of Forensic Anthropology.

Survey Section 2: Sex-related Questions

The second and largest section of the survey is the sex-related questions. Some of these focus on the terminology used by participants when estimating sex from the skeleton, like how they define "sex," "assigned sex," "biological sex," or whatever term they prefer to use, while others focused on whether they think a forensic anthropologist could identify an intersex individual from the skeleton (Table 3.2). The purpose of these questions is to assess the terminology and language used by forensic anthropologists while also assessing the preferred methods used when conducting a sex estimation. By inquiring about the preferred terminology, it may provide insights into common terms in forensic anthropology, the biases that arise from these terms, and how they influence the overall sex estimations. Additionally, questions regarding the preferred methodology when conducting a sex estimation also provide insights into the influences which arise when conducting a sex estimation using the skeleton because of the many binary methods used in the field. Furthermore, these questions will allow for comparisons between the preferred methods highlighted by other authors, such as Klales *et al.* (2020). If there are direct correlations between those highlighted by other authors and those here, it may suggest a continued preferred use in forensic anthropology. If there are differences, it may suggest a new preference in standards when conducting sex estimations. The following tables provide the questions found in the second section of the survey.

Table 3.2: Sex-related questions included in the survey.

Survey Section 2: Sex-Related Questions	
When estimating sex from the skeleton, which sex-related term do you use/prefer in your report? (Select all that apply)	"Sex;" "Assigned sex (at birth);" "Biological sex;" "Anatomical sex;" "Skeletal sex;" "Other (specify below)"
Define "sex", "assigned sex", "biological sex" or whichever sex-related term(s) you prefer/use.	Open ended.
Which sex analysis terminology (for methodology) do you use/prefer for forensic anthropological applications? (Select all that apply).	"Sex estimation;" "Sex determination;" "Sex assessment;" "Sex analysis;" Sexual dimorphism;" "Other (specify below)"
How do you report sex when neither "female" nor "male" can be estimated?	"Inconclusive;" "Indeterminate;" "Unknown;" "Other (specify below)"

Have you worked on a case involving an intersex individual?	Yes; No; Unsure
Have you or would you comment on the possibility that a decedent is intersex in your skeletal analysis notes forms?	Yes; No; Unsure
If yes, how might you approach writing such information in your skeletal analysis notes form?	Open ended.
Have you or would you report an individual as intersex in a forensic anthropology report?	Yes; No; Unsure
Do you think that forensic anthropologists can identify an intersex individual from the skeleton alone?	Yes; No; Unsure
What forensic anthropological evidence suggests intersex?	Open ended

What references or resources do you or would you use when identifying a potential intersex individual?	Open ended
Do you think that identifying an individual as intersex will improve the odds of identification?	Yes; No; Unsure
Do you or would you use any non-skeletal evidence to estimate sex?	Yes; No; Unsure
Do you think that estimated skeletal sex is aligned with or predictive of gender self-identity?	Yes; No; Unsure
When conducting a metric and nonmetric sex estimation of a complete skeleton, do the cranial or postcranial elements take precedence in your reporting?	Cranial; Postcranial; Cranial and postcranial equally

Assuming you are analyzing a complete skeleton, which methods do you prefer for estimating sex? (Select all that apply).	Pelvic nonmetrics (e.g., Phenice 1969; Klales et al. 2012; Buikstra and Ubelaker 1994); Postcranial/long bone metrics (e.g., Spradley and Jantz 2011; FORDISC; France 1998); Cranial nonmetrics (e.g., Garvin et al. 2014, Walker 2008, Rogers 2005); Cranial metrics (e.g., FORDISC; France 1998; Spradley and Jantz 2011); Gestalt pelvic assessment, Gestalt cranial assessment; Distal humerus morphology (e.g., Rogers 1999; Vance et al. 2011); Rhomboid fossa (clavicle)(e.g., Rogers et al. 2000), Femoral/humeral head diameter (e.g., Stewart 1979); Dental metrics (e.g., Adams and Pilloud 2019); Other (specify below)
Rank the following **NONMETRIC** sex estimation methods based on your preference (1=most preferred; 9=least preferred). If you have never applied the method before, please select "never applied/never used." Please note that this is not an exhaustive list of nonmetric methods, and it does not include all population specific derivations.	Pelvis morphology (Klales et al. 2012); Pelvis and Cranial morphology (Buikstra and Ubelaker 1994); Cranial morphology (Walker 2008), Cranial morphology (Garvin et al. 2014); Cranium morphology (Roger 2006); Clavicle morphology (Rogers et al. 2000); Humerus morphology (Vance et al. 2011)

Rank the following **METRIC** sex estimation methods based on your preference (1=most preferred; 9=least preferred). If you have never applied the method before, please select "never applied/never used." Please note that this is not an exhaustive list of nonmetric methods, and it does not include all population specific derivations.	FORDISC (cranial and postcranial); France 1998 (cranial and postcranial); Spradley and Jantz 2011 (cranial and postcranial); Stewart 1979 (humeral/femoral head)
Do you have anything to add regarding sex estimation and forensic anthropology?	Open ended

Survey Section 3: Gender-related Questions

In section three of the survey, gender-related questions, participants were asked a series of questions related to gender identity, specifically if they would address gender in their forensic anthropological reports or skeletal analysis notes, the types of evidence they would use to identify gender, and if they thought identifying gender would improve the odds of an overall identification (Table 3.3). Like the previous section of the survey, these questions allow an assessment of the present opinions on identifying gender in forensic anthropological contexts while also identifying areas in which the field is lacking. Traditionally, forensic anthropologists do not identify gender when estimating sex or producing a biological profile; by asking these questions, we might begin to render an opinion on the extent to which forensic anthropologists can use a biocultural approach in gender identification. The following table provides the questions found in section three: Gender-related questions.

Table 3.3: Gender-related questions included in this survey.

Survey Section 3: Gender-Related Questions	
Define “gender identity”	Open Text
Define “gender expression”	Open Text
Do you or would you comment on a decedent’s gender in your skeletal analysis notes forms?	Yes; No; Possibly; Unsure
Do you or would you report/comment on a decedent’s gender in a forensic anthropology report?	Yes; No; Possibly; Unsure
What evidence would you use to report on a decedent’s gender?	Select all that apply: None (would not report); Clothing; Personal effects; Scene context; Signs of gender-affirming surgeries; Information provided by law enforcement/investigative agency; Scene photographs; Other—open text
Briefly describe the extent to which a forensic anthropologist can provide insights into an individual’s gender expression?	Open Text
Do you think that identifying a decedent’s gender will improve the odds of identification?	Yes; No; Unsure
What evidence would you use to report on a decedent’s gender?	Select all that apply: None (would not report); Clothing; Personal effects; Scene context; Signs of gender-affirming surgeries; Information provided by law enforcement or investigative agency; Scene photography; Open (specify below).
Do you have anything to add regarding gender and forensic anthropology?	Open Text

Methods of Analysis for the Sex-related and Gender-related Questions

For the sex-related questions (see Table 3.3) with multiple choice (“select all that apply”), tabulating the sums and means provide valuable insights into preferred methodology, terminology, and opinions of practitioners. Cross-tabulations and Chi-square goodness of fit analyses were also conducted. Overall, the terminology used in forensic anthropology can be inadequate in properly identifying and describing a nonbinary decedent; some only denote a strict binary. By analyzing these, we may call attention to the inadequacies in the field when conducting sex and gender estimations. Questions requiring a “yes,” “no,” or “unsure” response (Table 3.2 and 3.3), were tabulated to show the majority or preferred response. This method allowed for ease of comparison amongst questions in other portions of the survey. Some insights from this analysis include the types of evidence used or would be used for identification purposes and then if this information would be provided in their skeletal analysis notes and reports.

Ranking the method by preference (Table 3.2) and similar questions were analyzed tabulating the most and least preferred methods or selected response. This will highlight which methods amongst the participants are preferred while also highlighting insights into trends in training and education. Additionally, a comparison with methods highlighted by Klales et al. (2020) offered additional insights into changes within the field. Furthermore, questions in this section (Table 3.2) also explored the types of evidence used for gender identification and their potential impact on expert opinions in the judicial system.

For open-ended questions on definitions, responses were compared with established definitions from various sources (Trans Doe Task Force (Redgrave and Redgrave 2022), the Oxford Learner's Dictionary (2022), Merriam-Webster (2022)). The comparison aimed to identify how forensic practitioners define terms related to sex and gender and whether they align with recognized terminology. TagCrowd.com (2023) was utilized for word cloud generation to visualize the most repeated words, simplifying the comparison process and facilitating identification of common and uncommon terms. However, the approach acknowledged potential limitations when handling multiple occurrences of words within a single response. This method offers insights into the prevailing opinions on these terms within the forensic field and highlights the complexities and challenges of their use in forensic reports."

Overall, his approach simplifies the process of individually reading individual responses and searching for the most common words, highlights the most repeated words in responses, and allows for a quick comparison of keywords from the dictionary definitions. Additionally, this has the potential to highlight terms that are not commonly used among the responses and can give direction for further inspection. One concern with this method is that if a respondent uses a word such as "internal" multiple times within the same definition, the program does not count that as one, but the number of times the word appears. The following list of terms was used as the basis for word choice comparison using eleven definitions of transgender from varying dictionaries and online resources: "gender identity," "sex," "birth," "gender," "differ," or "different from birth," and "personal identity," "hormone(s)," "transition," or "transitioned."

For sex, assigned sex, and biological sex, the following words were selected for comparison using varying sources: “medical profession,” or “doctor,” “external anatomy,” “chromosome,” “sex characteristics,” and “physical anatomy,” “physical conditions or characteristics,” “hormone,” and “physiological features.”

For the definitions of gender identity, the following terms were highlighted for comparison: “internal sense,” “concept of self,” “feel(s),” “view(s),” “self,” “internal experience,” “individual,” and “sense of self.”

For the term gender expression, the following terms were selected from varying sources: “representation of gender,” “manifestation of gender,” “outward appearance,” “outward,” “expression,” “behavior,” and “perceived characteristics.” Although this does not capture every definition of these terms, this method will provide insights into the general opinion of these terms in the forensic field while highlighting the difficulty of using these terms in forensic reports.

Survey Section 4: Transgender-related Questions

Section four, Transgender Related Questions, addresses questions concerning transgender identification with a focus on gender-affirming medical procedures and the type of evidence, if any, anthropologists would use to make this identification (Table 3.4). This allows for the comparison of opinions on if anthropologists believe they can identify intersex individuals, or gender, while also assessing if the avenues of evidence used to identify these groups are the same. Additionally, we might render an opinion as to the extent that a biocultural approach might be used to identify a transgender decedent from the information gathered here. Lastly, we will also be able to assess the extent to which forensic anthropologists have worked with identifying transgender decedents. If there is a lack of recognition of these individuals in a forensic context, then as a field, we must address how we may become more acquainted with the characteristics of transgender and intersex decedents in forensic contexts.

Methods of Analysis for the Transgender related Questions

This survey section is very similar to the previous sections, with slightly different avenues of inquiry. For example, this section asks whether the forensic practitioner has worked on a case involving a transgender decedent. The analysis of this section will also evaluate the opinions in which forensic practitioners can employ statements such as "this individual is likely transgender." It also assesses what knowledge forensic practitioners might have on gender-affirming treatments or if the identity of a transgender decedent can be ascertained from the skeleton and material context. Additionally, the questions in this can be compared with other sections regarding intersex and gender, allowing for direct comparisons of the perspectives on each avenue of inquiry. Analyses will include tabulation of total counts, cross-tabulations, and additional statistical analyses.

More specifically, by asking if a participant has worked on a case involving a transgender decedent, we can address the extent to which transgender decedents are being identified in a forensic context. If there is a low number of respondents who have worked on a case involving a transgender decedent, this would denote that these individuals are not being properly identified due to unknown variations or unknown characteristics which might identify the person as transgender. Lastly, the survey asks about gender-affirming treatments and if participants thought they would be visible in the skeleton.

While the extent of these treatments on the skeleton is unknown, some aspects are known, such as the minimal effect which facial feminization surgery has on a *FORDISC 3.1* analysis (Schall *et al.* 2020). By asking this, we are able to assess the knowledge within the field regarding the effects of gender-affirming treatment on individuals. If many participants are unsure or disagree with what is known about the effects of gender-affirming treatments, then the field should consider education and training in methods for gender-affirming treatments. Some of the statistical analyses of this section include Chi-square goodness of fit, cross-tabulation of questions, and analysis of variation among respondents.

Table 3.4: Transgender-related questions included in the survey.

Survey Section 4: Transgender-related Questions	
Define "transgender"	Open Text
Have you worked on a case involving a transgender individual?	Yes; No; Unsure
Do you think it is important for forensic anthropologists to identify a decedent as transgender?	Yes; No; Unsure
Do you think identifying a decedent as transgender will improve the odds of identification?	Yes; No; Unsure
Do you think that forensic anthropologists can identify transgender individuals from the skeleton alone?	Yes; No; Unsure
Do you think that forensic anthropologists can identify a transgender individual from material evidence/clothing alone?	Yes; No; Unsure
Do you think that forensic anthropologists can identify a transgender individual from the skeleton and material evidence/clothing?	Yes; No; Unsure
Have you or would you comment on the possibility that a decedent is transgender in your skeletal analysis notes forms?	Yes; No; Unsure
Have you or would you report on the possibility that a decedent is transgender in your forensic anthropology report?	Yes; No; Unsure
Do you think that gender-affirming medical procedures (e.g., facial feminization surgeries, genioplasties, rhinoplasties) in adults influence metric or nonmetric skeletal data used in skeletal sex estimation?	Yes; No; Unsure
Do you think that gender-affirming hormone therapy in adults alters the skeleton in a way that influences skeletal sex estimation?	Yes; No; Unsure
Do you have anything to add regarding transgender individuals and forensic anthropology?	Open Text

Survey Section 5: Courtroom testimony Questions

Section five of the survey, courtroom testimony questions, contains questions related to courtroom testimony, like whether certain material items such as clothing and other non-skeletal evidence could be used in courtroom testimony, what forensic anthropologists are testifying to, and their experience level of testifying in courtrooms (Table 3.5). This section allows us to assess not only the experience level of the anthropologist as it pertains to testifying but also the extent to which the Daubert criteria influences our ability to identify transgender decedents using non-skeletal evidence and assess the general level of comfort providing testimony on a decedents gender, if they are intersex, or if they identified as transgender. By inquiring about what forensic anthropologists are testifying to, the survey will highlight the significance of gender and sex identification in the judicial system compared to trauma, DNA, and other avenues of inquiry.

Table 3.5: Courtroom testimony questions included in the survey.

Survey Section 5: Courtroom Testimony Questions	
Approximately how many times have you provided expert courtroom testimony?	Open Text
If you have provided expert courtroom testimony, what subjects have you testified to?	(select all that apply): Have never testified; Recovery scene processing (forensic archaeology); Biological profile (i.e., sex, age, stature, population affinity estimations); Gender or transgender estimations/identifications; Positive skeletal identification (e.g., antemortem-postmortem radiographic comparisons); Dental identification; Trauma (e.g., perimortem trauma, dismemberment, thermal alteration); Pathologies; Abuse/torture; Manner/cause of death; Chain of Custody (evidence handling); DNA analysis; Video superimposition; Other—open text)
Would you feel comfortable providing courtroom testimony regarding a decedent's gender?	Yes; No; Possibly; Unsure
Would you feel comfortable providing courtroom testimony regarding the possibility that a decent is intersex?	Yes; No; Possibly; Unsure
Would you feel comfortable providing courtroom testimony regarding the possibility that a decedent is transgender?	Yes; No; Possibly; Unsure
Do you think the use of decedent-associated material evidence, clothing, or scene context by forensic anthropologists in sex estimation is *Daubert* compliant (Daubert v. Merrell Dow Pharmaceuticals, Incorporated, 509 US 579, 1993.)?	Yes; No; Unsure

Do you think the use of decedent-associated material evidence, clothing, or scene context by forensic anthropologists in gender estimation is *Daubert* compliant (Daubert v. Merrell Dow Pharmaceuticals, Incorporated, 509 US 579, 1993.)?	Yes; No; Unsure
Do you have anything to add regarding the courtroom testimony of sex, gender, or transgender identities?	Open Text

Methods of Analysis for the Courtroom Testimony Questions

This section of the survey is focused on the value that forensic practitioners place on associated evidence testimony and gender and sex testimony in the courtroom and the types of testimony practitioners are conducting. While some previous works have addressed the Daubert Criteria and its value in scientific testimony, this survey addresses whether forensic anthropologists would feel comfortable providing testimony to a decedent's gender or if they identified as transgender or intersex. Additionally, the survey asks if material evidence, such as clothing, is Daubert compliant in sex and gender estimation. If a summary of responses shows that most participants think material evidence can be used for skeletal sex estimation and not gender, or vice versa, then further inquiries as to the extent of their use should be addressed. Analysis of responses will include tabulation and frequency counts of the types of courtroom testimony, cross-tabulation of age, profession, and courtroom testimony, and evaluation of comfort providing sex and gender testimony in the courtroom.

Survey Section 6: Sex Estimation of the Donor Individuals

The last portion, section six, of the survey specifically addresses the results of a skeletal analysis of two donor individuals (BU33 and BU34) at the Boston University Chobanian and Avedisian School of Medicine's Forensic Anthropology program. The purpose of these analyses is to provide the results of metric and nonmetric sex estimation methods that forensic anthropologists may use to draw a conclusion about the individual's sex. In addition to providing this information, we provide participants with two sets of material context that may suggest the decedent's gender as conventionally a man or a woman. Using a male and female donor, we approach this situation from both sides of the sex binary. In theory, this approach should open the possible conclusions for sex estimation to include transmale, transfemale, and intersex. Additionally, by providing the results of the skeletal analyses, we eliminate the need for participants to travel and perform their own skeletal analyses while limiting the amount of experience bias in their conclusions.

The material context that was suggested for men included "men's" underwear and jeans, a baseball hat, condoms, and amyl nitrate (i.e., "poppers"). The material context that was suggested for women, includes "women's" underwear, a skirt, a bra, and high heels. The purpose of these material items is to ask participants, if presented with this material context, how might it influence or be considered in their sex estimation. Each context is provided with Individuals 1 and 2 following the initial presentation of the metric and nonmetric sex analyses. While these material items do not always indicate a context associated with men or women, they represent what might conventionally be considered associated materials of men or women.

During the skeletal analysis for these individuals, they were cautiously evaluated for antemortem pathologies, trauma, and postmortem taphonomic alterations which may impede any *FORDISC 3.1* (Jantz and Ousley, 2005), Klales *et al.* (2012), or Walker (2008) assessments. Neither individual had significant taphonomic alterations or significant pathological conditions that could negatively impact the results of this research. Using Langley *et al.* (2016) as a reference guide, all possible skeletal measurements were taken and were subsequently applied to *FORDISC 3.1* (Jantz and Ousley, 2005). Measurements were taken using kit BUFA05 (GPM Anthropological Instruments), mandibulometer BUM01, and an osteometric board (BU-OB-1). Kit BUFA05 consists of a sliding caliper, a spreading caliper, a measuring tape, and several wood pointers. All measurements were measured to the nearest millimeter and degree (rounded up). All measurements were peer-reviewed by another graduate student within the Forensic Anthropology program and consistently fell within two millimeters of each observer.

Once all the measurements were inputted into *FORDISC 3.1*, an initial sex assessment of "any" population in the Forensic Data Bank was conducted (Jantz and Ousley 2005). Initial assessments revealed several measurements beyond two standard deviations from the mean. These measurements were remeasured for accuracy and removed as necessary for subsequent analyses to limit the influence of skeletal variation on sex estimations (Jantz and Ousley, 2012: 28). All probabilities for both individuals

(BU33 and BU34) fell within the normal parameters of the *FORDISC 3.1* analyses (see FORDISC help file). The final *FORDISC 3.1* cranial and postcranial outputs were saved and placed within the survey. These outputs provide survey participants with a *FORDISC 3.1* analysis of a hypothetical forensic case subjected to their review, interpretation, and reporting in their own words. This procedure eliminates the need for participants to travel and conduct skeletal measurements while providing a control standard, alleviating any additional biases from multiple observers.

Following the *FORDISC 3.1* analyses of Individual 1 (BU33) and Individual 2 (BU34), Klales *et al.* (2012) and Walker (2008) sex estimation assessments were conducted using the nonmetric traits described in their work. Both individuals were subjected to a Klales *et al.* (2012) sex estimation assessment, scoring the three pelvic traits, accordingly, using Figure 2 and trait score descriptions as a reference guide (Klales *et al.*, 2012: 107, 109). The corresponding Y-score produced by the equation from Klales *et al*. (2012) is then placed in a probability equation for female and male populations (Klales *et al.* 2012). Once calculated, observers can interpret these probabilities as a sex estimation of male, female, or indeterminant.

When conducting the Walker (2008) analyses, the traits were individually assessed, accordingly, and recorded for both individuals using Figure 1 and Table 1 as reference guides (Walker, 2008:41-42). The recorded scores were then placed into equation one from Table 9, as this linear discriminant analysis equation provides the best classification rates for American English individuals (Walker, 2008:47). The corresponding Y-score is then inputted into the probability equation for female and male populations; once computed, observers can then interpret the probabilities as a sex estimation of: male, female, or indeterminant (Walker, 2008:47). For the survey, each individual's trait scores from the Klales *et al.* (2012) and Walker (2008) and their respective probabilities for female and male likelihoods were placed in separate tables for survey participants to interpret. This procedure eliminates the need for participants to travel and conduct skeletal measurements while providing a control standard, alleviating any additional biases from multiple observers.

Interpretation and Reporting of Individual 1 and Individual 2

While Tallman *et al.* (2022) conducted a survey regarding the perspectives of forensic anthropologists, they lack the interpretation of skeletal analyses, including metric and nonmetric sex estimations from *FORDSIC 3.1* (Jantz and Ousley, 2005), Klales *et al.* (2012), Walker (2008) from survey participants. The information from this section of the survey will provide insights into how forensic practitioners evaluate a *FORDISC 3.1*, Klales *et al.* (2012), and Walker (2008) assessments with and without material context. The addition of contextual information is to mimic instances of sequential unmasking where initial skeletal assessments provide a subset of information, and material context may enhance etic perspectives on sex and gender. A goal of this exercise is to determine if a practitioner would maintain their opinion of the evaluated skeletal evidence or be willing to consider or include contextual information when rendering a sex estimation.

In addition, the survey assesses practitioners' confidence in their reporting based on the provided information. If there are variations in confidence levels between Individual 1 and Individual 2, a thorough evaluation will be conducted to understand the reasons behind these changes. To assess potential changes in confidence, we conducted a summary analysis of reported confidence levels, analyzing mean, median, and range differences. While unexpected, changes in confidence might be influenced by the positive correlation between sex estimation and experience level, although some methods can be used by less experienced practitioners (Klales et al., 2020).

Large differences in confidence levels may indicate shifts in opinion or changes related to the presented sex analyses or material context. Although uncommon, it is possible for one individual to show more changes between sex estimations based on revealed material context. In such cases, two possible reasons may account for this phenomenon: the sex analyses could be inconclusive or indeterminate. or cultural views of sex and gender might influence results, as certain self-identified males may not be associated with materials suggesting women, while some self-identified females might have or wear materials typically associated with males. Consequently, in cases of indeterminate methods or insufficient evidence to support a specific sex, nonbiological evidence may be essential for reaching a conclusion, but it may also limit the ability to draw definitive conclusions as the evidence might not strongly support either the skeletal sex or an alternative.

Individual 1: BU33

Individual 1 is a nearly complete skeleton willed to the Boston University Aram V. Chobanian and Edward Avedisian School of Medicine’s Anthropology program. This individual is known to be White, or of European American descent, 81 years old, and female. This individual’s most recurring pathological condition is the numerous osteophytic growths, eburnation, and hypertrophy found throughout the skeleton is consistent with osteoarthritis and osteoporosis (Ortner 2003:547). Furthermore, the right radius of this individual is fragmented and shows carbonization, a thermally altered border, and fracturing, all of which is related to a poor maceration process.

In addition to the abnormalities noted above, some artifacts of surgery are apparent in the skeleton. This individual had a hip arthroplasty of the left innominate and femur, likely due to arthritis or another form of hip joint degeneration (Johns Hopkins Medicine, 2022a). The acetabular fossa and femoral head areas show significant remodeling and osteophytic growth. This skeletal abnormality would likely have impacted the individual's stature and gait but unlikely caused significant skeletal changes impacting ancestry or sex estimations.

Additionally, the femoral head and portions of the greater and lesser trochanter of the left femur are absent and are replaced by an artificial head, which rests within the femur and is removable. This artifact impacts the left bicondylar length and max femoral length measurements and is noted in the forensic anthropological notes of this individual; the right innominate and right femur were used for the metric assessments to ensure that these artifacts of surgery did not impact the *FORDISC 3.1* analysis. In addition to the abnormalities found within the left innominate and left femur, the sixth lumbar vertebra (non-pathological) is fused to the first sacral vertebra (S1), which limits any attempt to measure the transverse and anterior-posterior diameters of S1. This author believes that the absence of the first sacral measurements does not significantly impact ancestral or sex estimations and would not greatly impact this research (See Flanders 1978). The mandible and cranium also show alveolar resorption, consistent with antemortem tooth loss. This antemortem tooth loss and resorption did not negatively impact the *FORDISC* 3.1 or nonmetric analyses. All measurements that involve this individual's pathological and taphonomic conditions are noted in the forensic anthropological notes forms.

Using metric and nonmetric analyses, the sex of the individual is female. Using the cranial nonmetric traits of Walker (2008), the nuchal crest was scored a 3; Mastoid processes a 2, Supraorbital margins a 3, glabella a 2, and mental eminence a 2. Using equation 1 for glabella, mastoid, and mental eminence traits, a pF of 0.847 suggests that the skeletal characteristics are consistent with female. Using the left pelvic nonmetric traits of Klales *et al.* (2012), the ventral arc was scored as 4, the subpubic contour a 3, and the medial aspect of the ischiopubic ramus a 3. Using the logistic regression for all three traits, a Pf of 0.912 suggests skeletal characteristics consistent with female.

Using a *FORDISC 3.1* cranial analysis was conducted using nine cranial measurements (Jantz and Ousley 2005). These measurements were compared against all populations in the Forensic Data Bank (FDB) (Jantz and Ousley, 2005). Sex estimation was estimated as Hispanic female with 0.482 posterior probability (F Typ 0.890), followed by White female with 0.254 posterior probability (F Typ 0.776). Additionally, a *FORDISC 3.1* postcranial analysis was conducted using 14 postcranial measurements (Jantz and Ousley, 2005). Primary sex estimation is Black female with 0.854 posterior probability (F Typ 0.556), followed by White female with 0.128 posterior probability (F Typ 0.272).

Individual 2: BU34

Individual 2 is a nearly complete skeleton willed to the Boston University Aram V. Chobanian and Edward Avedisian School of Medicine's Anthropology program. This individual is known to be White, or of European American descent, 74 years old, and male. Most of the spine has fused via bridging (osteophytic lipping) on the anterior surfaces of the centrum, consistent with spinal osteoarthritis (Ortner, 2003: 449-550). Additionally, the left innominate of this individual is fused to the sacrum. Skeletal measurements were attempted and noted, and during the *FORDISC 3.1* analysis, the right innominate was utilized. The fusion of the sacrum and innominate occurs at the junction of the posterior inferior iliac spine, preauricular sulcus, and the lateral sacral crest's lateral border. There are osteophytes and bony growths throughout the left and right os coxae, consistent with osteoarthritis, and minimally impacts the measurements taken for the *FORDISC 3.1* analysis. In addition to the osteophytes seen throughout the skeleton, there is an artifact of a hip-pinning surgery (internal fixation) on the left femur (Johns Hopkins Medicine, 2022b). Additionally, there is some bone remodeling on the posterior aspect of the superior left femur due to this hip pinning surgery and is also likely associated with the antemortem fracture (Wedel and Galloway, 2014: 265). This abnormality likely does not impact sex estimation analyses but may impact stature estimations.

Finally, this individual has alveolar resorption in both the mandible and maxillae, consistent with antemortem tooth loss. Which does not significantly impact the *FORDISC 3.1* analysis in this research. Of the abnormalities, the fusion of the sacrum and the left innominate would likely have the greatest impact on the metric and nonmetric sex estimations, but it does not impede any results from the survey.

Using the metric and nonmetric analyses, the sex of this individual is male. Using the cranial nonmetric traits of Walker (2008), the nuchal crest was scored a 5; mastoid processes a 3, supraorbital margins a 4, glabella a 5, and mental eminence a 5. Using equation 1 for glabella, mastoid, and mental eminence traits, a pM of 0.999 suggests skeletal characteristics consistent with the male sex. Using the pelvic nonmetric traits of Klales *et al.* (2012), the ventral arc was scored as 4, the subpubic contour a 4, and the medial aspect of the ischiopubic ramus a 3. Using the logistic regression for all three traits, a Pm of 0.926 suggest skeletal characteristics consistent with male.

Using a *FORDISC 3.1* cranial analysis was conducted using 14 postcranial measurements, a (Jantz and Ousley 2005). These measurements were compared against all populations in the Forensic Data Bank (FDB) (Jantz and Ousley 2005). Sex estimation was estimated as Japanese male with 0.379 posterior probability (F typicality 0.491) followed by White male with 0.279 posterior probability (F typicality 0.443). Additionally, a *FORDISC 3.1* postcranial analysis was conducted using 14 postcranial measurements (Jantz and Ousley, 2005). Primary sex estimation is White male with 0.476 posterior probability (F typicality 0.120) followed by White female with 0.388 posterior probability (F typicality 0.111).

Table 3.6: Sex estimations, interpretation, and reporting questions included in the survey.

Survey Section 6: Sex estimation, Interpretation, and Reporting.	
Individual 1	
How would you report the sex of Individual 1? Please write this like you typically would for a "sex estimation" section in a forensic anthropology report.	Open Text
Limiting your conclusions to the metric and nonmetric data presented above; how confident are you in your sex estimation?	0-9% 10-19% 20-29% 30-39% 40-49% 50-59% 60-69% 70-79% 80-89% 90-99% 100%
If, after your skeletal analysis, sequential evidentiary unmasking revealed that this individual was recovered with conventionally considered "women's" underwear, a skirt, a bra, and high heels, how would this factor into your reporting?	Open Text
If, after your skeletal analysis, sequential evidentiary unmasking revealed that this individual was recovered with conventionally considered "men's" underwear and jeans, a baseball hat, condoms, and amyl nitrate (i.e., "poppers"), how would this factor into your reporting?	Open Text
Individual 2	

How would you report the sex of Individual 2? Please write this like you typically would for a "sex estimation" section in a forensic anthropology report.	Open Text
Limiting your conclusions to the metric and nonmetric data presented, how confident are you in your sex estimation?	0-9% 10-19% 20-29% 30-39% 40-49% 50-59% 60-69% 70-79% 80-89% 90-99% 100%
If, after your skeletal analysis, sequential evidentiary unmasking revealed that this individual was recovered with conventionally considered "women's" underwear, a skirt, a bra, and high heels, how would this factor into your reporting?	Open Text
If, after your skeletal analysis, sequential evidentiary unmasking revealed that this individual was recovered with conventionally considered "men's" underwear and jeans, a baseball hat, condoms, and a bottle of amyl nitrate (i.e., "poppers"), how would this factor into your reporting?	Open Text
Do you have anything to add regarding the interpretation and reporting of skeletal and material evidence analyses?	Open Text

Methods of Analysis for the Interpretation and Reporting of Individual 1 and Individual 2

For both individuals, the sex estimations based on the metric and non-metric sex estimations were summed by “Male,” “Probable Male,” “Female,” “Probable Female,” “Intersex,” “Indeterminant,” “Transgender,” and “Not specifically stated.” We did not specifically ask or provide a question for respondents to select these options but rather asked them to render a sex estimation with the provided results. To tabulate these, each response was read individually. While not every respondent explicitly stated “male,” “female,” and “intersex,” most responses had a conclusion. Those that did not provide a specific estimation were considered indeterminant. Following the sex estimations, respondents were asked to provide their confidence levels based on the metric and non-metric sex estimations provided. These, while they do not represent confidence in the respondent’s ability to conduct a skeletal sex analysis, provide insights into one’s confidence in rendering an opinion on a skeletal sex estimation strictly from a metric and nonmetric analysis.

In addition to the sex estimations and confidence levels provided by the respondents, they were also asked if they would consider the material context that is supportive and non-supportive of the skeletal sex analysis in their sex estimation. This was not a selected option and was an open-response style question, which required the reading of each individual response for tabulation and analysis purposes. Each response for both the male and female context was read and then categorized as they would mention it in the notes or report, would not consider it but mention the evidence, not consider it at all, possibly consider it but mention it, yes they would consider it, and yes they would consider it and mention the material context. An example of those that were explicitly not considering it includes statements such as "*It would not factor into my reporting*," while those that were included in the mention included statements such as "*This would be noted and reported as their gender was probably cisgendered*," while those considered in the yes categories included statements such as "*We would suggest that the decedent was a trans person and suggest contacting the TransDoe Network*."

Once all the responses to the material context were categorized, a comparative analysis using Chi-square goodness of fit was used to see how the association of skeletal sex and supportive material context and skeletal sex and non-supportive material context was conducted. This was to see how respondents might report or consider changing, mentioning, or including the material context in their reporting or sex estimation. There is more variation in responses when the non-supportive material context is provided to respondents, as differing levels of education and experience will influence how one considers the material context in their reporting. An additional comparison can be made between the skeletal sex estimations using the metric and non-metric results. There is an expected association between individuals 1 and 2 and the "correct" reported sex, with little variation between these individuals.

Survey Analysis

After closing the survey, on September 16th, 2022, all recorded responses were maintained in the Qualtrics survey suite and saved as an SAV and xlsx file. This filing system ensured that the original data was maintained while having a second copy of the data to be analyzed and studied in SPSS and Excel. Once all data was stored properly, data organization and cleaning were essential to conducting quantitative and qualitative analyses. The initial steps were to review responses and eliminate duplicates, false responses, and those which are computer automated. These were determined by a lack of written response questions answered or those in which the data was inconsistent throughout the survey response, or it repeated other responses exactly. In terms of differentiating finished and unfinished responses, Qualtrics determines finished versus incomplete surveys as “finished” indicating the respondent reached an endpoint in their survey; whereas “unfinished” indicates that the respondent left their survey before reaching an endpoint and the session was closed manually or the “session expiration” had closed the survey (Qualtrics, 2021).

Since some survey questions did not require responses, and some questions are conditional, not all the responses labeled “finished” by Qualtrics are 100% complete. Any responses that had the conditional questions or non-required questions unanswered but all other questions answered were determined as complete. The conditional formatting inevitably brings the total “finished” survey responses lower than Qualtrics reported; however, the benefit of qualitative data, such as survey responses, is that even incomplete data is informative.

RESULTS

The survey was distributed via email listserv and was open for three months. At the closing of the survey (Sept. 16, 2022), responses were quantitatively and qualitatively analyzed. The initial tally had 161 responses; upon further inspection, 31 responses were blank. After removing these 31 blank responses, 130 responses were recorded from the survey. Sixty-nine responses were complete, while 61 were incomplete. While having a 100% completion rate of all survey responses would be astounding, any information obtained, even with incomplete responses, is still beneficial.

Survey Section 1: Demographics

As seen in Figure 4.1, most respondents in the survey identified their gender as female (59.2%), with the second majority as male (19.2%). Additionally, the majority (93/130, 71.5%); identified their sex as female, including “cis female,” “cis woman,” “AFAB,” and “xx” (Figure 4.2). While bisexual, heterosexual, and pansexual are traditionally viewed as sexualities, these responses ([7/130], Figure 4.2) could be that the respondents misunderstood the question or how they chose to identify their sex. The following table shows the unique responses categorized into the self-identified gender and sexes (Table 4.1 and 4.2). The mean age of respondents is 36.8 years, with a maximum age of 79 years, a minimum age of 17 years, and a standard deviation of 11.9 years.

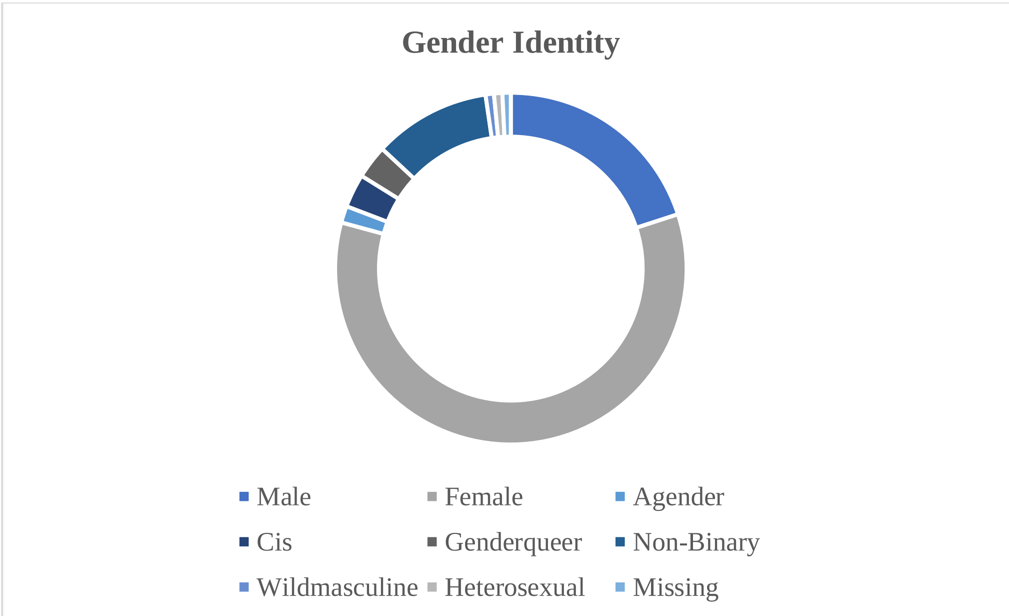

Figure 4.1. Pie chart showing percentage of self-identified genders of respondents; N= 130.

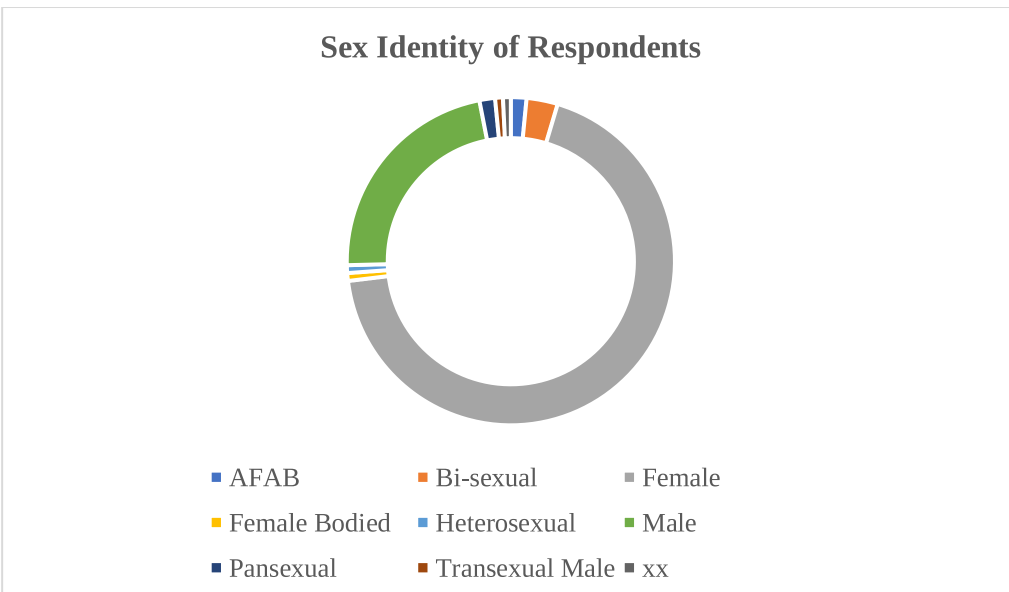

Figure 4.2. Pie chart showing percentage of self-identified sex of respondents; N= 130.

Table 4.1: Table showing gender identity categories and the unique survey responses.

Gender Identity	
Male	"Male,"
Female	"Female," "Cis-Female," "Ciswoman"
Agender	"Agender"
Cis	"Cis"
Genderqueer	"Genderqueer," "genderqueer female"
Non-binary	"Non-binary," "nonbinary ace," "nonbinary trans," "non-binary male"
Transgender Male	"Transgender Male"
Wildmasculine	"Wildmasculine"
Heterosexual	"Heterosexual"
Missing	Missing

Table 4.2. Table showing Sex identity categories and the unique survey responses.

Sex Identity	
AFAB	"AFAB"
Bi-sexual	"Bisexual"
Female	"biological female," "Cis female," "cis woman," "female," "woman," "Female-bodied," "xx"
Heterosexual	"Heterosexual"
Male	"male," "man"
Pansexual	"Pansexual"
Transexual Male	"Trans man"

Many respondents reported their social race as White, Mixed, or Hispanic (120/130, 92.3%), while all others (Table 4.3) comprised of 7.7% (Figure 4.3). A Chi-square test was conducted to compare the totals of White and non-White respondents between this survey and Tallman and Bird's (2022) survey. Non-White groups in this survey included all those not classified as White. A $X^2 = 3.0$ was calculated, with df = 1, at 95% confidence, and critical value = 3.841, representing an equivocal distribution between social races in this survey and Tallman and Bird (2022).

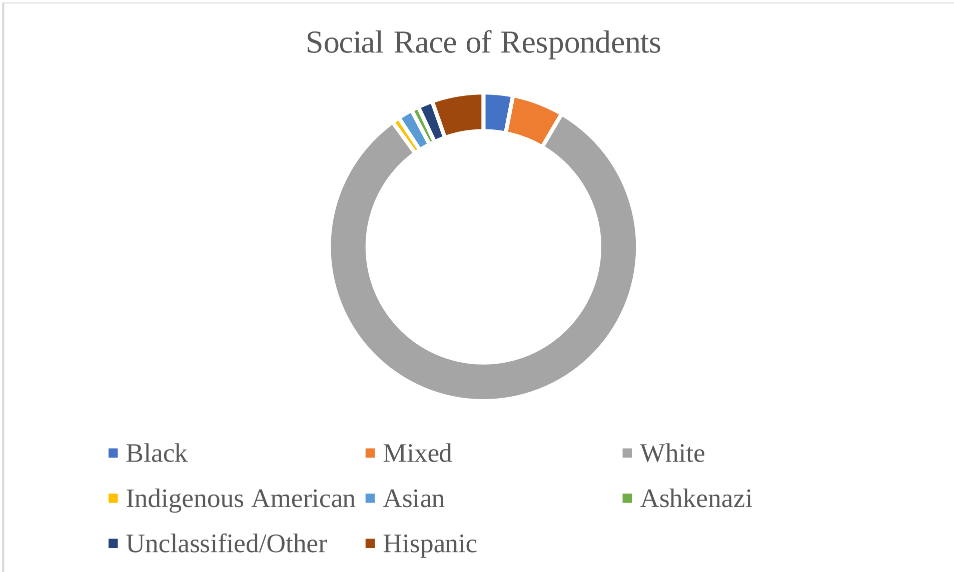

Figure 4.3. Pie chart showing self-identified social race of respondents by percent; N= 130.

Table 4.3. Table showing social race categories and the unique responses from survey responses.

Social Race	
Social Race Category	**Unique Responses**
Ashkenazi	"Ashkenazi"
Asian	"Asian," "Mongoloid"
Black	"African American," "Black," and "Black American".
Mixed	"European Ashkenazi," "mixed," "mixed Asian and White," "Mixed South Asian/European," "Mixed (Black/White)," and "multiracial," "mixed (USA based)."
White	"White," "White (United States)," "White British," "White Caucasian," "White," "non-Hispanic," "White?," "White/Latina," "European White," "European American/White," "American White," "European America," "European," "American," "White, Hispanic".
Indigenous American	"Indigenous American"
Unclassified/Other	"Male," missing (no response).
Hispanic	"Hispanic," "Hispanic White," "Mexican," "Latino," "Latina," "Latinx," "Hispanic/Latino-White," "Latino, mixed"

Furthermore, respondents were asked if they identify as part of the LGBTQIA community; (72/130, 55.38%) responded "No," (51/130, 39.23%) "Yes," and (7/130, 5.38%) "Preferred not to say." In comparing education and LGBTQIA status, a Kruskal-Wallis H test showed a statistically significant result (*p*-value<0.001) in LGBTQIA self-id and education; Kruskal-Wallis H = 15.637 df = 2. Additionally, a Spearman's rank-order correlation was run to determine the relationship between education level and whether a respondent has a certification from the American Board of Forensic Anthropology (ABFA). There is a strong, statistically significant, negative correlation between education and certification, (r_s (125) = - 0.474, *p*=<0.00.

Additionally, a Chi-square goodness of fit test was conducted to assess the level of education amongst all respondents, assuming a relatively equal distribution of respondents. A X^2= 26.110 was calculated, with df = 4 and a *p*-value <0.001, suggesting a diverse set of responses at varying education levels. To compare to the work of Tallman *et al.* (2022), a Chi-square test was run comparing the percentage of this survey's respondents with a bachelor's, master's, and PhD to those of Tallman and Bird's (2022) survey. A X^2= 7.55; df = 2; and p-value = 0.0229, and critical value of 5.991 at 95%, suggests our respondents represent different education levels from those in Tallman *et al.* (2022). While most respondents do not have a certificate from the ABFA (76.2%), most respondents have either a Ph.D. (58/130, 44.6%) or a master's (54/130, 41.5%) and identify as non-LGBTQIA and are White. In comparison to non-LGBTQIA members, those who identify as LGBTQIA, 25/130 report having a master's degree (19.2%), 14/130 have a doctorate (10.8%), and 9/130 have a bachelor's (6.9%).

Many respondents identified their profession and work context as Professor/Student and Academia (Figure 4.4 and 4.5). Additionally, 67.0% (87/130) of respondents reported having up to fourteen years of experience; among those with up to fourteen years of experience, most (40/127, 31.5%) had between five and nine years of experience. Furthermore, a Spearman's rank-order correlation was run to determine the relationship between the years of forensic anthropological experience and how often respondents participated in forensic skeletal analyses. There was a strong, statistically significant, positive correlation between the responses, (r_s (127 = 0.447, p=<0.001). Furthermore, a comparison of the differing levels of experience in Tallman *et al.* (2022) and this survey was made using a Chi-square goodness of fit test. A X^2= 52.59 was calculated; df = 6, and a p= <0.0001, indicating a significant difference in the years of experience between the surveys.

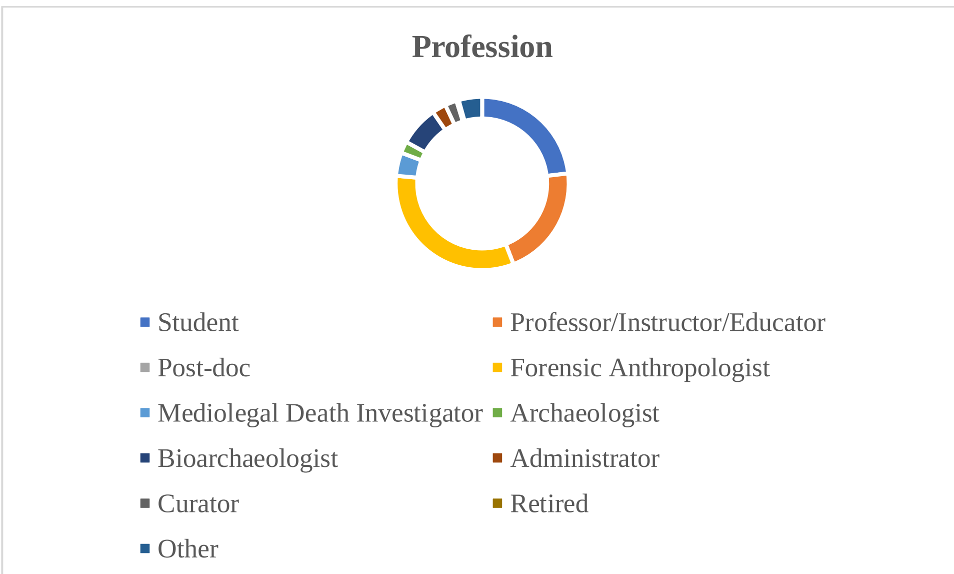

Figure 4.4. Pie chart showing percentage selected profession of respondents.

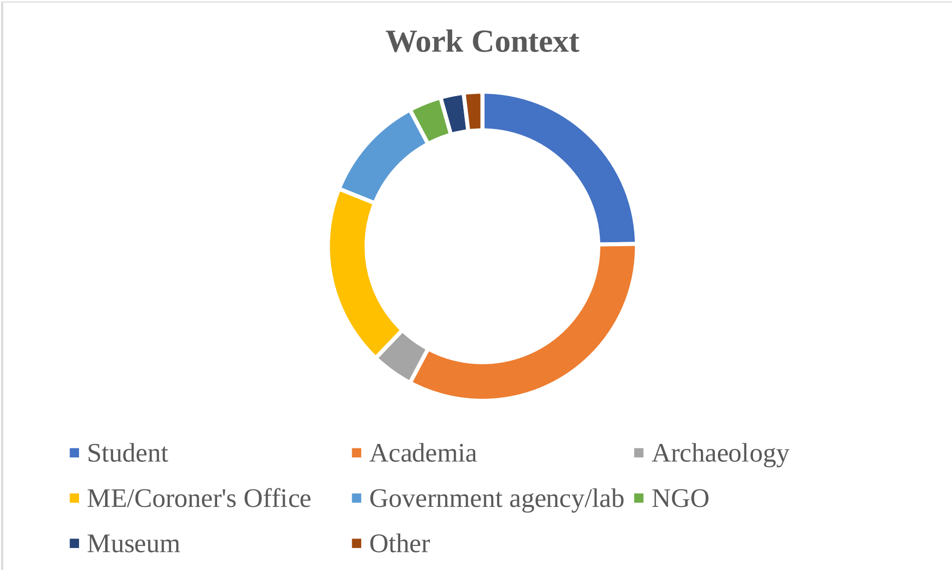

Figure 4.5. Pie chart showing the percentage of selected work context of respondents.

Survey Sections 2 and 3; Sex-Related and Gender-Related Questions

In terms of understanding and estimating skeletal sex and gender, there are consistencies amongst respondents when asked whether skeletal sex is predictive of gender self-identity, whether cranial or postcranial elements take precedence in reporting, and whether non-skeletal evidence is used to estimate sex (Table 4.4).

Table 4.4. Table showing the total responses when asked "Do you think skeletal sex is aligned with or predictive of gender self-identity?", "Do you or would you use any non-skeletal evidence to estimate sex?", and "When conducting a metric and nonmetric sex estimation of a complete skeleton, do the cranial or postcranial elements take precedence in your reporting?"

Survey Option	Do you think skeletal sex is aligned with or predictive of gender self-identity?	Do you or would you use any non-skeletal evidence to estimate sex?	When conducting a metric and nonmetric sex estimation of a complete skeleton, do the cranial or postcranial elements take precedence in your reporting?
Yes/ Cranial	18 (16.7%)	35 (32.4%)	4 (3.7%)
No/ Postcranial	72 (66.7%	54 (50.0%)	78 (71.6%)
Unsure/ Cranial and Postcranial Equally	18 (16.7%)	19 (17.6%)	27 (24.8%)
Totals	108 (100.0%)	108 (100.0%)	109 (100.0%)

The majority think skeletal sex is not predictive of gender identity (72/108; 66.7%), utilize postcranial over cranial in reporting (78/108; 71.6%), and most respondents do not use non-skeletal evidence for estimating sex (54/108, 50.0%). Additionally, when asked if they had anything to add about gender estimation in forensic anthropology, one reported:

"It's not ethical to apply a gender to a person (only they can do that) but it can be recorded about possible gender expression, and if it's reported by family in missing persons reports etc."

This implies that there may be ethical limitations in our reporting of gender to investigative teams or courtrooms. However, this also highlights that while we may not be able to identify a decedent's gender exactly, we may be able to identify their gender expression, specifically if there are indicators in missing persons reports.

Furthermore, while testimony relating to the identification of decedents is limited in courts (Survey Section 5), in response to "Would you feel comfortable providing courtroom testimony regarding the possibility that a decedent is intersex?" or "...is transgender?"; (62/94; 66.0%) were uncertain ("Possibly" and "Unsure") about providing testimony on an individual's gender as intersex; (74/94; 78.7%) were uncertain in testifying an individual as transgender. To further extrapolate gender's role in forensic anthropological work, respondents were asked whether they would comment on a decedent's gender in forensic anthropological reports and skeletal analysis notes. Half of the respondents were uncertain (Possibly and Unsure) (57/97; 43.9%) about providing the information in their skeletal analysis notes, while (66/97; 50.8%) are uncertain ("Possibly" and "Unsure") about providing such information in their anthropological reports. Interestingly, many respondents reported that they would include information as the decedent potentially being transgender in their skeletal notes (65/95; 68.4%) and anthropological reports (52/95; 54.7%). This may indicate that skeletal notes forms are more colloquial than anthropological reports, allowing additional opinions to be rendered or given than in anthropological reporting forms. In response to how one might report an intersex individual, a respondent reported:

"*Discussion of the shortcomings of skeletal sex estimation techniques given that traditional methods have been developed using only a binary framework, and* *acknowledgement that the individual may be intersex, but that skeletal sex estimations currently are not well-equipped to confidently determine this.*"

Table 4.5. Table showing whether respondents are reporting intersex, transgender, and gender in skeletal analysis notes and forensic anthropological reports.

Gender Reportng in Skeletal Analysis Notes and Forensic Anthropological Reports	Yes	No	Unsure	Possibly
Have you or would you comment on the possibility that a decedent is intersex in your skeletal analysis notes form?	51 (44.3%)	23 (20.0%)	41 (35.7%)	-
Have you or would you report an individual as intersex in a forensic anthropology report?	34 (29.6%)	31 (27.0%)	50 (43.5%)	-
Have you or would you comment on the possibility that a decedents is transgender in your skeletal analysis notes forms?	65 (68.4%)	6 (6.32%)	24 (25.3%)	-
Have you or would you report on the possibility that a decedent it transgender in your forensic anthropological report?	52 (54.7%)	10 (10.5%)	33 (34.7%)	-
Do you or would you report or comment on a decedent's gender in a forensic anthropology report?	8 (8.25%)	23 (23.7%)	13 (13.4%)	53 (54.6%)
Do you or would you comment on a decedent's gender in your skeletal analysis notes forms?	11 (11.3%)	29 (29.9%)	8 (8.2%)	49 (50.5%)

Furthermore, many respondents (67/130; 51.5%) reported that identifying the decedent's gender will likely increase the odds of identification while maintaining that skeletal sex is not aligned with gender. When asked about performing a sex estimation, what sex-related term is preferred (Table 4.6), (68/130; 52.3%) reported "sex," followed by "biological sex," (45/130; 34.6%), and "skeletal sex" (34/130; 26.2%); where the more apt descriptor "assigned sex" was only reported to be used by (25/130; 19.2%) of the respondents.

Table 4.6. Table showing respondent results to survey question: "When estimating sex from the skeleton, which sex-related term do you use/prefer in your report?"

Sex	68/130 (52.3%)
Biological sex	45/130 (34.6%)
Assigned sex (at birth)	25/130 (19.2%)
Anatomical sex	5/130 (3.8%)
Skeletal sex	34 (26.2%)
Other	6 (4.6%)

When asked about preferred sex analysis terminology, most (99/130, 76.2%) reported: "Sex estimation," followed by "Sex assessment" (28/130, 21.5%) and "Sexual dimorphism" (11/130, 8.5%). All other preferred terminology made up 13/130 (10.0%) of the respondents (Table 4.6). Of those strictly classified as other, were: "Assigned skeletal sex," "Binary sex," "Estimated biological sex," "Féminin / masculine features," and "Osteological sex".

Table 4.7 Table showing respondent results to survey question: "Which sex analysis terminology (for methodology) do you use/prefer for forensic anthropological applications (select all that apply)?"

Sex Estimation	99/130 (76.2%)
Sex Assessment	28/130 (21.5%)
Sexual Dimorphism	11/130 (8.5%)
Sex Determination	7/130 (5.4%)
Other (specify below)	3/130 (2.3%)
Sex Analysis	3/130 (2.3%)

Interestingly, when asked about when neither "male" nor "female" can be estimated, how do you report the information, "indeterminate" (73/117, 62.4%) seems to be preferred in the field (Table 4.7).

Table 4.8. Table showing respondent results to survey question: "How do you report sex when neither "female" nor "male" can be estimated?"

Indeterminate	73/117 (62.4%)
Unknown	15/117 (12.8%)
Other	15/117 (12.8%)
Inconclusive	14/117 (12.0%)

A Chi-square goodness of fit analysis was used to assess if respondents report sex when neither "female" nor "male" can be estimated in relatively equal chances. The four alternatives offered when "male" nor "female" can be estimated were "inconclusive," "indeterminate," "unknown," or "other." A $X^2 = 87.274$ was calculated; df = 3; and *p*-value <0.001. This suggests that while not all education levels, backgrounds, and experiences are the same, terminology in sex estimation is relatively the same. In other terms, forensic anthropologists consistently use "Indeterminate" over the other provided options. One reported

"*If possible, I try to describe each element that makes up the biological sex. If confined to a checkbox, I will generally select "inconclusive," as it leaves the door open for further analysis*."

While another reported that they use:

"*Ambiguous. I use "unable to be estimated" for when key traits for assessment are too damaged or not present. I realize this is going again[s]t precedent, and [I] wrote as much in my dissertation addressing this, but I do not believe any anthropologist should use "indeterminate" now since it is so vaguely defined in the literature and excludes remains with a combination of traits*."

Of those that reported the use of other terminology, not “Inconclusive,” “Indeterminate,” and “Unknown,” (5/15; 33.4%) reported utilizing the term “undetermined,” the other ten provided multiple terms or stated it was dependent on the reason sex could not be estimated. Additionally, respondents, much like the one above, rely on the skeletal material available to estimate sex and reported statements along the lines of:

> “*Depends on why sex can’t be estimated. “Inconclusive” if estimate methods are contradictory. “Indeterminate” if skeletal indicators are absent or insufficient due to postmortem damage.*”

While the terminology used in sex estimations is significant when it comes to reporting sex in forensic anthropology, the methodology is just as significant. The survey inquired as to the preferred methods for conducting a sex estimation (Figure 4.6). Most respondents reported using pelvic nonmetrics and cranial nonmetrics which shows consistency with other texts (Klales *et al.,* 2020). One respondent specifically referred to MorphoPASSE.

> “*I use MorphoPASSE, which combines nonmetric cranial and pelvic traits using a statistical framework that provides posterior probabilities/attributes that allow it to meet Daubert Standards.*”

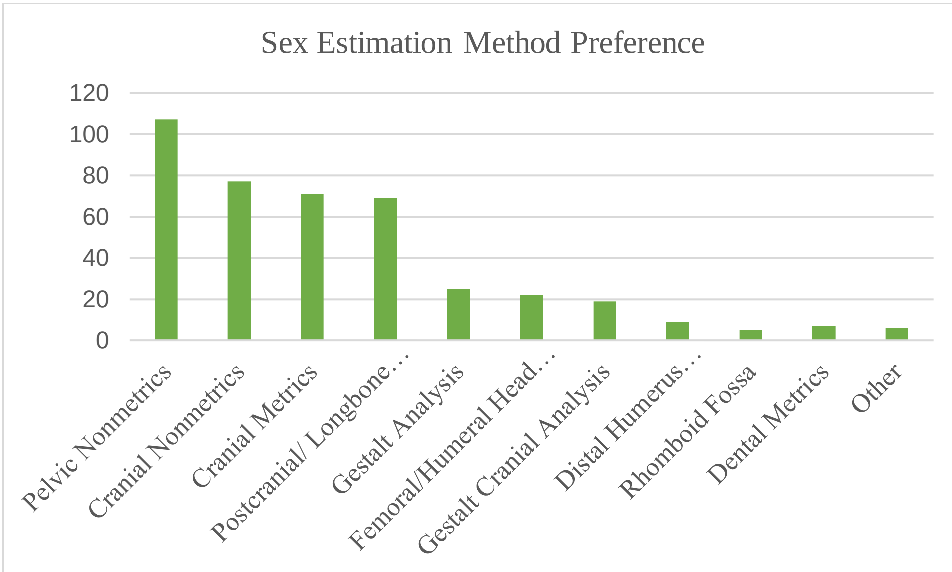

Figure 4.6. Bar graph showing respondent's preference of sex estimation methods by totals.

Specifically, MorphoPASSE is a program designed to estimate the sex of an individual using morphological traits of the pelvis and skull and comparing ordinal data from 2,500 individuals (Klales, 2018). Other respondents reported that while they use the methods provided in the survey, they "*[utilize] an array of methods depending on the circumstances*." While the likelihood that a single forensic anthropologist will employ more than three sexing methods, the varied responses here show the variability amongst forensic anthropologists in identifying the sex and potentially the gender of decedents.

Additionally, many respondents (54/108; 50.0%) report they would not use "non-skeletal evidence" in estimating sex, while some (35/108; 32.4%) would use "non-skeletal evidence." However, many, when reporting a decedent's gender, would use personal effects, clothing, or scene context (Table 4.9). Also, more than half of the respondents (77/130; 59.2%) would use signs of gender-affirming surgeries as evidence to report a decedent's gender. One respondent reported that the use of these materials depends on "*if you have access to the information*," which is in line with other respondents who reported they would use the gender reported from next of kin or family and tattoos/piercings.

Table 4.9. Table showing "What evidence would you use to report a decedent's gender?" selected choice.

Signs of gender-affirming surgeries	77
Personal effects	63
Clothing	61
Scene context	48
Scene photography	37
Information provided by law enforcement or investigative agency	27
Other	19
None (would not report)	18

Interestingly, respondents reported that they were unsure (55/115; 47.8%) or did not think (56/115; 48.7%) forensic anthropologists could identify an individual as intersex from the skeleton alone, while (4/115; 3.5%) do think forensic anthropologists can identify intersex using the skeleton alone. However, when asked how respondents would report on an individual potentially being intersex, respondents said they would describe the characteristics seen in the skeleton attributed to the idea of an intersex individual. Though presently, there are no known skeletal characteristics known to be intersex. Some reported that they would state, "*Skeletal parameters are inconsistent with the reported gender*." or similar statements. Three, 3/130; 2.3%) of respondents report that if present, they would comment on any surgical or cosmetic interventions which may have taken place, which highlights the role gender-affirming treatment might have in forensic anthropological contexts as it pertains to identifications.

One respondent reported that the estimation of intersex individuals is more chromosomal and would be hesitant to label an individual as intersex and hopes for further studies on the skeletal development in intersex individuals, while another would refer individuals to the pathology report for patient treatment and patient history. Lastly, when compared to whether respondents thought transgender individuals could be identified from the skeleton alone, using a Chi-square goodness of fit, a $X^2 = 9.36$ was calculated; df = 2; and p-value = 0.0093. The Chi-square result would suggest differing opinions on whether an intersex individual and a transgender individual can be identified from the skeleton alone.

In terms of identifying gender in forensic anthropology, the majority would possibly include the information in their notes (49/97, 50.5%) and would also possibly include the information in their reports (53/97, 54.6%). However, considering that gender is a social construct, and many respondents rely upon biological and skeletal observations, a higher number of individuals reported that they would not include such information in either their notes or reports; in fact, 29/97 (29.9%) report “No” for including in notes, and 23/97 (23.7%) report “No” for including in reports. This is also seen among the respondents when asked: “Do you think that estimates of skeletal sex are aligned with or predictive of gender self-identity?” The vast majority of respondents report that it is not (72/108; 66.7%), while those who were uncertain (18/108; 16.7%) or think it is (18/108; 16.7%), are equally split. Some comments specifically regarding gender estimation in forensic anthropology include:

"*We need to be extremely cautious about the kinds of assumptions that might go into associating clothing or personal effects with gender or sex. The presence of a skirt, for example, does not necessarily indicate an individual who identifies as female. However, I have worked on cases where gender-associated personal effects were effective in assisting with identification and heard about cases where personal effects were ignored in favor of biological/skeletal sex causing a case identification to be delayed by years. What we need is nuance.*"

And:

"*As noted above, I believe gender cannot be appreciated via the skeleton - even in the presence of gender affirmation evidence of surgical intervention, that still does not specify the decedents self-identification. Though evidence of surgical intervention would be noted/documented.*"

Additionally, many respondents reported that one could not identify transgender individuals from material evidence/clothing alone (60/95; 63.2%), while 31/95 (32.6%) were uncertain. Additionally, most respondents were uncertain (54/95, 56.8%) or did not think (34/95; 35.8%) transgender individuals could be identified by the skeleton alone. On the contrary, some respondents also reported that forensic anthropologists could identify an individual as transgender from the skeleton and material clothing (29/95; 30.5%). Additionally, many think that gender-affirming medical treatments influence skeletal sex estimations (66/95; 69.5%), which is consistent with respondents who reported that they would use gender-affirming surgery (77/130; 59.2%) in reporting the decedent's gender. Though there is some uncertainty about gender-affirming hormone therapy influencing skeletal sex estimations (57/95; 60.0%).

For example, one respondent reported.

"*For the question regarding hormones and altering the skeletal analysis. It depends on a number of factors including when they started hormone therapy and (if started prepubescent) if puberty-blockers were used. I believe that even when started as an adult ([age];25) the hormones would eventually have some effect but not drastic enough to alter a skeletal assessment.*"

Furthermore, one respondent noted, "*AFAB cis women also get feminization surgeries*," which highlights a potential issue using gender-affirming treatments such as facial feminization and masculinization surgeries, such as a genioplasty or rhinoplasty, as an indicator of intersex or transgender decedents. However, individuals who identify as transgender or intersex who have pursued FFS/FMS will likely have undergone multiple facial surgeries, while it is likely that cis individuals will typically get one type of facial surgery for reasons other than gender (Berli *et al.*, 2017; Hodgkinson 2022)

Defining Gender Identity

When asked to define gender identity, a person's internal sense of being male, female, some combination of male and female, or neither male nor female, respondents were generally consistent in stating "self-identified" or an iteration thereof (Merriam-Webster, 2022). The following image is from tagcrowd.com, showing the generated word cloud excluding the terms "gender" and "identity" as respondents started their definitions with

"Gender identity is…" (Figure 4.7). The key terms that were analyzed in the responses were: "internal sense," "concept of self," "feel(s)," "view(s)," "self," "internal experience," "individual," and "sense of self.".

Figure 4.7. Tagcrowd.com output, showing the most common words for defining gender identity, excluding "gender identity" by frequency.

"Internal" was tabulated 1/1215 (0.1%), and "sense" was tabulated 8/1215 (0.66%) times. "Self" and its iterations were tabulated 30/1215 (2.47%) times; more specifically, "self-defined" 2/1215 (0.16%), and "self-identify" 1/1215 (0.08%). "Internal" and its iterations were tabulated 3/1215 (0.25%) times, and "feels" was tabulated 11/1215 (0.91%). "individual" was tabulated 38/1215 (3.13%), and "person" and its iterations were tabulated 27/1215 (2.23%) times. Interestingly, "identifies" and its iterations, excluding "identity," was tabulated 37/1215 (3.0%) times. As we can see by the visual above, the most common words used by the respondents include "individual," "identifies," feels," person," "biological," "social," and "sex." The term "sex" is used at least 18/1215 (1.5%) times among the responses, consistently acknowledging that an individual's gender identity may or may not be related to their "biological sex." Examples from respondents include:

"Gender identity is how an individual can identify based on biological sex or other concepts. It is a spectrum and gender identity can change through time,"; "gender that most fits an individual, regardless of biological sex;" and *"How an individual views themselves within the generally accepted culturally-defines* [sic] *gender term. Regardless of biological sex."* The term behavior was tabulated 3/1215 times (0.25%); this term would more closely align with definitions of gender expression, as certain behaviors express one's feelings or identity; however, that is not to say a definition of gender identity based on behavior is wrong. For example, one of the two respondents defined gender identity as the interpretation of behaviors associated with men or women is what gender identity is based upon:

"The social identity that you feel most suites you, this can range from binary masculine/male behaviors to feminine/woman behaviors, a mix of these, or a rejection of the binary."

Defining Gender Expression

When asked to define gender expression and how someone outwardly presents their gender to the external world, respondents were generally consistent. Most definitions consisted of some iteration of outward expression, behavior, customs, or aesthetics; however, there were three responses that the respondent reported they did not know, and one respondent stated, "*I guess…*". The iterations of not knowing included: "*??,*" "*I don't know how,*" and "*No idea*." Of the responses to this question, the provided definitions of gender expression are basic in that they were able to discern that it is how one identifies or presents, and that it is social, but did not offer additional information. The following image was from tagcrowd.com, showing the generated word cloud excluding the terms “gender” and “expression” as respondents started their definitions with “Gender expression is…” (Figure 4.8).

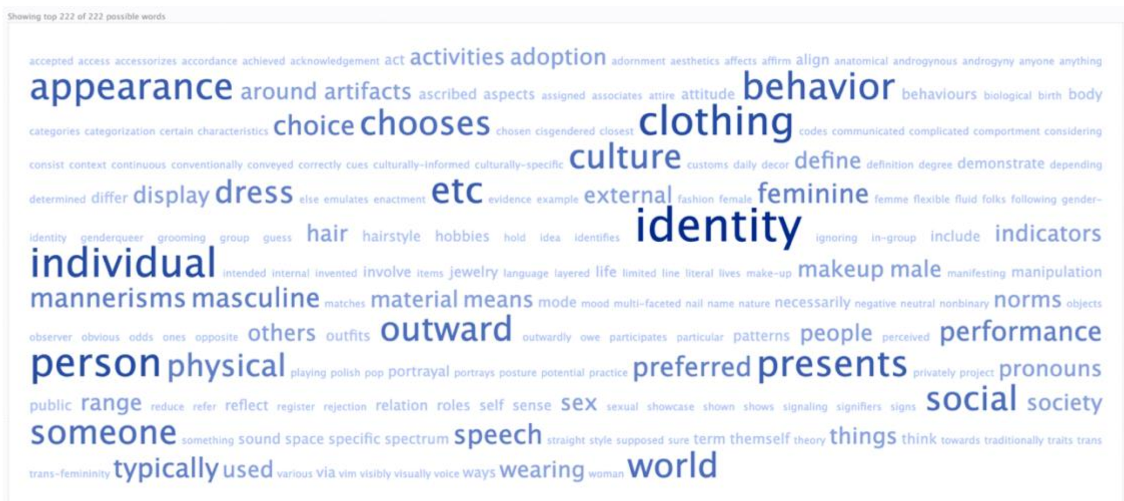

Figure 4.8. Tagcrowd.com output, showing the most common words for defining gender expression excluding “gender” and “expression” by frequency.

Some of the key terms of the 1330 words used (including common words) that were looked for specifically include: “representation,” “manifestation,” “appearance,” “outward,” “behavior,” and “perceived characteristics.” As we can see in the visual representation of the respondent’s definitions, “representation” does not appear among the definitions, “outward” was used 10/1330 (0.75%) times, “manifestation” was used 1/1330 (0.08%) times, “behavior” 17/1330 (1.28%), “appearance” 14/1330 (1.1%), “perceived characteristics” appeared 1/1330 (0.1%). While the specific words that were searched for were not all commonly used, this method has highlighted several words suggesting a consensus that gender expression is a cultural (12/1330, 0.9%) or social (12/1330, 0.9%) phenomenon, which is presented (14/1330, 0.1%), performed (6/1330, 0.5%), and related to behavior (17/1330, 1.3%).

Defining Transgender

When asked to define transgender, relating to, or being a person, whose gender identity differs from the sex the person had or was identified as having at birth, respondents were generally consistent. Most individuals responded with definitions aligned with the concepts of gender differing from the sex assigned at birth. The following image shows the most common words used by respondents, excluding transgender, using tagcrowd.com, the larger the word, the more times it was used by the respondents (Figure 4.9). As we can see, the most common words utilized by respondents include “gender” (86/1490; 5.8%), “identity,” and “identifies” (63/1490; 4.2%); additionally, they used “individual” (34/1490; 2.3%), “person” (29/1490; 1.9%), “someone” (13/1490; 0.9%); also “birth” (54/1490; 3.6%), and “assigned” (49/1490; 3.3%).

Figure 4.9. Tagcrowd.com output, showing the most common words for defining transgender, excluding "transgender" by frequency.

The key terms which were selected from various definitions for comparison include: "gender identity," "sex," "birth," "gender," "differ," or "different from birth," and "personal identity," "hormone(s)," "transition," or "transitioned." The term "birth" including "born" was tabulated 59/1490 (1.0%) words used. Specifically, "transition" was tabulated 3/1490 (0.2%). Terms that may indicate or denote a "transition" may include "treatments" (1/1490, 0.1%), "surgery" (5/1490, 0.3%), "reassignment" and "reaffirming" (2/1490, 0.1%), and "medically enhanced" (1/1490 (0.1%). The terms for comparison were tabulated as "sex" (69/1490, 4.6%) times, "gender" (86/1490, 5.8%), "birth," and "born" (59/1490, 4.0%), "person identifies" (28/1490, 1.9%), "hormone" (1/1490, 0.1%)), "gender" (86/1490, 5.8%) and "identity" (32/1490, 2.1%). Uniquely, one individual stated:

"I've made it habit to stop "defining" terms. They change to rapidly, always leave someone out, and are not for me to define. The cultural context of the word has a co[n]notation of changing one's culturally perceived sex to the gender they most relate to."

Define Sex, Assigned Sex, and Biological Sex

When asked to define sex, assigned sex, and biological sex or the preferred terms in reporting, these terms are generally referring to "the biological and physiological characteristics that define humans as female or male [however,], these sets of biological characteristics are not mutually exclusive … but these characteristics tend to differentiate humans as females or male" (Council of Europe, 2022). The following image is from tagcrowd.com word cloud generator, showing the most common words, excluding the words "assigned," "biological," and "sex" (Figure 4.10).

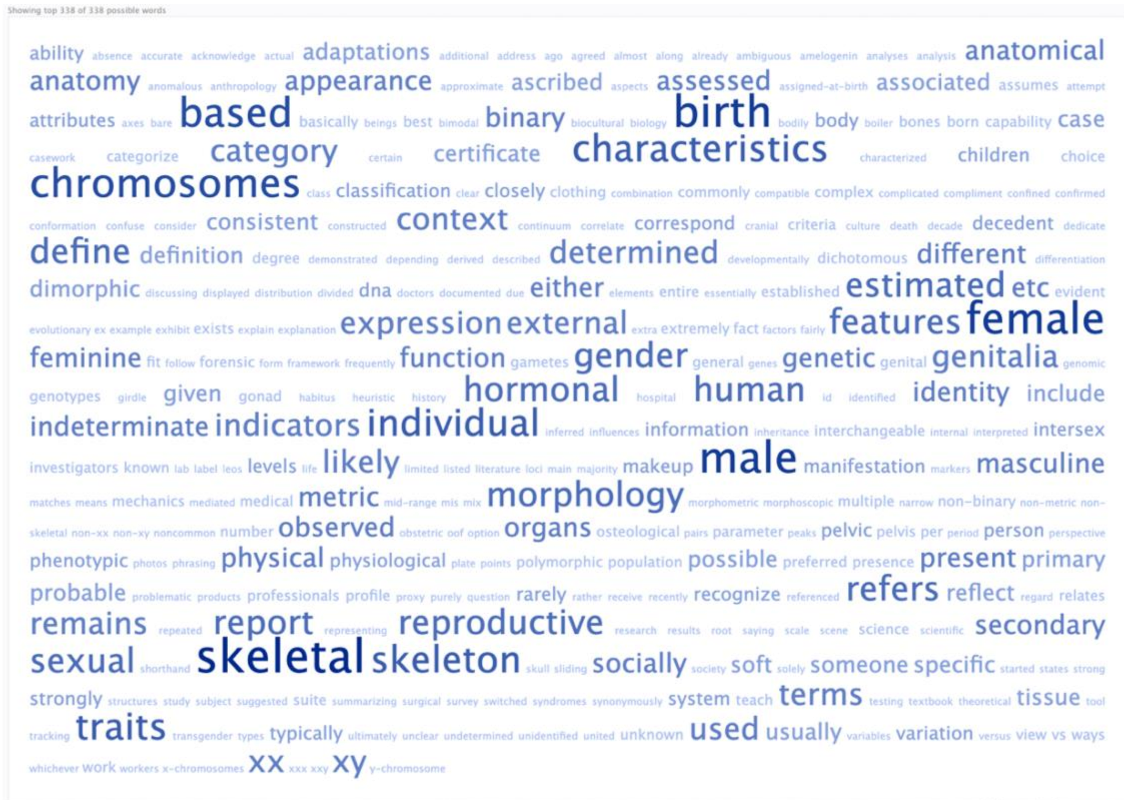

Figure 4.10. Tagcrowd.com output, showing the most common words used by respondents "sex," "assigned," and "biological" by frequency.

As we can see from the word cloud, some of the most common terms used by the respondents include "skeletal," "skeleton,", "male," "female," "morphology," "genitalia," and "reproductive." The terms which are used for comparison include: "medical profession," or "doctor," "external anatomy," "chromosome," "sex characteristics," and "physical anatomy," "physical conditions or characteristics," "hormone," and "physiological features." Chromosome, hormone, XX, XY, XXX, XXY were tabulated at least 30/2248 (1.3%) terms used. "External" was tabulated 8/2248 (0.4%) times, "doctor" was tabulated once (0.04%), "genitalia" and "gonad" were tabulated 12/2248 (0.5%) times, "hormone" 10/2248 (0.4%), and "physical" was tabulated 9/2248 (0.4%).

Interestingly, "DNA," "genes," and "genetic" were tabulated 9/2248 (0.4%) times, which is a constituent of a chromosome. Chromosomes are cells constructed of genes (Cleveland Clinic, 2023). Considering DNA as a part of chromosomes, this increases chromosomes and their iterations to 40/2248 (1.8%) times. Medical(ly) was tabulated 4/2248 (0.18%).

Survey Section 4: Transgender-Related Questions

Regarding whether or not forensic anthropologists think gender-affirming treatments affect sex estimations, some (23/95, 24.2%) respondents reported uncertainty about gender-affirming treatments (FFS/FMS/Genioplasties/etc.), while more (57/95, 60.6%) were uncertain. More respondents (66/95, 69.5%) reported that gender-affirming treatments (FFS/FMS/Genioplasties/etc.) affect sex estimations. While only 25/95 (26.3%) think hormones influence sex estimations, and 60.0% (57/95) were "unsure." A Chi-square analysis was run to assess the association between "Do you think gender-affirming hormone therapy in adults alters the skeleton in a way that influences skeletal sex estimations?" and "Do you think that gender-affirming medical procedures (e.g., facial feminization surgeries, genioplasties, rhinoplasties) in adults influence metric or nonmetric skeletal data used in skeletal sex estimations?" A X^2 = 83.9 was calculated; df = 2, and a p= <0.0001, suggesting a difference in opinions on the effects of gender-affirming hormone treatments and gender-affirming medical procedures on skeletal sex estimations.

Survey Section 5: Courtroom Testimony Questions

An additional measure of experience in the field is the amount of testifying experience. This was assessed by asking respondents if they have testified, and what was the topic; and a total of 56/130 (43.1%) of the respondents have never testified, while the rest have had varying experiences testifying to trauma analysis (26/130, 20.0%), scene processing (14/130, 10.8%), biological profile (13/130, 10.0%), and other forms of testimony (33/130, 10.0%) (Figure 4.11).

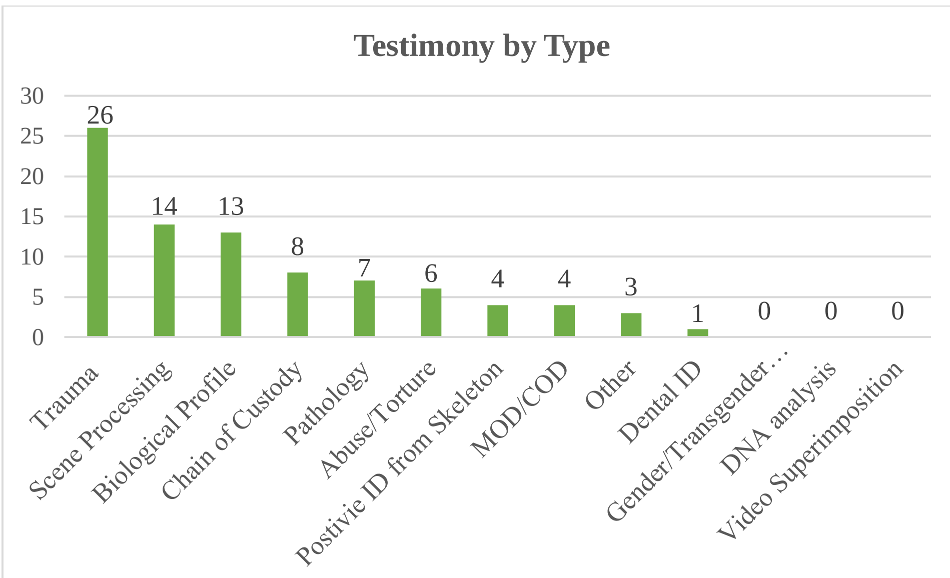

Figure 4.11. Bar graph showing the types of testimony conducted by respondents.

Addressing the question: “If you have provided courtroom testimony, what subjects have you testified to? (Select all the apply).”; the data reveals some insights (Figure 4.11). While not the primary topic of courtroom testimony, the biological profile makes up 17.5% (13/74) of all testimony types among respondents. Narrowing down testimony strictly related to identification purposes, only 13.9% (18/130) have testified to items directly relating to the identification, excluding pathology. If we consider pathological conditions as a proxy for identification, then testimony relating to identification raises to 19.2% (25/130). This does not consider material context or trauma as a manner of identification. Not surprisingly, no participants have testified to gender/transgender estimations (0/130 or 0.0%).

To assess the extent to which the *Daubert* criteria influence gender estimations, sex estimations, and forensic anthropologists' assessment of associated material evidence, questions regarding courtroom applicability were asked. Less than half of respondents (43/91, 47.3%) are uncertain if using material evidence for sex estimation is *Daubert* compliant. Additionally, half respondents (54/108, 50.0%) would not use non-skeletal evidence to report sex. Regarding testifying to gender (59/94, 62.8%) and identifying an individual as intersex (62/94, 66.0%) and transgender (74/94, 78.7%), most responded "possibly" or "unsure." There is an expected association between the number of people who have testified to gender 0.0% (0/130), those who would feel comfortable providing testimony, and those that reported they have worked on a case involving transgender (19/96, 19.8%) or intersex individuals (8/115, 7.0%).

A Chi-square goodness of fit was conducted to measure the association between those having worked on a case involving a transgender decedent (19/96, 19.8%) and those who have testified to gender (0.0%, 0/130). A X^2 = 58.86 was calculated; df = 1, and a p = <0.0001, corrected for continuity[1], X^2 = 60.32 uncorrected, suggesting a significant difference between the two. Additionally, a Chi-square analysis was done to

[1] Yates correction for continuity is used to reduce the error in the approximation, which deducts 0.5 from the observed and expected value and ultimately increases the p-value (Watson, 2013).

compare those having worked a case involving a transgender decedent and those who would be willing to testify to that topic, and a second analysis was also done for those having worked a case involving intersex decedents. A X^2 = 67.98 was calculated; df = 2, and a *p* = <0.0001 was calculated for those having casework involving transgender decedents and those who said they would be comfortable testifying to that topic. A X^2 = 33.69 was calculated; df = 2, and a *p* = <0.0001 was calculated for those having casework involving intersex decedents and those who said they would be comfortable testifying to that topic.

Survey Section 6: Sex estimation, Interpretation, and Reporting

At the end of the survey, respondents were provided with a *FORDISC* 3.1(Jantz and Ousley 2005), Klales *et al.* (2012), and Walker (2008) output asked how they would report the sex of two individuals from Boston University's Forensic Anthropology program (Table 4.6). Respondents were asked to provide how confident they were in their estimation, followed by being asked how certain material contexts would factor into their reporting. One context can be considered men's and the other women's. Individual 1 is female, with the FORIDSC 3.1 (Jantz and Ousley, 2005), Klales *et al.* (2012), and Walker (2008) sex estimation analyses corresponding with the known information (see methods). Individual two is male, with the *FORDISC 3.*1 (Jantz and Ousley, 2005), Klales *et al.* (2012), and Walker (2008) analyses corresponding with the known information (see methods). The provided context typically associated with women includes: "women's" underwear, a skirt, a bra, and high heels. The provided context typically associated with men includes: "men's" underwear and jeans, a baseball hat, condoms, and amyl nitrate (i.e., “poppers”). The following table (Table 4.10) presents the respondent’s estimated sex for both Individual 1 and Individual 2 (*FORDISC* 3.1, Klales *et al.* (2012), and Walker (2008).

Table 4.10. Estimated sex for Individual 1 (left) and Individual 2 (right) using skeletal analysis only (*FORDISC 3.1*, Klales *et al.* (2012); Walker (2008).

Individual 1 (Female): FORDISC 3.1 female posterior probability = 0.854 (f typicality = 0.556). Walker (2008): Female (prob. = 0.847). Klales *et al.* (2012): Female (prob. = 0.912)	**Estimated Sex**	**Skeletal analysis only**	**Individual 2 (Male): FORDISC 3.1 male posterior probability = 0.476 (f typicality = 0.120); Walker (2008): Male (prob. = 0.999); Klales *et al.* (2012): Males (prob. = 0.926)**	**Estimated Sex**	**Skeletal analysis only**
	Female	35/51 (68.6%)		Female	0/48 (0.0%)
	Probable Female	9/51 (17.6%)		Probable Female	0/48 (0.0%)
	Intersex	1/51 (2.0%)		Intersex	0/48 (0.0%)
	Indeterminant	2/51 (3.9%)		Indeterminant	2/48 (4.2%)
	Probable Male	0/51 (0.0%)		Probable Male	10/48 (20.8%)
	Male	0/521(0.0%)		Male	34/48 (70.8%)
	Transgender	0/51 (0.0%)		Transgender	0/48 (0.0%)
	Not Specifically Stated	4/51 (7.8%)		Not Specifically States	2/48 (4.2%)

An anticipated association exists between the material context and the estimated skeletal sex for both individuals (Individual 1: women's context and Individual 2: men's context). The proportions of respondents considering or not considering the material context for these individuals were compared using a Kolmogorov-Smirnov One-Sample Test. For the supportive context, a test statistic of 0.09 was calculated (alpha = 0.05, significance level = 0.1904, n = 51), indicating some variation in responses between the two individuals. However, a greater variation is expected when the context is non-supportive of the estimated skeletal sex. To assess this, the proportions of respondents who would and would not use the supportive material context were used as an expected distribution for the non-supportive material context. A second Kolmogorov-Smirnov One-sample test was performed to compare the opposing contexts for Individuals 1 and 2, resulting in a test statistic of 0.153 (alpha = 0.05, significance level = 0.1904). This indicates a greater variance of responses when reporting non-supportive material context information.

Individual 1

For individual one, the majority of respondents reported that based on the *FORDISC 3.1* (Jantz and Ousley, 2005), Klales *et al.* (2012), and Walker (2008) analyses, the individual was female (35/51, 68.6%), nine (17.6%) reported that the individual was probably female, one respondent (2.0%)mentioned intersex, two (3.9%)respondents reported indeterminate or undetermined, and four (7.8%) did not provide a specific sex estimation (Table 4.10). In response to the question regarding whether sequential unmasking revealed women’s clothing/materials would influence their reporting, 30/51 (60.8%) would likely mention the evidence associated with the individual in some manner in their report, regardless of it influencing their sex estimation. While mentioning the evidence was common among the respondents, most respondents reported they would not consider it in their sex estimation of the individual (37/51,72.5%), with 7/51 (13.7%) reporting they would consider it.

Regarding the sequential unmasking revealing materials associated with men most respondents (41/51, 80.4%) said they would mention it in their reports regardless of it being a factor in their sex estimations. Additionally, 34/51 (66.7%) respondents would not factor/consider the male clothing in their sex estimation, while three (3/51, 5.9%) reported they would consider it in their estimations. Seemingly, respondents reported that the presence of male clothing, in contrast to the sex estimations provided by *FORDISC 3.1*(Jantz and Ousley, 2005), Klales *et al.* (2012), and Walker (2008), would give pause to the initial reporting, but ultimately the context would only factor into the investigation and not the actual reporting or sex estimation. This maintains that clothing has or will have little influence or takes place in skeletal sex estimations. One individual reported:

> *"Following recovered evidence such as male clothing, it can be suggested that the individual is possibly transgender (biologically female but with a male gender identity)."*

While another reported:

> "*In our society, it is more acceptable for women to wear "men's" clothing than for men to wear women's clothing. The only thing that *might* be slightly odd is the presence of men's underwear, but I still probably wouldn't think much of it."*

Individual 2

For Individual 2, most respondents reported that based on the *FORDISC 3.1* (Jantz and Ousley, 2005), Klales *et al.* (2012), and Walker (2008) analyses, the individual was male (34/48, 70.8%), with ten reporting probable male (10/48, 20.8%), two reporting indeterminate or undetermined (2/48, 4.2%), and two not reporting (2/48, 4.2%). Regarding the sequential unmasking of materials associated with women, more than half of the respondents (26/48, 54.2%) would mention it in their reports regardless of it being a factor in their sex estimation. In addition, 16/48 (33.4%) of the respondents would not mention the material evidence in their reporting of sex estimation, while eight (8/48, 16.7%) would consider mentioning the context in some manner. One respondent who reported the sex of the individual as probably male stated:

> *"Personal effects associated with the individual are those most commonly seen worn by women. This could suggest that the individual did not ascribe to a gender that matched their biological sex."*

While another reported the sex as male stated:

> "*This should factor into secondary analyses of the skeletal remains but should not cause an immediate change in sex estimation until after all evidence is taken into consideration."*

One other individual who reported the sex as probable male stated:

> "*Considering the low posterior probabilities and typicalities in the FORDISC results, I would definitely say "possible" male instead of "probable" male and*

may comment that this individual could be female or could be a transfeminine individual of biological/skeletal male sex."

Regarding the sequential unmasking of material evidence associated with males, 23/48 (47.9%) respondents would likely mention the findings in their report regardless of it influencing their sex estimation. Thirty (30/48, 62.5%) respondents would not consider the material items in their sex estimation, while nine (9/48, 18.8%) would consider it a factor in their estimation. One respondent who reported the sex of the individual as male stated: "*This would help establish the identity of the individual in my reporting, as it might suggest that their biological sex may be male and that they also presented as male.*" When confronted with sequential unmasking that revealed materials commonly associated with men, in comparison, another reported that more material context is necessary, and the clothing would merely be referenced. Lastly, when comparing both individuals and the non-supportive material context, that is, the context contradictory to skeletal sex, more respondents reported they would mention/consider the material context in their estimation for Individual 2 (male) with women's context (8/48, 16.7%) than with Individual 1 (female) with male context (3/51, 5.9%).

When asked, "Limiting your conclusions to the metric and nonmetric data presented above, how confident are you in your sex estimation?" the average confidence level is 81.3%. For both individuals, the most reported confidence level was 90.0%. Overall, there is a greater variation in confidence levels for Individual 1 (SD=15.46683) than Individual 2 (SD=12.08529), which would indicate a greater consistency in confidence in Individual 2 than Individual 1. Of those reporting lower confidence levels for Individual 1, the origins of lower confidence appear in the inconsistent sex estimations between the methods: "*Based on the inconsistency between the scores, I would estimate that the assigned sex at birth for this individual is undetermined,*" or were directly related to the information provided to them. Also, considering that for Individual 1, a respondent reported a confidence level of 0, stating: "*Those methods are so outdated I would not rely on them.*" the standard deviation for Individual 1 is smaller. To ensure there was no significant difference in the median for confidence level between individual 1 and individual 2, a Wilcoxon Signed Rank Test was run. With a 95% confidence level, the sample size (n) = 43; the reported test statistic was 187.5, the *SE* = 53.371, and the Asymptotic Sig. is 0.151 (significance level 0.05). This would suggest that the survey questions had no significant effect between Individual 1 and Individual 2.

DISCUSSION

While the goal of the present survey is to so identify, extrapolate, and explore how forensic anthropologists presently view gender and sex within the field and when conducting a biological profile, the survey results show that forensic anthropologists think identifying gender, including transgender and intersex individuals, will improve the overall odds of identification. Additionally, the survey results support the idea that there is a lack of knowledge and educational materials to educate and guide forensic anthropologists in identifying gender-diverse decedents. Lastly, when sex estimation methods are inconclusive or contradictory information is presented in a material context, forensic anthropologists are hesitant to include material context in their sex estimations. While similar results have been shown in previous research, this survey also includes responses on metric and nonmetric sex estimations of two willed-bodied individuals with an associated material context at Boston University, Aram V. Chobanian and Edward Avedisian School of Medicine.

Demographics

Considering the history of forensic anthropology in the United States, this survey captured another view of the continued growing number of women and gender inclusivity within the field of forensic anthropology (Pilloud and Passalacqua, 2020; Tallman and Bird, 2022; Tallman *et al.*, 2022; Turner et al., 2018). Based on the survey results, at least 71.5% of the survey population self-identified as women. According to Pilloud and Passalacqua (2020), as of 2017, women in the American Academy of Forensic Sciences (AAFS) made up 72.7% while a similar percentage of women participated (76.8%) in

Tallman and Bird’s (2022) survey. Overall, women comprise between 70-80% of the field based on this survey and those produced by Tallman and Bird (2022) and Pilloud and Passalacqua (2022). Additionally, the number of women and men certified by the American Board of Forensic Anthropology (ABFA) was equal, and in 2020 the percentage of active diplomats who identified as women were 62% (Pilloud and Passalacqua, 2020).

In comparison to this survey, those who have a certificate from ABFA (26/130, 20%) and are female made up 65.4% (17/26) of the survey population, and those who were male comprised 26.9% (7/26). Furthermore, those who identified as female in our study represented all levels of education except high school, comparable to the findings of Tallman and Bird (2022), where women made up 76.8% of the American Association of Forensic Scientist (AAFS) and represented all levels of education (Tallman and Bird, 2022). Per this survey, many respondents do not have a certification from the ABFA; however, those holding a Ph.D. were more racially diverse than those holding a bachelor's or master's degree. While this is different from the findings of Tallman and Bird (2022), we must consider that this survey captures respondents in the several years following the publication of Tallman and Bird. Also, it is likely that some of the same respondents from their survey may be responding to this survey but representing higher education. Broadly speaking, this survey has captured a relatively diverse set of self-identified genders and social races.

In the survey, respondents were asked if they identify as part of the LGBTQIA community, and 72/130 (55.4%) responded “No,” 51/130 (39.2%) “Yes,” and 7/130

(5.4%) "Preferred not to say." Additionally, most respondents self-identified as White, Mixed, and Hispanic are the next majority of the survey population. In totality, self-identified social races, approximately 16.9% of respondents classified as non-white, including Hispanic and Mixed social races. This is consistent with Tallman and Bird (2022) in that the overwhelming majority of those participating in forensic anthropology are White (86.7% White and 13.3% Non-White) and non-LGBTQIA (Tallman and Bird, 2022: 86). The Chi-square analysis between this survey and the one conducted by Tallman and Bird (2020), shows that we have captured relatively equal numbers of both White and Non-White groups. Given that our field has been calling attention to the lack of diversity in the field, we have yet to fully dismantle the lack of diversity in the field (Antón *et al.* 2018). In a similar manner to Tallman and Bird (2022), a Kruskal-Wallis Test does not show a significant distribution of social race and education level. This is also supported by a significant result comparing self-identified LGBTQIA individuals and their level of education. The significant Kruskal-Wallis H test suggests a significant difference in the distribution between education and LGBTQIA status.

Although the survey is principally focused on the perceptions of gender and sex in developing a biological profile, the years of experience can be significant in the development of a biological profile. Compared to Tallman *et al.* (2022), who highlighted potential areas of research and the knowledge and experience within the forensic community when working with trans individuals, there are subtle differences in the number of people reporting their years of experience levels. Of 127 respondents in this survey who reported years of experience, 23.6% had zero to five years, 31.5% reported five to nine years, and 16.5% reported 10 to 14 years. In comparison, the respondents who reported experience level in Tallman *et al.* (2022), 22.1% reported zero to five years, 15.7% six to 10 years, and 10.7% reported 11 to 15 years out of 140 respondents. Overall, the respondents and responses are comparable in terms of education and years of experience, which have been shown to influence biological profile development, specifically when conducting sex estimations (Buikstra and Ubelaker, 1994; Christensen and Crowder, 2009; Hartley and Winburn, 2021) The survey demographics show that despite the calls for diversification in the field, there is still a lack of it, with the majority classifying as White and non-LGBTQIA.

Gender Identity in Forensic Anthropology

As part of the survey, numerous questions were included that related to the identification of gender in forensic anthropology. In considering testimony strictly related to identification purposes (biological profile, positive ID from skeleton, dental ID, gender/transgender estimations, DNA analysis), out of all of the respondents who have testified, only 20.9% have testified to items directly relating to identification, excluding pathology. If we consider pathological conditions are considered as a proxy for identification, then testimony relating to positive identification increases to 29.1%. Given that 50% of respondents did not consider material context such as clothing as *Daubert* compliant for sex estimation, it is unlikely that testimony to these items would be heavily utilized. Overall, the responses here show that the role of positive identification in court is minimal compared to other forms of testimony, such as trauma. This highlights that while some individuals are unidentified, the role of forensic anthropologists is to report on the relationships between trauma, pathology, and the skeleton rather than the identification of the decedent's sex and gender.

These results raise the question of how forensic anthropologists are presently identifying transgender and intersex decedents and how they are being reported. According to the Human Rights Campaign (HRC), 2022 had up to 38 known transgender fatalities, a mere fraction of all unidentified transgender decedents in the United States. Are all other transgender or gender-diverse individuals being identified using federal documentation, "deadnamed," or reported as the biological sex over their preferred sex and gender? If we consider that the overwhelming majority of individuals carry some sort of formal ID, it is likely that decedents, despite material context, are being identified using these forms of documentation, which is consistent with the Pima County Office of the Medical Examiner's. Additionally, there is some consistency in opinion if respondents think forensic anthropologists can identify transgender and intersex decedents, showing that there is no disagreement that identifying gender, including transgender and intersex decedents, will decrease the number of unknown decedents. But rather, there is a question of how the field should conduct these identifications when gender is considered nonbiological, and the skeletal traits of gender-diverse decedents are not yet known.

When identifying skeletal sex, many prefer "sex" (52.3%) or "biological sex" (34.6%) over the arguably more apt descriptors of an individual's skeletal sex, such as "assigned sex" (19.2%) and report using "indeterminate" when "male" or "female" cannot be estimated (56.2%). Using assigned sex at birth as a descriptor of skeletal sex promotes gender inclusivity by acknowledging that the skeletal sex of an individual may not have been how the individual identified. Although sex estimations using *FORDISC 3.1*(Jantz and Ousley, 2005), Klales et al. (2012), and Walker (2008) are of valid scientific inquiry, using "indeterminate" seemingly provides us with the knowledge of a failed test result; while using “inconclusive” may suggest that the evidence provided is insufficient to determine a sex estimation. If the goal of forensic anthropologists is to provide a scientific test result saying “male,” “female,” and “indeterminate,” then “indeterminate” provides investigators with sufficient information. However, if the goal of conducting a sex estimation is to provide information related to the individual's identity, then “inconclusive” provides us with the knowledge that more evidence is required to accurately identify individuals. This information which provides a more conclusive result may lie within the material context, clothing, and personal effects in which the decedent was found.

While "indeterminate" seems to be preferred in the field, it is consistent with most respondents rarely participating in scene recoveries (50.8%). With so few trips into the field, an indeterminate result solely based on the skeletal remains is consistent with the lack of material and cultural context to provide additional insights for identification and that they are strictly using sex estimation methodologies. Additionally, this result from the survey is contradictory with authors who suggest that context may be beneficial in establishing several aspects of forensic anthropological analyses, including the determination of the point of deposition, manner of death, and time since deposition (Pokines, 2022; Reichs, 1998; Symes *et al.*, 2002). However, scene avoidance may also limit the investigator's ability to infer gender and sex thoroughly, potentially missing contextual information that might be found in missing person reports (NamUs, 2023). Perhaps, in the field of forensic anthropology, when strictly conducting a skeletal sex estimation (sex identity), “indeterminate” or “probable male/female” may be best; however, if the sex estimation is also to include gender identity, “inconclusive,” “AFAB,” and “AMAB” would be best, especially if the identification of the individual is unknown. Nonetheless, as forensic anthropologists are reporting their conclusions, the terminology used for identification purposes should be readily defined, followed by their reasoning.

For example, one respondent to our survey reported, “*I say indeterminate, but I specify if it is due to either the individual presenting with traits existing between the two binaries, or the individual presents with a mix of both male and female indicating traits*.” when asked “How do you report sex when neither “female” nor “male” can be estimated?” While another reported that if confined to a checkbox, they would select inconclusive but otherwise would try to describe each element.

In this survey and the one provided by Tallman *et al.* (2022), respondents were asked if they had worked on a case involving a transgender decedent. In response to Tallman et al.’s (2022) survey, 28.6% of respondents reported working on a case involving a transgender decedent. In response to this survey, 19.8% reported working with a transgender decedent, and 37.5% were uncertain. Additionally, 7.0% of the respondents reported that they had worked on a case involving an intersex decedent, while 54.8% were unsure if they had worked on a case. The 26.8% from this survey (transgender and intersex) and the 28.6% from Tallman *et al*. (2022) suggest that both transgender and intersex decedents are currently represented in forensic casework, which is supported by the numbers of identified transgender decedents represented by the Human Rights Campaign (Human Rights Campaign, 2022a; 2022b; 2022c).

Moreover, the uncertainty of respondents in whether they have worked on a case involving transgender (36/96, 19.6%) and intersex (63/115, 54.8%) decedents supports the conclusion that the means of identifying these individuals are inconsistent and unknown. Overall, this could also mean that there is a general lack of knowledge in forensic anthropology when identifying gender-affirming treatments. This is supported by Tallman *et al*. (2022), where 60.9% of respondents were unfamiliar or somewhat familiar with facial feminization surgery (FFS). In addition to those who report that they have worked on an intersex or transgender decedent, (77/130; 59.2%) respondents reported they would use gender-affirming surgeries, and (48/130; 36.9%) would use scene context as evidence to report on a decedent's gender. This is also supportive of the survey respondents who think gender cannot be estimated from the skeleton alone. Interestingly, if we consider transgender strictly as a "gender" or social construct and not a sex identity, there are a low number of respondents (3.1%) who think a transgender decedent can be identified from material context and clothing. When considering the skeleton alone, many respondents (88/130, 67.7%) were uncertain or did not think transgender decedents can be identified from the skeleton alone. However, when asked about identifying a transgender decedent from material contexts, such as clothing, and skeletal materials, more respondents reported that it was possible (29/130, 22.3%), and fewer thought it was not possible or were uncertain (66/130, 50.8%). This suggests that there is both a skeletal and material aspect in identifying an individual as being transgender, which is supported by those who report that gender-affirming surgeries and hormone treatments may affect the skeleton and skeletal sex estimations.

The preferred terminology and non-use of material context seen in the responses of the survey support the belief that material context, such as clothing, is not *Daubert* compliant for conducting sex estimations in forensic anthropology, and our role in identification is strictly biological. This likely arises from a combination of education in forensic anthropology, lack of knowledge and methods for transgender identification, and statements from the Scientific Working Group for Forensic Anthropology (SWGANTH) and other organizations. SWGANTH (2010) has recommended that gender is not determinable from the skeleton alone, and is not recommended, while sex is determinable from the molecular (gene) to the macroscopic level (skeleton). This is also agreed upon by the standards produced by the American Academy of Forensic Science Standards Board (ASB) (2019) but encourages contextual evidence to be noted when inconsistent (American Academy of Forensic Science 2019).

While most respondents report never conducting scene recoveries, with some making less than five recoveries yearly, contextual documentation, field recovery and analysis, and laboratory analysis are all aspects of a death investigation and encourage a holistic approach to understanding a death scene (American Academy of Forensic Science, 2021; Pokines, 2022). This approach is seen amongst respondents, who report the use of clothing, personnel effects, and scene context when reporting an individual's gender.

In response to the survey asking if they had anything to add in regard to reporting gender, one respondent reported:

> "*You would write to inform, however, this is tricky and usually falls into cultural items, if there is physical evidence within the tissue. Mostly, use indeterminate.*"

While another reported:

> "*I would describe each organizational level as best as possible, from genetics to hormone level and function, organ presentation, skeletal morphology and osteometry, and the appearance of external genitalia.*"

When responding to "How would you report/comment on a decedent possibly being intersex?", these responses highlight the complexities that arise when identifying an individual’s gender or an individual intersex. In response to “What forensic anthropological evidence suggests intersex?”, there were consistencies in mentioning “surgical procedures”, “plastic surgery”, and “surgical implants”, and one individual mentioned the bone loss related to estrogen loss but would otherwise appear male as an example for identifying an individual as intersex. These consistencies are also seen when asked about identifying transgender decedents specifically in response to “Do you have anything to add regarding transgender individuals and forensic anthropology?” with responses varying from “*pretty contextual on a case-by-case basis*” to “*I believe that even when stated as an adult (25), the hormones would eventually have some effect but not drastic to alter skeletal assessments*.”

In response to “Do you have anything to add regarding transgender individuals and forensic anthropology?”; one respondent stated: “*I think I have included this in other text boxes, but will add it here as well. AFAB cis women also get feminization surgeries. It is impossible to concretely say someone is trans just based on that evidence, and it would be irresponsible to do so. It is different to discuss the evidence in context. I.E. This is what their skeleton says, with this additional evidence, it may be a good idea to also include people of this particular gender*.” This highlights an issue in identification when applying antemortem surgeries and treatments as a method. First, how do we differentiate between those surgeries performed on someone who identified as transgender versus someone who identified as intersex? A second issue, as posed by a respondent, is that some surgeries used in gender-affirming treatments are also used in non-transitioning procedures. One consideration for the latter issue is that when an individual is transitioning, many surgeons will conduct multiple procedures at one time to limit the amount of time under anesthesia, while non-transitional surgeries may solely be rhinoplasty or genioplasty. However, beyond that, there are no singular means of differentiating one genioplasty from another for identifying transgender and intersex decedents (Baker and Weinzweig, 2022; Deschamps-Braly, 2020; Park, 2018).

Considering that respondents in this survey believe there is some signs of gender-affirming treatment which appear in the skeleton, we must consider the number (%) of individuals receiving these treatments within the transgender community. As of the 2015 survey published by the National Center for Transequality, 78% of respondents have wanted hormone therapy with only 49% having received this treatment, with the majority currently receiving it (James *et al.*, 2016). Of those who received or are receiving hormone therapy, only 4% started when they were younger than 18, and 84% started hormone therapy between the ages of 18 and 44 (James *et al.*, 2016:100). Only 25% reported having a form of transition-related surgery as of 2015, with transgender men more likely to have had these surgeries.

Of the surgeries listed in the survey, respondents with female on the birth certificate reported having chest surgery, hysterectomy, metoidioplasty, and phalloplasty; all of which are soft tissue-related surgeries (James *et al.*, 2016:101). For those with male on their birth certificate, transition surgeries included hair removal (electrolysis), voice therapy (non-surgical), vaginoplasty/labiaplasty, augmentation mammoplasty, orchiectomy, facial feminization surgery, tracheal shave, silicone injections, voice surgery. Those involving bony elements include facial feminization surgery, which only comprised 6% of the survey respondents having had this, with an additional 39% wanting this procedure (James *et al.*, 2016:102). Furthermore, this survey included non-binary respondents, and of the non-binary respondents, 22% have had the surgery or want the surgery someday (James *et al.*, 2016:103). Therefore, gender affirming surgeries that impact the skeleton are only relying on such indicators will miss individuals who have transitioned or are in the process of transitioning.

We could also consider the definitions of transgender and intersex and how those begin to differentiate between the two groups of individuals. Generally, transgender refers to those whose gender identity differs from the assigned sex at birth; while intersex refers to one who is said to have the condition of intersexuality or the condition of having both male and female gonadal tissue or the internal gonads of one sex and external genitalia of another (Merriam-Webster, 2022; 2023). According to transequality.org, transgender people have internal knowledge of their gender identity; in fact, most transgender individuals do not identify as intersex and vice versa (transequality.org, 2015). While both transgender and intersex individuals are influenced by both biology and culture, one could consider transgender identities as related to gender identity and expression rather than chromosomal/biological (Davis, 2015:31).

As stated by Stone and Zimmer, “sex can be thought of as an individual’s combined expression of many different polymorphic biological characteristics; while genders are those assumptions of maleness and femaleness related to behavior, and one’s relationship to society” (Stone and Zimmer, 2022:436-437). Additional considerations should be made on the use of evolutionary skeletal development in identifying these individuals which has led to the binary methods we see today and ignores those between the binary. For example, Dunsworth (2020) calls attention to the simplified pop culture narrative of men being built for competition and women for reproduction; when, the human evolutionary development that has led to the sexually dimorphic traits is more complex (Dunsworth, 2020). While no specific characteristics have been identified as intersex, we must consider the influences of hormones on the skeleton, as some individuals identifying as intersex may have skeletal characteristics that one might consider as male or female (Astorino, 2015; 2023). While forensic anthropologists have yet to fully grasp the differentiation between transgender and intersex in terms of biological or skeletal characteristics, society has kept abreast with how these individuals identify and what makes them unique.

Defining Gender, Sex, and Transgender

Based on the respondents who participated in this study, there is consistency when defining gender identity, gender expression, sex, and transgender. Although some responses are textbook-like while others provide a broader understanding without specific details. While it would be beneficial to have a singular definition for forensic anthropologists to use in describing these aspects of a decedent, one respondent wisely noted the challenges in defining such terms due to their rapidly changing nature and cultural connotations. This highlights the need for periodic reevaluation of selected terms to maintain relevance. Respondents Recognized that gender as a social construct, is individual, assigned at an early age, and is fluid. In short, a forensic anthropologist may define gender as "based on the biological sex (AFAB/AMAB/Indeterminant) derived from a skeletal sex estimation in which an individual ascribes to social constructs defined throughout life beyond just man and woman" (Astorino, 2019). While gender cannot be solely estimated from skeletal remains, it can be inferred based on skeletal sex estimations with consideration of material context, input from investigators and pathologists, as indicated by respondents and previous studies (Gellar 2019; Stone and Zimmer, 2022)."

When differentiating gender identity and gender expression, respondents seemed to conflate the two definitions. This does not come as a surprise, as gender expression is closely affiliated with gender identity, such that clothing and other social concepts are often used to identify an individual's gender. For these comparisons, terms such as "outward appearance" or "perceived characteristics" were looked for, and generally, these concepts were seen in many responses when defining gender expression. While using terminology consistent with present definitions of gender expression, many respondents also maintained that gender expression is a culturally affiliated concept. Based on the present knowledge, as represented in the survey respondents, forensic anthropologists may identify gender expression for investigations as "the mannerisms in which a decedent may have performed during life based on the associated material, skeletal sex estimation, and next of kin interviews." While gender identity could be defined as "how the individual identified using pronouns such as he, him, she, and her and may be estimated from skeletal sex estimations, gender expression, and material context."

When defining sex, many respondents maintained that sex is biologically derived, using terms such as “genes,” “chromosomes,” “gonad, genitalia,” and “physiological features.” This encourages the utilization of accepted terms "male" and "female" to differentiate those with male and female genitalia. However, this author suggests that AFAB/AMAB be utilized to describe the sex of the decedent until additional information about the decedent's gender identity and expression can be extrapolated. Many individuals, upon birth, are generally assigned one of the two (male or female) at birth, and when genitalia are ambiguous at birth, many doctors will identify them as intersex but consult with the parents to define the assigned sex of the child (Astorino, 2015; Davis, 2015; Dunsworth, 2020). Using AFAB/AMAB over female and male denotes that the forensic anthropologist recognizes the biologically derived sex characteristics that would exhibit traits the doctor at birth would have made the assignment; while also acknowledging the decedent's individuality and recognizing that they may not have identified as the gender assigned to them (Kelley and Tallman, 2022).

When asked to define transgender, respondents mostly provided definitions consistent with those provided by Merriam-Webster (2022), Trans Doe Task Force (Redgrave and Redgrave, 2022), transequality.org (2006; 2015), WebMD (2022), and the Oxford Learners Dictionary (2022). Terms that were consistently used amongst all of the responses included “gender identity,” “associated,” “opposite,” “surgery,” “reassignment,” and “reaffirming”. Interestingly, no respondent replied with the nuances between the biological or skeletal aspects of transgender and transgender as a gender definition. This, of course, was not required of respondents, but an interesting point of differentiating it as a sex and as a gender. However, many respondents included surgeries or mentioned some form of medical intervention would imply the general understanding that a transition may require medical interventions, though a small percent of the transgender and non-binary community undergo these treatments (James *et al.* 2016).

As mentioned previously, not all transgender individuals are intersex, and not all intersex individuals are transgender, and this is where the nuances of biological and socially constructed definitions of transgender may be defined. While transitioning may not be entirely needed medically, individuals who have chromosomes such as XXY or other combinations may pursue these interventions as a means of affirming one gender or another. For defining transgender for forensic anthropologists, so it is applicable in forensic anthropological notes and reporting, one may use "*Likely AMAB/AFAB and* *identified as Transmale/Transfemale*." while the general term transgender may be used to define and describe the contradictory evidence found in the material context or to describe someone's gender differing from the one assigned at birth.

Ultimately, when it comes to reporting the decedents estimated sex and gender in forensic anthropological reports, anthropologists should be defining the terms they are using; and providing the evidence which had led to these conclusions. As one respondent said “if confined to a box” then these checklist terms in forensic anthropological notes and forms should be standardized definitions recognized by the SWGANTH, ASB, and Organization of Scientific Area Committee for forensic science. As suggested, rather than use male and female, AMAB and AFAB should be utilized to describe the biological skeletal sex that was estimated. If conclusions cannot be drawn strictly from the sex estimation methods (metric and nonmetric) then “indeterminant” may be the best possibility until additional information is gathered. Indeterminant would allow observers to concisely state that the sex of the individual is not exactly known. Additionally, when drawing the conclusion including a gender estimation, these conclusions should concisely describe both the biological descriptors (AFAB/AMAB/ Indeterminant) and the estimated gender identity (man/ women/ transmale/ transfemale/ intersex/ nonbinary) using cultural descriptors (gender expression) such as clothing and signs of gender-affirming treatments.

Sex Estimation Methods

In this survey, respondents were asked to organize nine nonmetric sex estimation methods and four metric methods for sex estimation in forensic anthropology to their preference (most preferred to least preferred). They were also asked when performing a skeletal analysis which skeletal material (cranial, postcranial, or considered equally) takes precedence. Most respondents reported that when they are conducting sex estimations, they preferred to use solely postcranial elements and then utilize postcranial and cranially equally over just using the cranium. Most respondents also reported that pelvic nonmetrics are preferred, then cranial nonmetrics, cranial metrics, and postcranial/long bone metrics when conducting a metric/nonmetric sex estimation on a complete skeleton. This is consistent with Klales *et al.* (2020:11), who stated: “We know that the pelvis (innominates and sacrum), specifically the pubis, remains the best skeletal indicator of sex, followed by postcranial metrics, and then morphology and metrics of the skull.” And, as suggested by SWGANTH (2010), sex estimations using metrics and non-metrics should be done regardless of if DNA analysis is being utilized to identify the decedent’s sex.

In terms of selected metric and nonmetric methods, most prefer to use *FORDISC 3.1* (Jantz and Ousley, 2005) and Spradley and Jantz’s (2011) metric methods, Klales *et al.’s* (2012), and Buikstra and Ubelaker’s (1994) nonmetric methods. In a cross-tabulation, 43.9% of all recorded responses to the question prefer both *FORDISC* and Klales *et al.* (2012), and 28.0% prefer both FORDISC and Buikstra and Ubelaker (1994). Furthermore, 22.0% prefer both Spradley and Jantz (2011) and Klales *et al.* (2012), while 15.9% prefer both Spradley and Jantz (2011) and Buikstra and Ubelaker (1994). Arguably the methods from which respondents could choose are either linear regression based, focusing on the peaks of the bimodal distribution which many sex estimations are built upon, or have associated probabilities that provide likelihoods of belonging to one sex or another (Tallman *et al.*, 2022).

As a point of comparison, the results from in Klales *et al.* (2020) was reviewed. Their work addresses that while continued research has shown that changes in population (secular change) have affected the results of sex estimations and that postcranial elements provide better results for sex estimations, standards for sex estimations are not fully defined (American Board of Forensic Anthropology 2019; Klales *et al.* 2020, SWGANTH 2010). One goal of their research was to highlight and investigate the methodologies for conducting sex estimations by biological anthropologists (Klales *et al.*, 2020: 12). They reported that the whole body (cranial and postcranial elements) produces higher accuracy for sex estimations, and that *FORDISC 3.0* (Jantz and Ousley 2005) was the preferred method for quantitative analysis, while non-metric methods showed greater variability (Klales *et al.*, 2020).

In the comparison to Klales *et al.* (2020), for nonmetric and metric methods, Buikstra and Ubelaker’s (1994) volume maintained its status as one of the preferred methods for conducting sex estimations. Interestingly, Phenice (1969) fell to third place when comparing pelvic nonmetric traits compared to Buikstra and Ubelaker (1994) and Klales *et al.* (2012). Additionally, Walker’s (2008) cranial nonmetric method for sex estimation of the cranium also fell below Buikstra and Ubelaker (1994), while the Klales *et al.* (2012) method was most preferred compared to other nonmetric methods, including Buikstra and Ubelaker (1994). This may suggest that Buikstra and Ubelaker's (1994) methods are still regarded as the standard method(s) in forensic anthropology; however, Klales *et al.* (2012) may be the newer standard taught to forensic anthropologists for pelvic traits.

Since Buikstra and Ubelaker appear to be the standard for performing skeletal sex estimation, we should consider the purpose for which the work originated. The original compilation and development of standards was for purposes of addressing the Native American Graves Protection Act (Public Law 101-601) and the National Museum of the American Indian (Public Law 101-185). At the time of its development, there was no standard for collecting data that allowed for comparing groups of individuals scheduled for repatriation (Buikstra and Ubelaker, 1994). In their work, the authors address that "for some groups, [skeletal] morphology provides a reliable basis for sex determination; for others, it does not;" however, they fail to provide probabilities or statistics for the methods (Buikstra and Ubelaker, 1994:19). If the purpose of the publication is to address the data collection for Indigenous Americans prior to repatriation; we must question why forensic anthropologists, biological anthropologists, and others are continuing to utilize these methods without statistical backing. Especially when three authors have produced revised methodologies using skeletal morphology for sex and ancestry estimation, each with their own issues but still revised and statistically sound (Klales *et al.,* 2012; Walker, 2005; 2008; Hefner, 2009).

Some of the skeletal sex estimation methods utilized in forensic anthropology that were surveyed, including Spradley and Jantz (2011), Walker (2008), Klales *et al.* (2012), and *FORDISC 3.1* (Jantz and Ousely, 2005) are binary. However, *FORDISC 3.1*, Klales *et al.* (2012), and Walker (2008), utilize binary logistic regression and discriminant function analyses, which produce associated probabilities. For example, *FORDISC 3.1* offers four types of probabilities: posterior, Typ F, Typ Chi, and Typ R. Posterior probabilities consider an individual's characteristics and test the hypothesis that an individual belongs to a specific population. Type F provides the probability of an individual fitting into a particular group, considering the sample size. Typ Chi relies solely on Mahalanobis distance, measuring the distance between two points in a multivariate distribution. Typ R probabilities evaluate the unknown individual's measurements as if they were part of the known sample (Jantz and Ousley, 2011). Typically, if any of these probabilities is over 0.05, one accepts the null hypothesis that the individual can generally be considered part of the population. Probabilities falling between 0.01 and 0.05, or below 0.01, may indicate that the individual does not belong to that specific population, or an error has occurred due to skeletal pathology, skeletal differences, or user error (Jantz and Ousley, 2011).

Skeletal sexing methods that provide associated probabilities offer greater accuracy in determining an individual's likelihood of belonging to a specific population, making them more representative of the entire population compared to sectioning points that strictly dichotomize sex (Hartley et al., 2022). In contrast, sectioning points, influenced by cognitive bias and restricted to a limited number of metric measurements, tend to yield singular estimates, which can lead to the exclusion of nonbinary individuals when compared to methods using associated probabilities.

Moreover, the lack of a standardized criterion for classifying individuals as 'probable female' or 'probable male' in sex estimation methods adds further complexity, as these terms merely attempt to describe the variability observed within the male and female populations. However, such classifications may not fully capture the diversity present in human skeletal traits. Instead, it is the presence of extreme non-metric skeletal traits that serves as the most reliable indicators for male or female sex estimation. Traits exhibiting characteristics between these extremes are better classified as “indeterminant” or “inconclusive.” For instance, when comparing the ordinal scales presented by Buikstra and Ubelaker (1994) and Walker (2005), we find similar drawings, but Walker (2005) discovered that an ordinal score of two is more representative of males than females in that specific population (Walker, 2005:388). While certain methods employ statistical analyses and associated probabilities by combining various skeletal traits, sexing methods still rely on binary categorizations, which may inadvertently exclude individuals with non-binary and non-normative gender identities (Klales et al., 2012; Walker, 2008; Jantz and Ousley, 2005). Thus, embracing more inclusive and nuanced approaches in sex estimation is crucial to avoid overlooking nonbinary individuals in forensic anthropology studies.

As a mean of discerning which sexing methods using statistics enhances our conclusions, Bartholdy and colleagues (2020) compared the use of logistic regression (logR) analysis and discriminant function analysis (DFA) in sex estimations to highlight their performance and accuracy. While they found no discernable difference in estimating the sex under certain conditions, logR has increased flexibility and allows observers to calculate the “uncertainty of an estimate,” while DFA often requires the data for which the method originated to be known. Additionally, they found that when excluding individuals with classification probabilities below 0.8, the number of misclassifications fell for linear discriminant function analyses. This would suggest that when DFAs are being used, a minimum benchmark of 80% classification accuracy in the population may be necessary. Overall, while the associated probabilities using DFA and logR highlight the “chances” the individual belonged to a population, they do not address issues related to “indeterminant” results, transgender and intersex decedents, or consider the material context.

Sex Estimations and Material Context

In the survey, the results of two nonmetric sex estimation methods and a FORDISC output for two willfully donated individuals were provided to the respondents with both supportive and contradictory material context. Individual 1 (BU-33) is identified as female. For Individual 1, the top result using *FORDISC 3.1* cranial measurements produced a Hispanic female with a posterior probability of 0.482 (Typ F 0.890). For postcranial elements, the top result was Black female with a posterior probability of 0.854 (Typ F of 0.556). The Klales *et al.* (2012) output resulted in probabilities of Pf of 0.912 and Pm of 0.087, and the Walker (2008) output resulted in a Pf of 0.847 and Pm of 0.153. Individual 2 (BU-34) is identified as male. For Individual 2, the top result using *FORDISC 3.1* cranial measurements produced a Japanese male, with a posterior probability of 0.379 (Typ F 0.491). For the postcranial elements, the top result was White male, with a posterior probability of 0.476, (Typ F 0.120). The Klales *et al.* (2012) output resulted in probabilities of Pf of 0.074 and Pm of 0.926, and the Walker (2008) output resulted in a Pf of 0.001 and a Pm of 0.999.

For individual 1, most respondents reported the sex of the individual as female (28/51 reporting), AFAB (7/51), and probable female (9/51), with one respondent also indicating intersex. When confronted with material context associated with women's clothing (“women’s” underwear, a skirt, a bra, and high heels), most would not factor it into their sex estimation, with at least 23 mentioning the associated materials in their notes/reports. Seven would factor the materials into their sex estimation and mention the information in their notes/reports. When confronted with material context generally associated with men's context (“men’s” underwear and jeans, a baseball hat, condoms, and amyl nitrate (i.e., “poppers”), most would still not factor it into their sex estimation; however, they (34/51) would mention the information in their notes/report as the material information contradicts the sex estimations. One respondent stated that the alternative clothing might suggest that the individual may be trans and would request assistance from the Trans Doe Task Force (TDTF).

Interestingly, at least two respondents seem to believe that clothing is not as significant in terms of women wearing men's clothing. However, both seem to agree that there is no reason a woman wouldn't wear the clothing mentioned in both contexts. Additionally, when confronted with conflicting context, the context would be mentioned by most in the notes/reports, but they would not give weight or consider it in their estimations, though 3/51 (5.9%) would consider the context in their sex estimations. One respondent reported:

> "*I would still be comfortable with the biological sex estimate being Probable Female. In this case I may mention in the report the phrase "sex assigned at*

> *birth." I would consult with the forensic pathologist that did the autopsy to come to an agreement on the best way to report a possible difference between the decedent's gender identity and sex assigned at birth.*"

This suggests that medical examiners and pathologists may have additional insights from soft tissue analysis, which may provide additional evidence suggesting a conclusion for the conflicting evidence. While another respondent reported that they would discuss the discrepancy and the limitations of the methods utilized for producing the sex estimation.

For individual 2, most respondents reported that the sex of this individual is male 34/48 (70.8%), with 10/48 (20.8%) reporting probable male and two (4.2%) as indeterminate/ inconclusive in their sex estimation. When confronted with traditional women's context, 16 respondents reported they would not factor it into their sex estimation, while 8 would factor/consider the context in some manner. Overall, 26 of the 48 respondents reported they would mention the information regardless of their consideration in their sex estimation. One respondent reported:

> "*Following recovered evidence such as female clothing, it can be suggested that the individual is possibly transgender (biologically male but with a female gender identity).*"

Another reported:

> "*would not change the sex estimation but may factor into comments regarding inferences to the decedent's gender if it is contextually supported and relevant to the case. more information would be needed.*"

When confronted with traditionally male context, most (29/48) would not factor this into their sex estimation; however, nine of these respondents would consider/factor the material context in their sex estimation.

Overall, for Individual 1 (female), when offered evidentiary information typically associated with women (i.e., “women’s” underwear, skirt, bra, and high heels), many (72.5%) would not factor it in their reporting of sex. When offered evidentiary information typically associated with men (i.e.,“men’s” underwear and jeans, a baseball hat, condoms, and a bottle of amyl nitrate), many (64.7%) would not factor it into their sex estimation, but more (80.4%) would mention the information in their reports than for the evidence typically associated with women. Likewise, for Individual 2 (male), when offered evidentiary information typically associated with men, many (62.5%) would not factor it into their reporting of sex. When offered evidentiary information typically associated with women, many (54.1%) would not factor it in their reporting of sex, but more (58.3%) would mention it in their reports. Additionally, between both individuals, 32 responses reported that when confronted with non-supportive material context for sex estimation, they would mention that the individual may be gender diverse.

For reporting both individuals, respondents were hesitant when confronted with material items contradictory to the initial sex estimation. With the contradictory material evidence, more respondents acknowledged it relevance in the possibility of nonbinary identities; however, non-contradictory evidence aligning with the skeletal sex is often disregarded. Based on the findings of this survey, it is evident that there is a substantial dependence on skeletal sex estimation methods, particularly when the material context aligns with the results (Hartley et al., 2021). However, the reliance on these methods decreases when the material context does not support the sex estimation. The reliance on these methods is reasonable in terms of the Daubert Criteria and testimony; however, this inherent bias and reliance on the methods may lead to the exclusion of nonbinary identities in certain contexts. Moreover, the reporting of material context can be influenced by the observer's sex, gender, and prior experience with similar cases. For instance, an observer who identifies as a woman and wears men's clothing for comfort may view an AFAB decedent with male clothing as less significant compared to an AMAB individual wearing female clothing.

Another point of interest is for Individual 1; when contextual information would suggest male rather than female, there was more of an acceptance of the sex estimation. That is, there seems to be an acceptance that women can wear male clothing, with the only question being the male underwear, but even then, respondents reported that they would merely acknowledge its existence. On the contrary, for Individual 2, no respondents reported any statements like "it's generally accepted in our society for men to wear women's clothing." The closest statement from a respondent regarding men wearing women's clothing is:

> "*Possibly, the majority of self-identified men in the United States are not wearing high heels and a bra. I would consider whether this individual was non-binary or transgender*."

These comments suggest that when the decedent's sex is estimated to be male, forensic anthropologists may propose that the individual is nonbinary or transfeminine or mention the contradictory evidence ("Women's" underwear, high heels, skirt) in their reporting. While, if the decedent's sex is female and contextual evidence is contradictory, there is less consideration that the individual is transgender or nonbinary and would likely mention the evidence or not at all. This bias may be related to how people perceive gender roles in the U.S. or that; there is a greater chance of people hearing/knowing about individuals who identify as transwomen than transmen. According to the University of California San Francisco, transwomen are 1 in 30,000 people, while transmen are 1 in 100,000, though these are likely underestimated (*Division of Prevention Science*, 2023). While our sexing methods follow the strict binary of male and female, gender roles are not as strict; in fact, some of the gender-normative definitions are derived from the Victorian period (Stone and Zimmer, 2022).

Anthropology has been inherently biased by deep-rooted gender norms, thereby limiting the recognition and understanding of non-normative identities like transgender and intersex individuals in anthropological contexts (Boellstorff, 2007; Gellar, 2009). Although the second and third-wave feminist movements, along with the integration of queer theory in biological anthropology, have brought non-normative identities to the forefront, forensic anthropology has largely maintained traditional "sexual" divisions of labor and gender roles, even incorporating gendered clothing norms from the 20th and 21st centuries.

Considering previous statements on material evidence and the reported information for Individuals 1 and 2, there is significant disuse and neglect of material evidence in forensic anthropology except when applicable for identifying undocumented border crossers along the Mexico border (Anderson, 2008; Anderson and Spradley, 2016; Birkby *et al*, 2008; Beatrice and Soler, 2016; Martinez *et al.*, 2014). If indeed the material evidence is, to put in the words of another: "*I would leave that job for the investigators*," or "*I think that the forensic pathologist has the authority to comment on this*," and "*material evidence is solely the job of the pathologist (breast implants, soft tissue alterations) or investigators (clothing, earrings, pills)*," then forensic anthropologists must consider all alterations to the bone in sex estimations via Gender affirming treatments (GAT) even though many may not show any signs, and only a mere percentage of this population actually receives these gender-affirming treatments. When asked whether respondents believed gender-affirming medical treatments and gender-affirming hormone therapy influence the skeleton, the majority believed that some medical interventions are visible and influential in sex estimation; however, most respondents were unsure about the hormone's influence on the skeleton.

Considering that 60.9% of respondents in Tallman *et al.* (2022) were either unfamiliar or somewhat familiar with FFS would suggest training on materials/skeletal changes should be conducted with forensic anthropologists. Additionally, when asked, "What evidence suggests intersex?" only four respondents replied, of which three said they would use "skeletal modifications," "plastic surgery and surgical implants," and "cranial measurements that skew neutral…" furthering the need for providing supportive resources. According to Coleman and colleagues (2022), at least eight surgical interventions may involve skeletal changes; and these include but are not limited to rhinoplasty, chin augmentation/reduction, mandibular angle reduction, brow augmentation/reduction, and facelift (mid-face lift) (S136). To date, one study by Schall and colleagues (2020) has compared pre- and post-operative cranial metric measurements applicable to *FORDISC*, using CT scans. Overall, there are too few samples are available for forensic anthropologists to develop a complete dataset of transgender decedents who have undergone gender-affirming surgical interventions (Schall *et al.*, 2020).

Schall and colleagues (2020) highlighted potential issues when relying on a metric analysis (*FORDISC 3.1*) for skeletal sex estimations for transgender individuals following facial feminization surgery. Although the surgeries altered aspect of the cranial skeleton, the *FORDISC* analysis indicated male. To address this, Schall and colleagues (2020) propose considering macromorphoscopic traits (screws, plates, implants) when working with potential nonbinary and transgender cases. Moreso, the authors identified the bigonial breadth and mandibular length as two measurements which may be artificially inflated (++ or +++ std. dev.) due to the genioplasties and mandibular contouring procedures (Baker and Weinzweig, 2022; Coleman et al., 2022; Deschamps-Braly, 2020). These surgeries aim to reduce, angle, and contour the chin to appear more feminine. However, the presence of plates and screws obscures the landmarks used for measurements, making it challenging to obtain accurate readings (Deschamps-Braly, 2022; Schall et al., 2020:8). Considering their findings, it is reasonable to consider that decedents who have undergone such surgeries, including intersex and transgender individuals, may exhibit measurements or medical artifacts that deviate two to three standard deviations from typical group means within FORDISC analysis.

While a pre- and post-operative comparison, such as Schall *et al.* (2020), can be beneficial, especially when there is a presumptive identity, it cannot be done for every case where a transgender or intersex decedent is suspected. However, in cases where medical plates and screws such as the ones seen in Schall *et al*. (2020) are seen, the medical devices might, per the Safe Medical Devices Act of 1990, have identification or associated batch numbers (Ubelaker and Jacobs, 1995; Vollner, 2020; Wilson *et al.*, 2011). Several of the procedures that would be involved in gender-affirming surgery related to the facial skeleton can involve plates, screws, or bone grafts (Dechamps-Braly, 2022; Ousterhout, 2011; Ousterhout and Deschamps-Braly, 2019; Park, 2018). For example, osseous genioplasties, and malar reduction surgeries, are likely to involve surgical plates for holding the bone in place during the healing process post-surgery (Lee, 2018; Park, 2018;). More specifically, Lee (2018:23) highlights that pre-bent titanium plates "reduces the chances of postoperative asymmetry or under-or overcorrection of the zygomatic contours." While in genioplasties, titanium plates may likely be used for "controlling the degree of anteroposterior adjustment during chin advancement or setback in accordance with preoperative measures" (Park, 2018: 69). Ultimately, the plates and screws serve the purpose of fixation and maintaining the new structure of the corrected facial skeleton. A type three (Type III) forehead reduction may require bone grafts, as this is the most extensive of the forehead contouring surgeries (Ousterhout, 2019).

If decedents are presenting with bone remodeling around the gonial angles of the mandible, supra-orbital ridges, mental eminence, malar region of the zygomatics, or if they are presenting with titanium plates within the facial skeleton, they may have identified as transgender or intersex. However, the number of individuals receiving these surgeries specific to the transgender community is limited; furthermore, not all genioplasties, rhinoplasties, or other facial surgeries are exclusionary to gender-diverse individuals (James *et al.*, 2016).

At present, there is a lack of comprehensive studies analyzing the effects of gender-affirming hormone treatment on the entire skeleton, as existing research has primarily focused on shorter-term (<50 years) effects. Deutsch et al. (2016) found that transwomen using estrogen and transmen using testosterone to develop secondary sex characteristics showed varying responses in hormone levels after six months of treatment. For transmen, some experienced persistent menses, increased body mass, and elevated estradiol levels, indicating the need for further optimization of their hormone regimen. On the other hand, transwomen generally achieved hormone levels within the target range but exhibited differences in free testosterone levels, suggesting variations in drug metabolism.

Delgado-Ruiz et al. (2019) conducted a systematic review of several studies on bone mineral density (BMD) in transgender individuals. The results were contradictory, with some studies showing stable or increased BMD related to hormone levels or increased muscle mass, while others reported signs of osteoporosis in certain regions, such as the lumbar spine and distal arms. The review's limitations include the exclusion of short-term effects of cross-sex pharmacotherapy, younger patients, and various population and biological differences. Based on their findings, the review concluded that transwomen might experience a slight decrease in BMD, while transgender patients (transmale and transfemale) could experience increased bone formation, indicated by elevated Serum Procollagen type I N-Terminal pro-peptide turnover markers. Although longer-term and relatively short-term (<3 years) effects of hormone treatment require further investigation, it appears that significant macroscopic changes to the skeleton, relevant for forensic anthropological sex estimations, are unlikely to occur. However, the occurrence of osteoporosis, particularly in transwomen, should be considered during bio-cultural analyses of potential transgender decedents (Delgado-Ruiz et al., 2019). Sites of analysis for osteoporosis should include the lumbar spine, distal arms, and pelvis, which may exhibit normal bone quality but below-average bone quantity, with reduced trabeculae numbers and diameter and cortical bone thinning (Ortner, 2003).

Nevertheless, it is crucial to recognize that osteoporosis can have multiple etiologies, such as lifestyle, diet, age, and sex, all of which can impact the spine, pelvis, and other cancellous bones (Branch, 2023). As highlighted by the systematic review by Delgado-Ruiz and colleagues (2019), studies indicate increased bone markers due to gender-affirming treatment; however, bone marker turnover analysis, typically assessed through urine and blood tests, may be the responsibility of the pathologist, if present, and should not be solely relied upon for gender estimations. Overall, while these studies provide valuable insights into the effects of GAHT, increased bone mineral density, the potential risk of osteoporosis, and elevated bone markers cannot be used as sole indicators for gender estimations in transgender and intersex individuals.

Considering the variability in the effects of gender-affirming hormone treatments and the small number of self-identified transgender decedents who are pursuing or wish to pursue facial feminization and masculinization surgeries, forensic anthropologists must also include the use of material context for sex and gender estimations via a biocultural approach. It is evident that material contexts, such as tattoos, brands of clothing, foodstuffs, phone numbers, and amulets, have been beneficial in identifying immigrants along the Mexico border (Anderson, 2008; Birkby *et al.*, 2008). It is likely that identified material context for both transmen and transwomen will be beneficial in providing appropriate sex and gender estimations for intersex and transgender decedents. Some work has been done in gathering resources and solutions for aiding anthropologists in identifying gender-diverse decedents, including a proposed Contextual Observational in Support of all Gender Expression (COSAGE) form (Blatt *et al.*, 2023). While they provide some "additional resources" highlighting items that might be flagged as material context with the decedent, they also encourage consultation with surgeons, community consultation, and descriptions of why sex estimations were ruled "undetermined" or "ambiguous." Until forensic anthropologists can confidently apply these in the forensic context, our methodology may simply be halted by utilizing binary methodology with inclusive language.

Overall, this survey shows yet another perspective of forensic anthropology, with the majority population comprised of women, White individuals, and non-LGBTQIA community members. Furthermore, the survey responses show that the majority are participating in some form of academic setting (student, research, professor) with less than ten years of experience. While this is not surprising for the field, it highlights that we still lack the diversity which would enhance our research and engage new avenues of inquiry. By increasing our diversity, can research focus on the development of diversified methods, increasing awareness of biased methods established on populations of convenience. For skeletal sex estimations, *FORDISC 3.1*(Jantz and Ousley, 2005) and Spradley and Jantz (2011) are the preferred metric methods, while Buikstra and Ubelaker (1994) and Klales *et al.* (2012) are the preferred non-metric methods. Moreso, when conducting skeletal sex estimations, postcranial elements maintained the place in preference and utilization.

The survey also shows that the majority of respondents use “sex,” “biological sex,” and “indeterminate” when conducting sex estimations; and they also maintain that gender including transgender cannot be estimated from the skeleton alone. Additionally, many respondents showed preference in the used of skeletal sex estimations in reporting sex, even when the material context is contradictory (skeletal sex: male, material context: female). This would indicate that when conducting a sex and gender estimation material context should be utilized, especially when the evidence in contradictory or skeletal sex estimations are indeterminant. This has been shown to be beneficial for identifying immigrants along the U.S.-Mexico border and will likely provide the same benefits for trans and intersex individuals. This is also supported by two facts, one very few individuals within the transgender community pursue GAT such as FFS; two, little is known about the long-term effects on the skeletal system. If the associated material context would indicate signs of GAS or transmen or transwomen, then conclusions may be drawn.

CONCLUSIONS

The processes for identifying transgender, intersex, and non-binary decedents have yet to be firmly established within the field of forensic anthropology. An anonymous survey was conducted to explore forensic practitioners' methods, procedures, and knowledge of sex estimation of transgender and intersex individuals. The survey revealed that forensic anthropologists recognize the importance of identifying the gender of a decedent or identifying them as intersex or transgender to increase the overall odds of identification. However, there is a lack of knowledge about gender-affirming treatments (GAT) and associated material contexts in relation to intersex and transgender decedents. Additionally, the survey highlighted that forensic anthropologists t rely on skeletal sex estimations while excluding material context, even when it supports the sex estimation. This preference for sex estimation methods, without considering material context, is problematic and biased, especially considering the origins of some sex estimation methods.

While DNA and Isotope analysis are useful for narrowing down potential identifications, the SWGANTH still suggests using skeletal sex estimations for identification purposes (2010). Nevertheless, a biocultural approach involving sex estimations and gender estimations may enhance the overall odds of identification, acknowledging non-binary and queer understandings of sex and gender. Some popular sexing methods among respondents include Buikstra and Ubelaker (1994), FORDISC 3.1

(Jantz and Ousley, 2005), Klales et al. (2012), and Spradley and Jantz (2011), with an emphasis on metrics and pelvic morphology.

Concerning gender-affirming surgeries (GAS), it is likely that signs of these surgeries will be encountered in a forensic anthropological context, although Schall et al. (2020) suggested assessing cranial elements for signs of gender-affirming surgeries when available. While the effects of Gender-affirming hormone therapy (GAHT) have not been fully evaluated, certain skeletal changes, such as early onset osteoporosis, may indicate the pursuit of hormone therapy, though it is unlikely these will be visible. The use of a biocultural approach is advocated for identifying transgender, intersex, and non-binary decedents, combining FORDISC 3.1 (Jantz and Ousley, 2005), Klales et al. (2012), Walker (2008), and other postcranial sex estimation methods with the sequential unmasking of material context. This approach may lead to conclusions such as "Likely AMAB/AFAB; however, material context may suggest Transmale/Transfemale or non-binary." Skeletal sex identification along with suggested gender identity may aid in the identification of these individuals.

APPENDIX A

FORDISC 3.1: Individual 1 (BU-33) Cranial

FORDISC 3.1.316 Analysis of Current Case
Using cranial data file version 1.23
DFA results using 9 measurements:
DKB FOL GOL MDH NLB OBB OBH OCC ZYB
Measurements removed: UFBR FOB GNI HMF TMF GOG CDL WRB MLN XRH MAN

Measurement Checks and Group Means
Group Means
AF AM BF BM CHM GTM HF
HM JF JM VM WF WM
Current Case Chk 30 53 80 126 74 78 55
215 124 195 48 274 489

DKB 22 22.3 22.4 22.3 23.5 22.0 21.6 20.3
21.1 20.5 21.4 21.3 20.1 21.3 FOL 36 36.2 36.5 34.5 36.5 35.6
35.8 35.4
36.5 34.5 35.9 34.5 35.7 37.4
GOL 170 - 177.0 179.9 177.9 186.7 179.3 173.6 171.1
178.3 171.9 179.3 172.4 177.5 187.6
MDH 27 25.0 29.5 28.2 32.3 29.4 30.9 26.0
29.4 26.2 30.2 26.5 27.7 32.0 NLB 23 25.3 26.0 24.9 26.2 26.2
25.5 23.8
25.0 25.0 25.6 26.2 22.6 24.0 OBB 41 40.6 42.2 38.5 40.5 38.7
38.9 39.0
39.8 37.7 39.3 38.4 39.2 41.2 OBH 36 35.0 35.2 34.5 35.2 33.7
36.1 35.3
35.2 33.8 34.1 33.8 33.4 34.0 OCC 96 94.0 93.9 96.7 99.0 98.2
95.9 95.6
97.3 96.7 100.2 98.4 97.8 100.6
ZYB 121 131.6 140.7 121.7 130.6 132.8 131.4 123.2
131.0 125.0 133.2 130.0 120.8 129.9

+/- measurement deviates higher/lower than all group means; ++/-- deviates 1 to 2 STDEVs
+++/--- deviates two to three STDEVs; ++++/---- deviates at least 3 STDEVs
----

Outliers in the reference groups: 9

Natural Log of VCVM Determinant = 20.4879

Classification Table

From Group	Total Number	Into Group (counts) AF	AM	BF	BM	CHM	GTM	HF	HM	JF	JM	VM	WF	WM	Correct
AF	30	13	5	0	0	0	1	3	2	2	0	2	2	0	43.3 %
AM	53	0	38	0	1	3	2	0	0	1	2	1	1	4	71.7 %
BF	80	3	0	44	5	0	2	9	1	5	0	0	8	3	55.0 %
BM	126	4	3	8	69	7	2	1	4	2	4	1	5	16	54.8 %
CHM	74	0	1	0	7	23	5	3	5	5	19	3	0	3	31.1 %
GTM	78	2	5	4	2	4	38	4	8	3	3	5	0	0	48.7 %
HF	55	2	0	7	0	0	4	24	1	5	1	2	8	1	43.6 %
HM	215	23	13	4	19	22	30	17	30	9	17	8	6	17	14.0 %
JF	124	4	1	11	1	8	5	17	1	47	4	21	4	0	37.9 %
JM	195	5	20	2	9	31	12	4	15	10	56	20	3	8	28.7 %
VM	48	0	1	2	0	7	8	3	0	7	5	14	1	0	29.2 %
WF	274	7	0	29	3	2	1	30	3	14	1	0	164	20	59.9 %
WM	489	10	16	9	65	13	2	5	20	4	19	1	30	295	60.3 %

Total Correct: 855 out of 1841 (46.4 %) *** CROSS-VALIDATED ***

Multigroup Classification of Current Case

Group Classified Distance Probabilities into from
Posterior Typ F Typ Chi
Typ R

HF **HF** 4.4 0.482 0.890 0.883
0.875 (7/56) WF 5.7 0.254 0.776 0.772
0.655 (95/275) BF 6.3 0.184 0.718 0.707
0.642 (29/81) AF 10.0 0.029 0.383 0.351
0.290 (22/31) JF 10.8 0.020 0.301 0.291
0.096 (113/125)
HM 11.9 0.012 0.228 0.221
0.264 (159/216) BM 13.2 0.006 0.164 0.155
0.220 (99/127) WM 13.7 0.005 0.138 0.134
0.122 (430/490) GTM 13.8 0.004 0.141 0.131
0.127 (69/79) VM 15.4 0.002 0.091 0.080
0.184 (40/49) JM 17.9 0.001 0.039 0.037
0.026 (191/196) CHM 18.9 0.000 0.029 0.026
0.013 (74/75) AM 24.3 0.000 0.005 0.004
0.056 (51/54) ---

Current Case is closest to HFs

Figure A.1 *FORDISCI 3.1* Individual 1 (BU-33) Cranial Output

FORDISC 3.1: Individual 1 (BU-33) Post-cranial

FORDISC 3.1.316 Analysis of Current Case
Using postcranial data file version 1.18
DFA results using 14 measurements:
CLAAPD FEMEBR FEMMAP FIBMDM HUMEBR HUMMWD HUMMXD ILIABR
INNOHT SACABR SCAPBR SCAPHT TIBDEB TIBPEB

Measurement Checks and Group Means

		Group Means			
		BF	BM	WF	WM
Current Case	Chk	24	71	144	353
CLAAPD	12	11.4	14.0	10.7	13.1
FEMEBR	80	72.8	83.8	75.5	85.8
FEMMAP	31	27.5	31.8	27.7	31.1
FIBMDM	16	14.1	15.6	14.5	16.1
HUMEBR	57	53.8	64.6	55.3	64.8
HUMMWD	19	16.1	19.6	15.2	18.8
HUMMXD	21	20.2	23.8	19.9	23.5
ILIABR	162	143.0	155.0	156.6	162.3
INNOHT	205	189.5	212.6	203.0	224.9
SACABR	109	98.1	102.3	109.5	109.2
SCAPBR	100	93.6	111.2	95.9	108.6
SCAPHT	144	136.5	161.2	141.7	163.8
TIBDEB	51	45.2	51.3	45.4	51.5
TIBPEB	78	68.4	79.4	69.7	79.7

+/- measurement deviates higher/lower than all group means; ++/-- deviates 1 to 2 STDEVs
+++/--- deviates two to three STDEVs; ++++/---- deviates at least 3 STDEVs

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Outliers in the reference groups: 8

Natural Log of VCVM Determinant = 30.3104

Classification Table

From Group	Total Number	Into Group (counts) BF	BM	WF	WM	Correct
BF	24	18	1	5	0	75.0 %

BM 71 0 67 0 4 94.4 %
WF 144 17 0 126 1 87.5 %
WM 353 5 35 6 307 87.0 %
--- Total Correct: 518 out of 592 (87.5 %) *** CROSS-VALIDATED ***

Multigroup Classification of Current Case --

Group Classified Distance Probabilities into from Posterior Typ F Typ Chi Typ R

BF **BF** 13.5 0.854 0.556 0.489 0.480 (13/25)
WF 17.3 0.128 0.272 0.242 0.172 (120/145)
WM 21.9 0.013 0.098 0.081 0.110 (315/354)
BM 23.8 0.005 0.065 0.049 0.167 (60/72)

Current Case is closest to BFs

Figure A.2 *FORDISCI 3.1* Individual 1 (BU-33) Post-cranial Output

FORDISC 3.1: Individual 2 (BU34) Cranial

FORDISC 3.1.316 Analysis of Current Case
Using cranial data file version 1.23
DFA results using 14 measurements:
ASB AUB BBH BNL BPL EKB FRC GOL MDH NLB
NLH PAC ZMB ZYB
Measurements removed: UFBR FOB GNI HMF TMF GOG CDL WRB MLN XRH
MAN

Measurement Checks and Group Means
Group Means
AF AM BF BM CHM GTM HF
HM JF JM VM WF WM
Current Case Chk 25 48 32 58 73 74 36
177 123 193 48 148 291

ASB 116 + 106.9 110.9 106.7 110.9 106.9 108.6 107.4
109.9 104.3 107.7 105.0 109.7 114.7
AUB 124 125.6 131.9 115.6 121.2 123.6 123.7 118.4
124.0 117.2 123.1 122.8 117.1 123.4
BBH 143 + 129.1 132.9 131.3 137.2 139.5 133.2 129.9
135.8 131.9 138.3 137.8 134.0 140.5
BNL 107 + 99.5 102.9 98.1 104.0 100.6 98.3 95.3
100.4 95.6 101.7 97.6 98.4 105.3
BPL 97 96.4 100.1 98.2 103.5 96.0 97.7 92.6
98.0 93.7 97.5 95.4 91.3 97.2 EKB 97 98.5 101.4 94.9 100.5 96.9
96.3 93.4
96.3 93.4 97.2 95.3 93.6 98.0 FRC 110 107.0 110.6 107.7 112.9
112.8 106.6 104.7
110.5 107.0 110.9 112.1 109.4 114.7
GOL 190 + 176.6 179.7 177.6 186.9 179.4 173.5 170.1
177.6 171.8 179.3 172.4 176.8 187.3
MDH 36 + 24.7 29.3 28.5 33.2 29.5 31.0 25.4
29.9 26.1 30.2 26.5 27.8 32.3
NLB 27 + 25.3 26.1 24.7 26.5 26.2 25.5 24.2
25.0 25.0 25.5 26.2 22.7 24.2 NLH 54 + 51.9 53.8 48.7 52.7 52.4
51.6 48.6
52.2 48.8 51.4 53.1 48.7 52.7
PAC 122 + 107.4 109.8 113.1 117.0 115.3 112.7 108.5
111.4 109.1 113.5 110.4 112.9 117.7
ZMB 94 97.6 100.4 88.3 92.4 99.0 94.1 89.6

93.5 93.3 98.6 98.7 84.8 89.4 ZYB 136 132.2 141.3 122.0 130.6
132.9 131.4 122.7
130.9 124.8 133.2 130.0 120.8 129.7

+/- measurement deviates higher/lower than all group means; ++/-- deviates 1 to 2 STDEVs
+++/--- deviates two to three STDEVs; ++++/---- deviates at least 3 STDEVs

----

Outliers in the reference groups: 11

Natural Log of VCVM Determinant = 36.5832

Classification Table

From Group	Total Number	AF	AM	BF	BM	CHM	GTM	HF	HM	JF	JM	VM	WF	WM	Correct
AF	25	14	4	1	0	0	1	1	0	2	2	0	0	0	56.0 %
AM	48	3	33	0	1	1	1	1	3	0	2	2	0	1	68.8 %
BF	32	0	0	18	2	0	0	5	1	3	0	0	1	2	56.3 %
BM	58	1	1	4	42	1	2	0	2	0	2	0	0	3	72.4 %
CHM	73	2	2	0	1	27	3	1	4	7	17	9	0	0	37.0 %
GTM	74	3	3	3	4	5	32	5	6	2	6	2	3	0	43.2 %
HF	36	3	0	3	0	0	1	14	0	7	0	1	7	0	38.9 %
HM	177	17	5	5	12	7	24	8	44	12	11	11	4	17	24.9 %
JF	123	3	0	6	1	3	3	14	7	72	7	7	0	0	58.5 %
JM	193	6	8	2	4	42	13	3	9						

12 80 7 1 6 41.5 %
VM 48 1 0 0 0 10 1 2 3
5 0 26 0 0 54.2 %
WF 148 0 0 7 0 0 1 13 0
3 0 1 108 15 73.0 %
WM 291 0 2 3 17 3 4 3 18
0 2 0 23 216 74.2 %

--- Total Correct: 726 out of
1326 (54.8 %) *** CROSS-VALIDATED ***

Multigroup Classification of Current Case

Group Classified Distance Probabilities into from
Posterior Typ F Typ Chi
Typ R

JM **JM** 13.7 0.379 0.491 0.474
0.361 (124/194) WM 14.3 0.279 0.443 0.429
0.473 (154/292) CHM 15.4 0.157 0.374 0.349
0.338 (49/74) HM 16.8 0.080 0.284 0.267
0.354 (115/178) BM 17.7 0.050 0.245 0.219
0.271 (43/59) GTM 17.9 0.046 0.234 0.212
0.173 (62/75) AM 21.8 0.006 0.100 0.082
0.224 (38/49) JF 25.0 0.001 0.041 0.035
0.008 (123/124) BF 27.4 0.000 0.025 0.017
0.030 (32/33) AF 27.4 0.000 0.026 0.017
0.038 (25/26) VM 27.9 0.000 0.020 0.015
0.020 (48/49) WF 28.7 0.000 0.014 0.011
0.007 (148/149) HF 29.2 0.000 0.014 0.010
0.054 (35/37) --

Current Case is closest to JMs

Figure A.3 *FORDISCI 3.1* Individual 1 (BU-34) Cranial Output

***FORDISC 3.1*: Individual 2 (BU34) Post-cranial**

FORDISC 3.1.316 Analysis of Current Case
Using postcranial data file version 1.18
DFA results using 14 measurements:
CLAXLN FEMBLN FEMXLN FIBXLN HUMXLN RADTVD RADXLN TIBCIR TIBNFT TIBNFX TIBXLN ULNPHL ULNTVD ULNXLN

Measurement Checks and Group Means

		Group Means			
		BF	BM	WF	WM
Current Case	Chk	26	63	170	377
CLAXLN	153	140.9	159.6	139.5	157.5
FEMBLN	454	435.2	484.6	433.2	469.1
FEMXLN	459	439.5	487.9	437.2	472.6
FIBXLN	373	358.8	401.5	352.0	386.5
HUMXLN	331	307.2	340.7	304.9	334.9
RADTVD	14	13.6	16.2	13.7	16.5
RADXLN	236	235.1	268.2	227.2	253.6
TIBCIR	91	86.6	102.3	85.0	97.8
TIBNFT	24	23.0	26.9	21.8	25.1
TIBNFX	34	31.3	37.6	31.7	36.8
TIBXLN	374	364.5	409.9	358.9	392.7
ULNPHL	222	225.0	255.3	216.3	240.5
ULNTVD	15	13.8	16.9	14.3	17.4
ULNXLN	262	252.7	286.7	243.8	271.8

+/- measurement deviates higher/lower than all group means; ++/-- deviates 1 to 2 STDEVs
+++/--- deviates two to three STDEVs; ++++/---- deviates at least 3 STDEVs

----

Outliers in the reference groups: 15

Natural Log of VCVM Determinant = 38.3148

Classification Table

From	Total	Into Group (counts)				
Group	Number	BF	BM	WF	WM	Correct
BF	26	14	1	10	1	53.8 %
BM	63	5	46	0	12	73.0 %

WF 170 41 1 120 8 70.6 %
WM 377 11 69 20 277 73.5 %
-- Total Correct: 457 out of 636 (71.9 %) *** CROSS-VALIDATED ***

Multigroup Classification of Current Case --

Group Classified Distance Probabilities into from Posterior Typ F Typ Chi Typ R

WM **WM** 21.0 0.476 0.120 0.103
0.148 (322/378) WF 21.4 0.388 0.111 0.093
0.129 (149/171) BF 23.5 0.133 0.080 0.053
0.185 (22/27) BM 31.3 0.003 0.008 0.005
0.063 (60/64) --

Current Case is closest to WMs

Figure A.3 *FORDISCI 3.1* Individual 1 (BU-34) Post-cranial Output

Klales *et al.* (2012) and Walker (2008) assessments Individual 1 (BU-33).

Klales et al. (2012) Output:

Pelvic Trait	**Left**	**Right**
Ventral arc (VA)	4	3
Subpubic contour (SPC)	3	2
Medial aspect of the ischiopubic ramus (MA)	3	3
Probabilities	**Pf=0.912**	**Pm=0.087**

Logistic Regression Equation: (2.726[VA]+1.214[MA]+1.073[SPC]-16.312)
(Pf)= 1/(1+EXP(Score)) (Pm)= 1-(Pf)

Walker (2008) Output:

Cranial Trait	**Left**	**Middle**	**Right**
Nuchal crest		3	
Mastoid process	2	-	2
Supraorbital margin	3	-	3
Glabella	-	2	-
Mental eminence	-	2	-
Probabilities	**Pf=0.847**		**Pm=0.153**

Linear Discriminant Function Equation (America/English): Y=(glabella*-1.375)+(mastoid*-1.185)+(mental*-1.150)+9.128)
(Pf)= 1/(1+e(Y)) (Pm)= 1-(Pf)

Figure A.4, Klales *et al.* and Walker Outputs for Individual 1 (BU-33).

Klales *et al*. (2012) and Walker (2008) assessments Individual 2 (BU34)

Klales et al. (2012) Output:

Pelvic Trait	Left	Right
Ventral arc (VA)	4	4
Subpubic contour (SPC)	4	3
Medial aspect of the ischiopubic ramus (MA)	3	4
Probabilities	**Pf=0.074**	**Pm=0.926**

Logistic Regression Equation: (2.726[VA]+1.214[MA]+1.073[SPC]-16.312)
(Pf)= 1/(1+EXP(Score)) (Pm)= 1-(Pf)

Walker (2008) Output:

Cranial Trait	Left	Middle	Right
Nuchal crest	-	5	-
Mastoid process	3	-	3
Supraorbital margin	4	-	4
Glabella	-	5	-
Mental eminence	-	5	-
Probabilities	**Pf=0.001**		**Pm=0.999**

Linear Discriminant Function Equation (American/English): Y=(glabella*-1.375)+(mastoid*-1.185)+(mental*-1.150)+9.128)
(Pf)= 1/(1+e(Y)) (Pm)= 1-(Pf)

Figure A.5. Klales *et al.* and Walker Outputs for Individual 2 (BU-34).

Statistical Analysis of Individual 1 (BU33) and Individual 2 (BU34)

Individual 1 Walker (2008) Equation 1:
y=((2*-1.375)+(2*-1.185)+(2*-1.150)+9.128)
y = ((-2.75)+(-2.37)+(-2.3)+9.128)
y = (1.708)

Pf= [1/(1+e-(1.708))]
Pf = [1/(1+0.1812278862)]
Pf = [1/(1.181227886)]
Pf = [0.8465766952]

Pm = (1-0.8465766952)
Pm = (0.1534233048)

Individual 1 Klales *et al.* (2012):
y = (2.726(3)+1.214(3)+1.073(2)-16.312)
y = (8.178+3.723+2.146-16.312)
y = (-2.346)

Pf = [1/(1+e(-2.346))]
Pf = [1/(1+0.0957514028)]
Pf = [1/(1.095751403)]
Pf = [0.9126157605]

Pm =(1-0.9126157605)
Pm = (0.0873842395)

Individual 2 Walker (2008) Equation 1:
y = ((5*-1.375)+(3*-1.185)+(5*-1.150)+9.128
y = ((-6.875)+(-3.55)+(-5.75)+9.128)
y = (-7.052)

Pf = [1/(1+e-(-7.052))]
Pf = [1/(1+1155.166768)]
Pf = [1/1156.166768]
Pf = [8.649271262E-4]

Pm = (1-8.649271262E-4)
Pm = (0.9991350729)

Individual 2 Klales *et al.* (2012):
y = (2.726(4)+1.214(3)+1.073(4)-16.312)
y = (10.904+3.642+4.292-16.312)
y = (2.526)

Pf = [1/(1+e(2.526))]
Pf = [1/(1+12.50339241)]
Pf = [1/13.50339241]
Pf = [0.0740554647]

Pm = (1-0.0740554647)
Pm = (0.92599445353)

Figure A.6. Statistical Analysis of Individual 1 (BU33) and Individual 2 (BU34)

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