Beyond Binary Identification:

Gender Affirming Care and its Utility in Forensic Anthropology

by

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Abstract

The role sex plays in forensic anthropology varies from the role gender plays in cultural performance. This thesis looks at how the changes that occur during a transition may be interpreted by forensic anthropologists. Violent crime rates against gender-diverse individuals are high for the small size of the population and variation in gender-affirming can offer potential avenues to assist in forensic investigation. Through a literature review and a series of interviews, this thesis will look at some of the actions transgender individuals may choose to undergo to affirm their gender identity and how these choices may be reflected in the skeletal record. It also recognizes current calls for action by the transgender community and members of the academic community urging forensic anthropologists to deepen their understanding of how individuals who have undergone transition might be recognized postmortem. Working with transgender communities to expand our understanding of surgical intervention in the context of transgender medical care, forensic anthropologists might offer insights about a decedent's history that conventional sex estimation from metric data may not be able to provide.

Preface

This thesis is an original work by Brianne Bertram, supervised by Dr. Sandra Garvie-Lok. The interviews conducted as part of this thesis received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Beyond Binary Identification: New ideas of gender and how they fit into forensic anthropology," No. Pro00133307.

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Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction.

My interest in sex identification research began when I learned about the small population of individuals born intersex throughout the modern world via the documentary "Intersexion: Boy or Girl" (Lahood 2013). This led me to question my understanding of sex beyond the traditional binary that I was raised with in Western Canada. This pathway continued throughout my studies in anthropology and led me to take courses on the anthropology of gender where I learned about the disproportional and increasing rates of violence affecting transgender individuals. As I developed an interest in osteology, I wanted to learn more about the role hormones play in bone development. From there I wondered what effects individuals who undergo a hormone transition would display in the osteological record and how this would affect forensic anthropologists' ability to identify individuals.

My research aims to determine how the processes involved in gender-affirming care can affect the body and to determine which of those processes are reliable indicators of transition to forensic anthropologists. In order to do this, I first had to become familiar with bone growth and development and the role that hormones play in sexual dimorphism and aging. I also needed to become familiar with the current practices of sex estimation in forensic anthropology and the history behind them. In this process, it was apparent that the current methods were created during a time when gender and sex binaries were not questioned by osteologists; they were assumed. This influenced the way methods developed, looking only for ways to differentiate between male and female without considering the people born outside of this binary. Thinking of the documentary that started my interest in this topic, I looked into the lack of research regarding intersex skeletal development in both forensic identification and clinical research. Unfortunately, the research I did find suggested that distinctive intersex traits would be limited to soft tissue and

outside the scope of the thesis. Instead, I focused on how changing the natural hormone cycle during gender-affirming care may result in observable changes to bone.

After considering how sex is defined in current research, I investigated multiple methods of skeletal sex estimation both historically and those used by anthropologists today to better understand how a forensic determination between male and female is made. After this, I identified four areas where a review of the literature can suggest the evidence that transitioning might leave in skeletal remains: pharmaceutical hormonal modifications, facial plastic surgery scarring, surgical implants, and the historic practice of castration to see how the act of emasculation affected skeletal development. As I will discuss below, each of these areas has its own interest for my research question and its own potential strengths and weaknesses as a potential method for identifying the remains of trans individuals.

I conducted interviews to get feedback on the methods I had researched, but also to gain insight on the current practices of professional forensic anthropologists and where they see the future of this research going. Based on the research I had done, I wrote interview questions, an interview guide and completed my ethics application to interview practicing forensic anthropologists. From Fall 2023 to Winter 2024, I conducted my interviews with four participants over Zoom and in person. In the following months, I analyzed their responses for key themes and considered what they suggest about where research in this area is heading.

This thesis presents the results of my work as follows. Chapter 2 discusses the reasons why transgender individuals are an at-risk population in forensic terms and reviews the current calls upon forensic anthropologists to use inclusive terminology in case reports. Chapter 3 contains a discussion of how we can define sex and current osteological practices for determining sex. Chapter 4 considers clinical evidence for the skeletal effects of hormonal

treatment and what the archaeology of castration can tell us about these effects, as well as the impact of surgical modifications, and how all of these may appear in the skeletal record. Chapter 5 is where I discuss my interviews; it contains information about the participants and their professional roles, their recruitment, and the insights my interview research provide. Finally, my conclusion in Chapter 6 summarizes these discussions and provides my overall findings and suggestions for where further research can be conducted.

Chapter 2: Violence against Transgender Individuals

The role of the forensic anthropologist in identifying individuals from their skeletal remains is deeply intertwined with legal systems which have adapted to meet modern ideas of sex and gender, allowing individuals to change their sex on their legal identification. This presents the first new complication in forensic assessments of transgender individuals. The second is the unknown effects transition has on the skeleton. In addition to presenting more complicated cases, transgender individuals are often the victims of violent crimes resulting in murder. The social disenfranchisement faced by transgender individuals makes them vulnerable to individuals seeking to commit violence and isolation leads to the abundance of missing persons cases reported annually.

Doug Meyer shares several personal accounts from LGBT+ individuals who have experienced gender-based violence in his work "Violence Against Queer People: Race, Class, Gender, and the Persistence of Anti-LGBT Discrimination." Multiple individuals reported being cornered and sexually assaulted, accompanied by a verbal assault that focused on their sex or gender along with the implication that they would be interested in the unwanted advance because of said sex/gender (Meyer 2015). Dominique, a twenty-three-year-old transgender woman, describes two incidents of sexual assault, the first of which occurred when she resisted a man's advances and he got aggressive with her, and she feared he would beat her or kill her (Meyer 2015, 80). The second assault occurred when Dominique was engaged in sex work and a man pulled a gun on her and forced her to continue; when she reported to a nearby police car after the event, she was disregarded, and the officers drove in the opposite direction of the assailant's car (Meyer 2015, 81). Eva, a transgender woman, emphasized the victim blaming that transgender women face when she attempted to report to the police. The officers' response included

statements that she "couldn't be raped" because she was transgender and the interchangeable use of "he" and "she" to refer to Eva (Meyer 2015, 78). Meyer did not feature any accounts from transgender men, but these ideas are repeated by others throughout his work. While the reasons for LGBT+ discrimination are outside the scope of this thesis, these accounts provide insights into some of the violence LGBT+ individuals are experiencing. While Dominique and Eva are only telling their experiences, stories spread and the fear of not being taken seriously or further abused can make LGBT+ individuals afraid to report assault.

Moving from the personal to the general, a 2015 survey by the National Center for Transgender Equality reported that 46% of transgender respondents had experienced verbal harassment within the past year (James et al. 2016). 9% of respondents reported being physically attacked within the past year and 47% reported sexual assault within their lifetime, 10% of whom reported that this occurred within the past year (James et al. 2016). The American Bureau of Justice Statistics followed up on this report with research on violence resulting from sexual orientation and gender identity and found that the rate of violent victimization of transgender individuals during 2017-2020 was 2.5 times the rate experienced by cisgender individuals, with 51.5 of every 1,000 transgender individuals surveyed reporting themselves as victims (Truman and Morgan 2022). Wirtz et al. (2020) created a comprehensive list of the studies done on gender-based violence in the United States between 2008 and 2016, during which time 165 transgender people were reported murdered in the United States while 2,343 were reported murdered globally. That study found that the estimated prevalence of gender-based violence among trans individuals in the United States reported by individual studies ranged from as low as 7% to as high as 89%; they argue that this large range is partly due to a lack of reporting by victims who do not feel safe or do not want to involve the police (Wirtz et al. 2020). These rates

of violence experienced by transgender individuals are disproportionately high given the number of transgender individuals in the population.

Flores et al. 2021 studied survey data from 2017-2018 looking for patterns of victimization against transgender individuals. The goal of this article was to help raise awareness of this disproportionate violence and call on public health institutions to increase awareness and address the issue (Flores et al. 2021). One pattern they found was that the number of violent incidents reported by transgender individuals was approximately half the actual number of violent incidents experienced (Flores et al. 2021; Gyamerah et al. 2021). One reason for this has been illustrated by the stories of transgender individuals who had negative experiences with certain police officers. In "Violence against Queer People: Race, Class, Gender, and the Persistence of Anti-LGBT Discrimination" we are presented with several interviews of individuals like Eva discussed above, who reported that the gender-based physical or verbal violence they experienced was repeated when they attempted to report these interactions to the police (Meyer 2015).

Distrust between the Queer community and public institutions like the police has a long history. On June 28, 1969, there was a six-day rebellion in New York, N.Y., where the LGBT+ patrons of the Stonewall Inn rebelled against a police raid and anti-homosexual laws (Halkitis 2019). While Stonewall was not the first uprising in response to police actions, it is one of the most recent successful and influential uprisings that had an impact on Western homosexuality laws. Despite the resulting changes to these laws, the tensions between the police and queer community have lingered and stories of individual police officers who enact violence against transgender individuals who attempted to report a crime against them have resulted in a lasting distrust of the police; as a result, many cases go unreported (Meyer 2015).

In 2010 the National Coalition of Anti-Violence Programs found that 50% of the individuals who died of violent crime and were reported to them in 2009 were LGBT+ individuals. Transgender women made up only 11% of the total reported victims but 50% of the 22 hate-motivated murders reported that year (Mitchell-Brody and Ritchie 2010). A global study conducted between 2008 and 2011 estimated that 831 transgender or gender non-conforming individuals were reported murdered (Balzer and Hutta 2012). The murders of transgender individuals occur across the world, illustrating the need to recognize this group and look for ways to assist forensic anthropologists in identifying those who have been victimized.

Also relevant to forensic anthropologists is evidence of repeat abuse. In 2010, the National Intimate Partner and Sexual Violence Survey found that 50% of transgender individuals surveyed had experienced physical partner violence since coming out as transgender (Black et al. 2011). More recently, a review of 85 articles on intimate partner violence found that transgender individuals were 2.2 times as likely to experience physical intimate partner violence and 2.5 times as likely to experience sexual abuse at the hands of their domestic partner than cisgender individuals (Peitzmeier et al. 2020). As noted by the authors, self-reporting does not always provide the most accurate results for this population as approximately half of the individuals approached did not partake in the surveys and thus did not report the violence they have experienced. Taking this into account, the number of transgender individuals who experience physical violence is overrepresented for the small population size and may be even larger than what was reported.

It is important to note that within these statistics is another statistic; approximately half of those who have experienced transgender-related violence are people of colour (MitchellBrody and Ritchie 2010; Gyamerah et al. 2021). The intersection of racial and gender identity is outside

the scope of this thesis, but it needs to be noted that not only are transgender people of colour more disenfranchised, but they are particularly targeted when they appear obviously transgender or do not conform to the predominant gender ideologies of the dominant culture (Jefferson, Neilands, and Sevelius 2013). Using data initially collected for a longitudinal study on HIV in trans women, Gyamerah et al. (2021) used the additional data collected to look at the hate crime experiences of these women between 2016-2018. They found that again, only half of these women (51.1%) reported their experiences to the police, but their data set also took ancestry into account and found that of those who reported experiencing violence, Black and Latina trans women were more frequently victims of violence with a weapon and sexual assault (Gyamerah et al. 2021). This thesis will focus on the skeletal remains of transgender individuals, but the ability to access resources and the intersection between race and sex are crucial to a broader understanding of profiling.

The rates of violence against this group were a driving factor for my thesis research. There are a handful of new works calling specifically for research in this area. One that became a major influence on my interview research is a 2021 publication resulting from a master's research project reporting that 82.1% of 115 forensic anthropologists surveyed had discussed the difficulties of emerging gender identities, the socially changing relationship between sex and gender and how these relate to forensic anthropology with their students (Tallman, Kincer, and Plemons 2022). Another 60% of respondents reported discussing potential issues of identifying transgender decedents (Tallman, Kincer, and Plemons 2022). This report will be discussed in more depth in Chapter 5, as the survey research inspired some of my interview questions and I wanted to get more detailed answers on these topics than a survey could provide.

Adams et al. (2023) reviewed current literature on the anti-trans violence "epidemic" and called upon forensic anthropologists to recognize the role they play in "cisgenderist practices and systems: in casework, research and education" (142). Adams and colleagues argued that the work forensic anthropologists do is rooted in cisgenderism that is ingrained in the academic, health and legal sectors. They call on forensic anthropologists to act in four ways: by being transparent about the limitations of forensic anthropological analysis, by mitigating biases and misinterpretation of skeletal analysis, by making use of a bio-cultural profile, and by actively combating misgendering within case files and investigations (Adams et al. 2023). The limitations of skeletal analysis will be discussed in the next chapter where I look at how sex is defined within forensic anthropology. Adams et al. (2023) applied Evans and Kneppers' (2020) to create their suggestions for best practice.

Table 1 Measures advocated by Adams et al. (2023, 154)

Tiers of the Diversity and Inclusion Model (Following Evans and Knepper [129])	Application to the Forensic Anthropology Classroom
Tier 1: Representation of gender	• Interject gender diversity readings in course syllabi and lectures. • Include guest speakers from the TGD community on the course schedule. • Meaningfully include specific examples showcasing how gender diversity is represented in forensic cases. • Use "they/them" pronouns when referring to unidentified decedents and persons of unknown gender identity in lecture materials.
Tier 2: Gender-sensitive course environment	• Create a welcoming classroom environment by outlining expectations for inclusivity and discussion. • Assign readings from diverse authors that emphasize multiple perspectives.
Tier 3: Embedded application	• Challenge cisnormativity in readings and discussion. • Encourage sharing of experiential knowledge. • Promote self-reflection for both students and instructor. • Commit to application of queer theory in course design and instruction. • Design assignments that challenge binary conceptions of sex and gender.
Tier 4: Gender acculturation	• Acknowledge that language, visuals, terms, and phrases are often gender-coded and re-examine usage in the classroom and syllabi. • Avoid using images, quotes, and phrases that reinforce gendered stereotypes. • Critically examine all examples and images used in coursework to ensure that underlying messages are inclusive.

In 2024, Adams and eleven other forensic anthropologists again called upon the field of forensic anthropology to engage in more activism and advocacy for transgender communities

(Adams et al. 2024). One goal of this publication was clarity on the activism they had previously called for, explaining that activism does not need to mean protesting and marches, but rather an individual choice to engage in measures like the shift in terminology from simply 'sex' to 'assigned sex at birth' or 'osteological sex' in reports (Adams et al. 2024). This article also covers other disenfranchised groups, as well as issues of intersectionality, primarily advocating that awareness is the first step towards activism (Adams et al. 2024). For those more interested in activism, Adams and colleagues suggest forensic anthropologists look at the history of forensic anthropology pedagogy and evaluate the role those prominent ideologies of sex and gender had in its development, comparing this to the re-evaluation of ancestry within the field. The history of the development of sex estimation methods will be further looked at in Chapter 3.

In Chapter 4, I discuss plastic surgery and the visible traces it may leave in the skeletal record for forensic anthropologists to interpret. On this subject, Flaherty, Byrnes, and Maddalena (2023) were presented with an opportunity to analyze the CT scan of a transgender woman who had undergone 13 procedures to feminize her face including three rhinoplasties, cheekbone reduction and reconstruction, tracheal shave, gonial angle reductions, and orbital rim shaving. The transgender woman, called Patty in their article for confidentiality, approached Flaherty and team and asked them to analyze her CT scan using the program FORDISC to determine if the new measurements of her skull after these surgeries would present her as male or female. The CT scan, shown in Figure 4 of this thesis (page 48), was used to generate twenty-seven measurements that were inputted into FORDISC and resulted in a classification of White Male with a validation of 92.2% (Flaherty, Byrnes, and Maddalena 2023). While this experiment did not yield the results Patty hoped for, it provides information about our potential ability to analyze the evidence of surgical modification on the skull which I will discuss more in Chapter 4. One

important example is that forensic anthropologists have been approached by a civilian who was concerned about her ability to be correctly identified if something happened to her. Patty's concern is an example of the individual fear felt by transgender individuals and their desire to engage in more community-led research.

The disenfranchisement of transgender individuals is not a new concern. The violence against this group is well documented, even despite reports that suggest only half of the actual incidents are reported. Forensic anthropologists are not unaware of this group, and the desire to find ways to identify them and otherwise support their needs is expressed by a handful of academic articles calling for a change in terminology (Flaherty et al. 2023; Adams et al. 2023; 2024). The issue has also been raised by a transgender individual who approached scholars, looking for ways to help identify her community members (Flaherty, Byrnes, and Maddalena 2023). The concern has been voiced and now it is up to forensic anthropologists to answer the call, starting by looking at the history of sex estimation in our discipline and how we define sex.

Chapter 3: Current Practices in Sex Estimation

The conversation about sex is much larger than can be covered by the scope of forensic anthropology alone due to our narrow focus on the skeleton. Clinical definitions of sex agree that it is determined by several interplaying factors, but in forensic anthropology, we look to the sexual dimorphism that occurs in the human skeleton during life. Many traditional methods have forensic anthropologists score skeletal morphology on a 5-point scale of masculine to feminine working on the assumption that human sex is binary but recognizing that skeletal morphology is not, with individuals who fall between the two extremes described as male, possibly male, unknown, possibly female, or female (Buikstra and Ubelaker 1994; Blau 2017; Klales 2020). This scale presents the first issue forensic anthropologists face: how do we define what sex is in order to score it?

3.1 How do we Define Sex?

The generally accepted definition of sex is that it is biologically determined and is different from gender, which is a social construct. This idea was first popularized by Sigmund Freud in the 1895 "Studies on Hysteria," where he expressed the opinion that sex was something completely separate from gender (Bourseul 2014; Alfandary 2019). Freud argued that gender was a social construct that shaped the way people were supposed to behave, whereas sex referred to the physical transformations of the body and the cognitive developments that occurred alongside them (Freud 1895; Bourseul 2014; Alfandary 2019). This notion has continued in modern feminist scholarship. An example of this thought is Dr. Judith Butler's "Bodies that Matter" where she addresses the issue that the category of sex is almost always considered equal to gender although that is not the case (Butler 2011; Reid 2018). Butler demonstrates the connection between the physical body and gender expression and how these tie into specific

cultural constructions of gendered roles (Reid 2018). The relationship to culture is one of the fundamental differences between sex and gender, the other being that sex refers to a set of biological characteristics. Despite this difference, sex and gender are often used interchangeably in casual discourse and every culture has its own prescribed opinions on how individuals should express their gender through actions and appearance in socially acceptable ways.

Biological sex can be defined by a combination of biological factors, including phenotypic expression, chromosomes, and gamete production (Goymann, Brumm, and Kappeler 2023). Due to the complexity of biological sex, many argue that one simple defining factor is not enough (Garofalo and Garvin 2020; Klales 2020). Rather, biological sex is made up of the interplay of these factors; for example, an individual may be born with externally malepresenting genitalia but possess ovaries, a female reproductive organ.

Beside male and female, the third sex category largely accepted in western academia is intersex, coined by Richard Goldschmidt in 1917. Looking at the larger animal kingdom, Goldschmidt framed his argument for the term intersex by acknowledging the variety of sexual dimorphism that can occur in various species and the ability of some species to undergo sex changes in response to environmental stimuli. He concluded that sex characteristics are not decided until the point of fertilization, especially in the case of some insects which do not require two individuals for reproduction (Goldschmidt 1917). From there, the term intersex was derived to mean in-between sexes, chosen for its ability to be translated into other languages but also because Goldschmidt found that humans he characterized as intersex presented with a wide variety of organ and hormone variation between individuals making it challenging to describe the specifics of the condition. This term was not used by clinicians until the later part of the 20th century and was used interchangeably with hermaphrodite, rather it was the adoption of the term

by the intersex community in the 1990s that led to the medical community prioritizing the term (Feder and Karkazis 2008).

Some scholars argue that the multifaceted definition of sex and intersex individuals means the sex binary should be questioned. One scholar's argument against a sex binary is presented in "The Five Sexes," by Dr. Anne Fausto-Sterling (1993), where she argues that two biological sexes are not enough to accurately represent the full range of human variation, beginning what continues to be a discussion 30 years later. She defines sex on three levels, cellular (sex-specific cells, or X and Y chromosomes), at the hormonal level and at the anatomical level; she goes on to explain that each of these can be misaligned with gender identity. The original article proposed three additional categories: true hermaphrodites, male hermaphrodites and female hermaphrodites (Fausto-Sterling 1993). The term hermaphrodite comes from the name of two Greek Gods, Hermes and Aphrodite, who were said to have parented a child who was born male and fused with his true love resulting in a body with the organs of both sexes (Fausto-Sterling 1993). Later, in "The Five Sexes, Revisited," FaustoSterling (2000) called for a switch from 'hermaphrodite' to 'intersex.' It was hoped that this shift would eliminate the idea that these expressions of gender are deviations from a natural binary, encouraging the understanding that intersex in some form has always existed and should therefore be considered its own category, not a sub-category of binary sex (Fausto-Sterling 2000).

The frequency at which we see the combination of phenotypic traits and gamete production resulting in what we describe as male or female has meant that the binary sex system has remained dominant in clinical practice despite Fausto-Sterling's (2000) estimation that 1.7% of children are born outside of this binary and can be considered intersex. Other scholars argue

that due to the nature of human reproduction, the process of anisogamy, the ability of sexually reproducing organisms to produce either large gametes (eggs) or smaller mobile gametes (sperm), only allows for two sexes (Goymann, Brumm, and Kappeler 2023). They continue by highlighting sex roles in other species which may vary, but note that the gamete production remains consistent and argue that these traits do not reflect male or femaleness (Goymann, Brumm, and Kappeler 2023). Using this definition on the example of an individual born with male genitalia but large gamete-producing organs, we run into the issue that this is not sufficient to describe natural variation (Rehmann-Sutter et al. 2023). Rehmann et al. (2023) also bring up the issue of those born infertile who are still able to be categorized as male or female due to sex being more complex than one definition allows for.

An example of the critical responses to Fausto-Sterling's work is Sax (2002), who approaches Fausto-Sterling's work from the angle of the chromosomal sexes. There are largely considered to be two chromosomal sexes - XY and XX, male and female respectively - which are the most common chromosome presentations and have contributed to the current binary sex model. However, the definition of intersex used by Fausto-Sterling to expand into five sexes is considered by Sax (2002) to be inaccurate because it considers those born with Klinefelter syndrome, Turner syndrome, and XXY syndrome as intersex. If this definition is changed, as Sax proposes, to mean only that either chromosomal sex and phenotypic expression do not align or that phenotypic expression is not able to be classified as either male or female, the number of predicted intersex individuals drops to 0.018% (Sax 2002). Using Fausto-Sterling's definition, these chromosomal syndromes would be defined as three additional chromosomal sexes, which have a range of mental, physical, and hormonal effects on an individual. To evaluate this

argument, we need to understand each of these syndromes and their presentations. The following descriptions of these syndromes focus on the potential skeletal impacts that may be visible.

X0 syndrome describes the situation when one of the two X chromosomes is fully or partially missing; it was named Turner syndrome in 1938 by Dr. Henry Turner (Roberts and Fechner 2020). Turner syndrome presents osteological symptoms as a result of its associated SHOX haploinsufficiency. The SHOX protein plays a key role in bone growth and maturation, so its low level in X0 individuals affects the skeleton during development (Marchini, Ogata, and Rappold 2016). Turner syndrome individuals can present with shortened 4^{th} and 5^{th} metacarpals, altered body proportions with a high upper-to-lower segment ratio (also described as sitting height), and dorsal subluxation of the distal ulna related to epiphyseal growth arrest of the distal radius, also known as a Madelung deformity (Atik, Çoğulu, and Özkınay 2016). Treatment for Turner syndrome includes the use of growth hormone therapy, but the long-term outcomes of this treatment are still unclear (Jodarski et al. 2023). Turner syndrome also puts individuals at higher risks of developing cancer and autoimmune conditions, which may present as additional lesions on the skeleton; these lesions have been studied in the field of osteoimmunology (Jodarski et al. 2023).

Klinefelter syndrome refers to the situation in which an XY individual is born with at least one additional X chromosome. This may present as either 47,XXY syndrome, 48,XXXY syndrome, 48,XXYY syndrome, or 49,XXXXY syndrome, but all are grouped as chromosomal variants of Klinefelter syndrome. Klinefelter syndrome occurs in approximately one in 1,000 XY individuals born; almost all of these individuals will be infertile, but phenotypic effects are far more varied (Wattendorf and Muenke 2005). Klinefelter syndrome is primarily characterized by hypergonadotropic hypogonadism (abnormally low hormone production in the gonads) and

neurodevelopmental deficits, but tall stature is also considered a classic feature of Klinefelter syndrome in individuals with the 47,XXY karyotype (Wattendorf and Muenke 2005). However, if the 49,XXXXY karyotype is present, it can result in short stature as well as other skeletal traits: cleft palate or a flattened nasal bridge (Rajabzadeh, Taheri, and Jazayeri 2022). Additionally, the even rarer 48,XXXY karyotype has presented with mild craniofacial dysmorphism, taurodontism (apically displaced teeth with decreased root length, less visible cervical constriction, and a larger than average pulp cavity), clinodactyly and radioulnar synostosis or elbow deformity (Joseph 2008; Atik, Çoğulu, and Özkınay 2016).

XYY syndrome, named for the presentation of an additional Y chromosome in XY individuals and sometimes referred to as Jacob's syndrome, is characterized by neurodevelopmental phenotypes including developmental delay, increased mental health risk, and cognitive impairment (Jodarski et al. 2023). The phenotype of tall stature may accompany XYY syndrome, but overall physical characteristics are considered less evident than the other two syndromes discussed and have a large variation among individuals that has resulted in the underdiagnosis of the syndrome historically (Jodarski et al. 2023).

While these three chromosomal presentations can have skeletal markers, these are seen in only a small fraction of the already small population of individuals, one best described by the current description of the chromosomal fluctuations as part of larger syndromes. This brings into question whether any additional clarity would be added to forensic anthropology by introducing Fausto-Sterling's proposed additional chromosomal sexes and veering away from a sex binary. Due to the infrequency of these chromosomal syndromes, the many problems that accompany them and the range of human natural variation within them, I believe this would only increase confusion in the assessment of individual sex. Rather, any presentation of these syndromes

would be better noted in terms of pathologies and individualizing features. The presence of accompanying pathologies is better considered as an individualizing feature that will provide examiners with additional information about the decedent. Additionally, many of these syndromes are described by doctors in terms of their relationship to the traditional sex binary. For example, Klinefelter's is described as a syndrome which occurs in 1/1000 boys; this suggests that the development of the individual's secondary sex characteristics will still fit within the recognized sex binary, again making noting evidence of these syndromes more useful as identifying features because the individual would have been labelled as a boy in life.

3.2 Current Methods in Sex Estimation

Sex estimation methods used in biological anthropology focus on classic male and female phenotypes and then score skeletal traits on a continuum between them. This is in part because, during the creation of our standards of practice, the two sexes male and female were relatively unquestioned. While the conversations of Freud and others about the mental aspects of sex and gender were being discussed, the biology of the two sexes remained unquestioned. In the field of anthropology, our methods look at sex in the same way: there is an understanding that sex and gender are two separate yet often related categories, but sex is an unquestioned binary. The most commonly used methods for sex estimation primarily use the innominate and the skull to complete their assessments as these are the most consistently sexually dimorphic parts of the skeleton (Yang et al. 2020; Klales 2020). Even the term dimorphic reflects the dominant assumption in the field that sex is either male or female.

For both sexes, practitioners can use methods that rank each skeletal feature along a comparative scale to assess how masculine or feminine it is. We can also use quantitative measures like 3D modelling and metric analysis to determine the sex of an individual. It is

important to add that no method is perfect; even the best do not offer 100% accuracy and as a result, the best practice is to use multiple indicators to generate a composite estimate with the decedent assessed as male, female, likely male or female, or undetermined. I will review the specifics of scoring some commonly used morphological traits and how these are considered to range from masculine to feminine.

3.2.1 The Phenice Indicators

Many biological anthropologists rely on the longstanding practice of applying the Phenice traits to estimate the biological sex of skeletal remains. The Phenice traits are three morphological distinctions in the pelvis described by T.W. Phenice in 1969. Phenice created his approach using these traits to help anthropologists working with fragmented or delicate ancient remains, but the practice has since been used for modern contexts as well. His methods were based on observation, looking for the presence or absence of traits associated with either males or females. However, as he noted some of these traits can be possessed by both sexes but have different expressions. These methods are an important foundation of biological anthropologists' ability to conduct sex estimation of the pelvis and were included in the 1994 *Standards* volume published by Buikstra and Ubelaker, becoming the standard across the field.

The Phenice traits are the ventral arc, subpubic concavity, and ischiopubic ramus ridge. The ventral arc is located on the ventral surface of the pubic bone. It is an elevated ridge along the surface that is prominent in females and slight in males (Buikstra and Ubelaker 1994). In the 1960s, when the ventral arc was originally scored by Phenice, it was only observed in known female innominates. Phenice did record instances where males had a similar ridge, but he argued that when properly observed, the male ridge is either extended from the pubic crest to the pubic symphysis or extends over the pubic symphysis inferiorly and ends superior of the subpubic

angle, forming a similar angle to the ventral arc (Phenice 1969, 298-300). Since then, when scoring the ventral arc, a complete absence is considered to indicate a male pelvis, but methods have since developed that allow ventral ridge prominence to be scored to further determine if the individual is female or unknown (Moore 2013; Ubelaker 2018; Klales 2020). The ventral arc is considered to have the highest accuracy of the Phenice traits, over 85%, due to the relative lack of observer error (Kilmer and Garvin 2020).

Phenice first used the subpubic concavity, located on the dorsal side of the subpubic region, to determine sex. He looked at the border of the ischiopubic ramus to determine the level of concavity or convexity present. Initially, it was determined that if the border is concave the individual is female, and if it is convex it is male (Kilmer and Garvin 2020). As with the previous Phenice trait, the male-female distinction is not quite as simple as it initially seemed due to the natural range of individual variation caused by different directions of growth occurring at the middle of the ischiopubic ramus (Buikstra and Ubelaker 1994). The medial border of the ischiopubic ramus is its own trait scored by Phenice, described as narrow and crest-like in females, whereas male ridges are considered broad and flat (Buikstra and Ubelaker 1994). Phenice (1969) believed that the ischiopubic ramus was the least accurate of the three methods, and today the ischiopubic ramus is considered to be a supportive classification with a 75.8% success rate when scored alone (Klales, Ousley, and Vollner 2012, 111).

The Phenice traits have been tested numerous times over the years for their validity and repeatability. Klales et al. (2012) found their 75.8% success rate by taking the average of four students: two graduate students with experience in sex determination, one student who was familiar with an undergraduate course, and the last student with no previous knowledge of estimation or osteology. Later in a review of studies testing the Phenice methods, Klales et al.

(2020) found that the traits average between 80-99% effective, though one outlier study reported only 59-83% accuracy. The Phenice traits have been repeated countless times and their continued accuracy is why they remain a prominent method in today's standards of human sex identification.

3.2.2 Other Morphological Traits of the Pelvis

The greater sciatic notch and the preauricular sulcus are the two other pelvic traits scored in the 1994 *Standards* volume published by Buikstra and Ubelaker, which has become a widely used standard for data collection from skeletal remains (Klales 2020). The addition of these two measurements reflects their pattern of sex-specific variation and when used alongside the Phenice methods is reported to achieve an accuracy rate of 95% (Moore 2013).

The greater sciatic notch matures to be deep and narrow in males, creating a "J" or "U" shape, and is wide and shallow in females (Houghton 1974). The greater sciatic notch is assessed on a 5-point scale, where 1 is feminine and 5 is masculine (Buikstra and Ubelaker 1994). The greater sciatic notch is praised for its ability to survive intact making it a popular trait to score in archaeological contexts (Houghton 1974). It has been noted that in older females, the greater sciatic notch can come to take on masculine traits and should be used in tandem with other methods when possible to conduct sex estimation (DesMarais, Obertova, and Franklin 2024). However, it has since been argued that changes to the greater sciatic notch are due more to extrinsic factors and population affinity than age itself (DesMarais, Obertova, and Franklin 2024).

The preauricular sulcus runs along the interior edge of the auricular surface and has been argued to have two forms, one of which only occurs in females (Houghton 1974; Buikstra and

Ubelaker 1994). The first is described as giving "the impression of being formed by the coalescence of a series of pits, or small craters, in the bone…the floor of the [sulcus] is uneven… with a undulating margin" (Houghton 1974, 381). The second form of the sulcus is more variable and is described commonly as short, narrow and straight-edged though it can be wider, when it is it tends to have a rough lateral edge and is only found in females who have had at least one child (Houghton 1974; Karsten 2018). The preauricular sulcus is scored on a 0-4 scale, with the absence of a preauricular surface as 0 and the numbers 1 to 4 assigned to sulci of different appearances. For example, 4 describes a narrow preauricular surface that is less than 0.5 cm and a "shallow, and smoothed-walled depression" (Buikstra and Ubelaker 1994). In a study of 500 left os coxae of known sex, it was found that 75.8% of individuals had a correct assessment based on the preauricular sulcus (Buikstra and Ubelaker 1994). The same study found accuracy for 62.84% of males and 89.96% of females being assessed and females were found to have a wider, longer sulcus than their male counterparts (Buikstra and Ubelaker 1994). The preauricular sulcus is an example of a feature where scoring traits on a scale is more informative than only acknowledging the presence or absence of a trait.

These traits were devised to determine male or female from the pelvis but recognize the large range of natural variation that can present; this is why traits are often scored on a scale as opposed to strictly present or absent. The robusticity of the pelvis allows it to preserve well and the sexual dimorphism it presents makes it one of the most useful skeletal regions for sex determination. The methods discussed above have been tested and repeated and found to be consistently accurate even when performed by those with minimal background in sex identification. In developing methods of pelvic estimation, the morphological traits were devised

to prevent user error and are best used in tandem with the other traits listed to identify sex with as many factors as possible to allow for natural human variation.

3.2.3 The Morphological Traits of the Skull

The other sexually dimorphic component often used in the sex estimation of a skeleton is the skull. Once again, Buikstra and Ubelaker (1994) have set the standards in modern best practice with their five-point scale measuring the nuchal crest, mastoid process, supraorbital margin, glabella, and mental eminence. The skull is also often chosen to assess ancestry due to the presentation of population-specific features; these features may cause challenges in sex estimation (Klales et al. 2020). For example, if all of the population has inflated mastoid processes and large supraorbital margins, individuals may be scored as male if considered alone but female when considered within the context of the population.

The nuchal crest is located on the posterior aspect of the cranium, where the attachment area of the nuchal musculature is located (Gill, Jeffreys, and Werrett 1985; Bukyya et al. 2021). It is scored from minimal expression to a large nuchal crest with considerable projection from the bone; a marked expression also features a "hook" or "well-defined bony ledge" (Thomas 2020). The mastoid process is located below the external auditory meatus. It scores on a 5-point scale where 1 is a minimal expression, female, and describes a process that only projects a short distance below the external auditory meatus (Latham and Miller 2018; Thomas 2020; Turingan et al. 2020). A 5 is a large mastoid process that appears substantially larger than the external auditory meatus and is considered typically masculine (Ubelaker 2018; Thomas 2020; Latham and Miller 2018). The supraorbital margin is located on the frontal bone and defines the superior border of the eye socket; minimal expression scores as a 1 and features a margin that can be described as sharp when you run your finger along it. This varies from the extreme masculine

expression scored as 5, where the orbital border is rounded. The glabella is located on the midline of the frontal bone near its inferior border, between the eyes. Often it is also called the brow ridge. A score of 1 is given to a minimally pronounced brow ridge that borders on being considered smooth as it has little to no projection. A score of 5 describes the maximum expression, a large protrusion that is rounded, and sometimes described as loaf-shaped (Ubelaker 2018). The last standard trait is the mental eminence located on the anterior midline of the mandible. It is scored from minimal expression with little to no protrusion of the eminence to a massive protrusion said to occupy the majority of the anterior mandible (Buikstra and Ubelaker 1994). These traits are best used in tandem with other methods, including estimations based on the pelvis and the use of DNA to support findings when possible.

Similar to the pelvic traits, these cranial traits have been tested multiple times across the world but findings have been more varied than the pelvis due to the varying sexual dimorphism present across populations (Rogers et al. 2024). In a study of 34 skeletons of south Asian ancestry, the traits scored a 63% accuracy rate for correctly classifying males and females. Interestingly, this study found 100% success rate in correctly identifying female remains, but only 35% for males (Rogers et al. 2024). In a study of 192 known skulls from the Ottoman period, accurate classification rates ranged from 72-86%, again favouring females as more accurate than male assessments (Yaşar and Sağır 2023). When determining sex, anthropologists must also consider ancestry and compare their findings to previous research on populationspecific morphology to determine if the population was more gracile or robust; without this consideration, there can be confusion and bias towards one sex or the other (Kelley and Tallman, 2022).

3.2.4 DNA Analysis

To support their morphological findings, anthropologists can use DNA analysis to determine the sex chromosomes present in an individual. In 1984 Alec Jeffrey was the first to use DNA analysis for identification in the field of forensic sciences (Gill, Jeffreys, and Werrett 1985; Bukyya et al. 2021). This had major implications for the field of forensics as it allowed for the sex estimation of remains that lack the morphological features described above, like juvenile remains or fragmentary remains. Prior to this discovery, forensic anthropologists and our morphological techniques were the primary sources of information for sexing human skeletal remains.

DNA analysis looks for markers of the Y chromosome only present in men (Skoglund et al. 2013; Dash, Rawat, and Das 2020). One method applied globally uses the amelogenin gene, responsible for the creation of the tooth enamel matrix, to look for the AMELY and AMELX homologues related to men and women respectively (Dash, Rawat, and Das 2020; Gamble et al. 2024). The analysis looks for sex-specific sequences in the gene; if the Y specific fragment is detected, the individual is determined to be male (Dash, Rawat, and Das 2020). This method is not flawless as the absence of the AMELY marker due to poor preservation can result in misidentification of males as female; the method can similarly misidentify men with deletion or mutations in the AMELY region. To combat this, an alternative method based on amelogenin was tested by Gamble et al. using the protein rather than the DNA sequence (2024). They suggest that this method may solve the issue of false negatives caused by deletion, and is a relatively inexpensive and highly accurate method for sex determination (Gamble et al. 2024). Another solution for false negatives is alternative markers for sex determination including Steroid sulfatase (STS), the SRY gene, TSPY gene family, DYZ1 or Alu, all of which involve distinctive

sequences on the Y chromosome and use these for sex determination (Dash, Rawat, and Das 2020). Anthropologists argue that whenever possible, DNA sampling should be used in tandem with other methods of sex estimation for the best result (Ubelaker 2018; Thomas 2020; Latham and Miller 2018).

Methods of sex estimation using DNA may be unable to detect the presence of the presence of Klinefelter, Turner, or XXY syndrome causing deviations in data (Skoglund et al. 2013). However, Roca-Rada et al. (2022) used DNA sequencing to look specifically for the presence of X, Y and autosomal chromosomes in archaeological individuals with the goal of mapping them. They found one individual with evidence for a 47,XXY genotype and after examining the remains for the typical morphology described in detail in Section 3.1, they determined that this individual had Klinefelter's (Roca-Rada 2022). Moilanen et al. (2022) used a similar method on a Finnish archaeological individual uncovered in 1968 whose sex has been debated since its discovery. They created their own approach using down-sequencing methods to determine if the DNA sequences recovered best matched XX, XY, XXY, or a contaminated sample (Moilanen et al. 2021). They found overwhelming evidence of genetic patterning which resembles the modern XXY karyotype, again an individual with Klinefelter syndrome (Moilanen et al. 2021). While genetic syndromes are not tested for upon initial examination of sex in DNA, the work done by archaeologists provides a potential solution to the problems raised in Section 3.1, the wide range of sex presentation and physical attributes individuals may naturally present with.

The methods currently used by forensic anthropologists recognize the natural human variation that occurs but work to fit presentations of this variation into a binary system. The standards of sex estimation used are excellent at determining the average individual, but they do

not take into account the new ways individuals can modify themselves to express sex in addition to gender or the unique ways individuals who are born intersex can present. It is stressed throughout the publications cited in this chapter that whenever possible all three of the above methods (pelvic morphology, cranial morphology and DNA) should be used together for analysis of modern remains to offset any unreliability from one method alone. Through the use of morphological methods and DNA, anthropologists can accurately determine the sex of individuals who fit within the traditional sex binary, but what about those who have taken active steps to disrupt or alter this process as is the case with some transgender individuals?

Chapter 4: Thinking about Transgender Skeletons

This chapter covers a broad scope of knowledge, looking for ways to observe evidence of transition in the skeletal record. First looking at bone mass density and puberty blockers, I evaluate what I call hormonal body modification, the intentional modification of the body's natural hormone production process. This may be in the form of a disruption in hormone production, like a puberty blocker or an event like castration, or through supplementation using hormone treatments. Hormonal body modifications may be accompanied by a physical modification, like gender-affirming surgery, another source of changes that the forensic anthropologist might be able to see on examination. This chapter will evaluate these potential sources of skeletal difference for their visibility and usefulness to the examining forensic anthropologist.

One method mentioned throughout the chapter is the use of dual x-ray absorptiometry (DXA) to measure bone mass density (BMD). DXA measurements are reported as bone mineral content (BMC, g) or areal bone mineral density (aBMD, g/cm^2) which can then be compared to reference values from healthy individuals of similar age, sex, and ethnicity (Bachrach and Gordon 2016; Ramchand et al. 2019). A z-score is calculated using this age and populationspecific reference data. The factors helping to determine an individual's score are complex as

BMD is affected by the individual's diet, exercise, and hormone production (Hale and Ross 2018). For those who are older, a T-score is evaluated to consider risks of osteoporosis (Bacharach and Gordon 2016). Sometimes, more than this score is required to assess bone density. For example, if a juvenile being measured experienced chronic illness over childhood resulting in delayed pubertal development, this individual cannot be directly compared to others

their age as the lack of sex steroid exposure during pubertal development will have impacted their BMD (Bachrach and Gordon 2016). While there is currently no single agreed-upon method to evaluate BMD in situations of restricted growth, using z-score measurements to compare an individual to the height of peers in the same category will help to identify the growth-restricted children (Specker and Schoenau 2005; Bachrach and Gordan 2016).

Hormonal treatment for gender-affirming care relies on a category of treatments broadly described as Cross-Sex Hormone (CSH) therapy. Sometimes also referred to in the literature as Gender-Affirming Hormone Treatment (GAHT), this is the pharmaceutical administration of hormones to help an individual achieve a physical appearance that matches their gender identity and expression (Yun, Kim, and Lee 2021; D'hoore and T'Sjoen 2022). Treatment using gender-affirming hormones, like Gonadotropin-Releasing Hormone analogues (GnRHa) or testosterone, provides adolescents with a relatively reversible method of altering their body to achieve their desired appearance (Nos et al. 2022). Many of these pharmaceuticals have additional uses; for example, GnRHa is also used to treat endometriosis in menstruating women (Surrey 2023). Hormone treatments are continued in different formulations and smaller doses throughout life to maintain results.

Another term used throughout this chapter is gender-affirming surgery; this is when an individual who is experiencing gender dysphoria or discomfort reaches out to a medical professional to alter their physical features to closer resemble the image of themselves they desire (Agochukwu-Mmonu et al. 2022). This may encompass a range of surgical procedures including facial feminization and facial masculinization surgeries, a range of plastic surgery procedures on the face to feminize or masculine appearance (Agochukwu-Mmonu et al. 2022). In section 4.2, I will look at these procedures and evaluate how they may impact the skull in

ways a forensic anthropologist could observe. The other surgical intervention evaluated in the section is the insertion of implants for gender affirmation, including penile implants and breast implants. Most surgical implants have an assigned and registered serial number which would assist in identification.

The last section of this chapter looks at how a dramatic hormone change may present in the skeletal record by looking at the effects of castration on archaeological skeletons. While castration was not a gender-affirming procedure in these past societies, rather being associated with a social role or profession, it still caused a dramatic halt in testosterone production that has a visible effect on the skeletons examined today. Looking at these effects, I will compare the archaeological record to what forensic anthropologists might see when observing a decedent who had undergone a radical decrease in testosterone production during their life.

This chapter evaluates various methods of modification for their visibility in the skeletal record. To do this I will outline the existing literature on each topic and what is known about osteological presentation and discuss potential usefulness to forensic anthropologists.

4.1 Hormonal Body Modification

Hormonal body modification, particularly pharmaceutical interventions including puberty blockers and oral contraception, can affect the density of an individual's bones. The effects of many pharmaceuticals on BMD are very well studied because of concerns over preventing osteoporosis caused by premature drug-triggered bone loss. For patients on some medications, regular DXA scans are recommended to monitor BMD changes (Sheu and Diamond 2016). The effects of medication-induced osteoporosis are well outlined in Panday, Gona, and Humphrey (2014) and Alahmari et al. (2023). Low BMD can serve as a predictor of increased fractures in all ages but is most well-researched in older adults with osteoporosis. Osteoporosis is a common

chronic bone disease characterized by the deterioration of bone, including reduced bone mass; this weakens the bone and causes an increased risk of fractures (Sözen, Özışık, and Çalık Başaran 2016; Buikstra 2019). However, osteoporosis cannot be diagnosed from BMD data alone; diagnosis of osteoporosis requires evidence of secondary fractures to be considered (Bachrach and Gordon 2016; Buikstra 2019). Despite this challenge, research on osteoporosis provides an excellent base of understanding for the appearance of decreased bone mass density. Hale and Ross (2018) present three forensic case studies where DXA scans assisted forensic anthropologists in their analysis; they argue that DXA provides additional insight into fracture patterns, history of starvation or neglect, and other aspects of a decedent's lived experience.

Puberty blockers, cross-sex hormones and oral contraceptives are pharmaceuticals that are used by individuals for gender affirmation and have known effects on BMD (Ferguson 2020; Twohey and Jewett 2022). The next sections will outline how these drugs may affect bone mass.

4.1.1 Cross-Sex Hormones, Puberty Blockers and Bone Mass

Most of an individual's bone mass is acquired during the first 18 years of life and rates of bone mass acquisition increase during puberty when the actions of growth hormones and sex steroids in the skeleton are at a high (Almstedt, Shoepe & Snow 2005; Ciancia, Dubois, and Cools 2022). A key hormone that sees increased production during puberty and has a direct effect on bone mass is estrogen. BMD reaches a peak in the lumbar spine of young women around age 16, continuing to increase at some other sites until approximately age 25 when it begins to decrease throughout the rest of their lives (Almstedt, Shoepe & Snow 2005). Wang et al. (2006) measured serum levels of testosterone and E2 (estradiol, the key form of estrogen), in 258 healthy girls aged 10-13 and compared these to tibial shaft CT scans. They found that E2 and testosterone had different relationships to bone mineral density (Wang et al. 2006). E2 inhibits

bone resorption during rapid growth periods like puberty, as well as after menopause when it is present at high concentrations (Riggs, Khosla, and Melton III 1998; Wang et al. 2006). While this is a single study, focused on young girls around menarche, it is an example of the importance of hormones released during puberty for determining bone morphology and BMD.

Since medically monitored transitions began, doctors have used cross-sex hormones to supplement the loss of natural sex steroid production caused by a gonadectomy. This treatment continues throughout the patient's life, as disruptions to the body's natural hormone production may result in bone loss. In youths, treatment plans may suggest the use of puberty blockers to temporarily prevent the development of secondary sex characteristics, which provides a reversible option should the patient decide they do not wish to undergo the next stage of transition (Coleman et al. 2022). For those who wish to continue their transition, the next step is the administration of Gender Affirming Hormone Treatment (GAHT) to initiate the puberty of the patient's desired sex (Coleman et al. 2022). During this time, bone growth returns to normal, bone maturation continues, and a growth spurt begins as the body undergoes puberty (Coleman et al. 2022). If individuals elect to undergo the recommended gonadectomy, they are prescribed long-term GAHT to compensate for the lack of natural sex steroid production.

While GAHT has a long history, puberty blockers are a more recent development. Puberty blockers are a pharmaceutical way to prevent the progression of puberty in adolescents by halting their production of estrogen or testosterone, providing a reversible initial step in transitioning. By administering GnRHa (gonadotropin-releasing hormone analog), doctors are able to suppress the progression of puberty (Coleman et al. 2022; D'hoore and T'Sjoen 2022). Puberty blockers have become a controversial aspect of transitioning in recent years with the

New York Times publishing articles about medical concerns for individuals who take the medication (Twohey and Jewett 2022; Ghorayshi 2023). Concerns about the age of competency and a teen's ability to consent to the long-term effects of puberty blockers are prominent in these articles, but these are ultimately outside the scope of this thesis. Instead, this section briefly reviews key research on puberty blockers, BMD, and the effects of puberty blockers and GAHT on the skeleton.

Van Kesteren et al. (1998) conducted one of the first studies on bone mass effects of hormone treatment when they surveyed 20 male-to-female and 19 female-to-male transgender individuals who averaged around 25 years old. Individuals in this early study were treated with GAHT in preparation for a gonadectomy, after which they were treated with lower long-term levels of GAHT. BMD was measured in patients upon intake to establish a baseline throughout treatment, they were then measured again at 1 year after 28-63 months (Van Kesteren et al. 1998). This study was conducted because researchers at the time were aware that sex steroids affect bone mass, but did not understand the long-term effects pharmaceutical methods would have on their patients. The results from this study found that female-to-male patients had a gradual decrease in BMD which researchers attribute to an insufficient androgen given to those who had undergone an ovariectomy (Van Kesteren et al. 1998). Male-to-female participants had signs of lower bone turnover, but no bone loss occurred, which researchers attributed to the supplemental hormones. The researchers concluded that cross-sex hormone therapy does affect bone mass and bone metabolism, and called for more research in the area (Van Kesteren et al. 1998).

Another early longitudinal study to follow adult transgender individuals looked at bone mass density at 3 months and 12 months after beginning cross-sex hormone therapy (Haraldsen

et al. 2007). 33 transgender individuals in Norway between 1996 and 1999 were included in this study with an age range of 20-46 and compared to a control of 122 individuals (Haraldsen et al. 2007). X-ray absorptiometry (DXA) was used to measure BMD in participants, as well, biochemical markers of bone metabolism were measured. The study found that male-to-female patients had 50% lower values for the bone formation and resorption markers than the control did at 12 months. However, female-to-male patients had elevated bone formation markers over time (Haraldsen et al. 2007). This study is limited by the short period it followed its participants, but emphasized the need for longitudinal studies to see how these trends continue to progress with ongoing treatment.

Klink et al. studied the effects of hormonal treatment on bone mass using data collected at their institute, VU University Medical Center in the Netherlands, where children with gender dysphoria can receive GnRHa treatment from the age of 12. If at age 16 individuals still desire a sex change, they are prescribed cross-sex hormones to achieve the desired gender-affirming results (Klink et al. 2015). The study used retrospective data of individuals who had undergone the full course of treatment (including a gonadectomy) and whose bone mass (areal bone mineral density – aBMD – of the lumbar spine and femoral neck) had been measured at three times: at the start of GnRHa, at the start of CSH therapy, and at 22 years of age. The researchers divided their study sample into transwomen and transmen, noting other recorded measurements at these three times including their height, weight, BMI, pubertal staging and hormone levels. They note that one limitation of the data is that due to the nature of this retrospective study diet and physical activity could not be considered since they were not monitored; these are two major factors in bone mass density. The transmen and transwomen treated had lower BMD z-scores after GnRHa treatment than before; although both groups had an increase in bone mass following

GAHT treatment, it was still not equal to the typical score in individuals who had not undergone GnRHa therapy (Klink et al. 2015). They conclude that their results suggest a potential increased risk factor for fractures later in life, a topic for future research.

Jospeh, Ting and Butler (2019) conducted a longitudinal study of DXA scans of youths aged 12-14 undergoing GnRHA treatment. Their data set consisted of DXA scans done one year apart for 70 transgender youths, with a third scan at the 2-year point for 31 of the participants. This study was the largest to date to measure the skeletal effects of GnRHA on a longitudinal basis. Comparing their results to the size adjusted standards of BMAD developed by Crabtree et al. 2017, the following pattern was outlined. BMD z-scores showed a progressive decrease following the implementation of GnHRa treatment, most rapidly occurring over the first year. However, participants did not have any significant changes to absolute BMD scores. The authors suggest this indicates that sex hormone withdrawal during GnHRa treatment does not cause a direct loss of BMD but does cause a delay, leading to low bone mass compared to untreated individuals of their age group (Jospeh, Ting, and Butler 2019).

Vlot et al. (2017) argued the opposite when they looked at 34 female-to-male individuals and 22 male-to-female individuals who were treated with GnRHa triptorelin followed by crosssex hormone therapy at incremental doses when the individuals reached 16. The study measured bone turnover markers and bone density in the lumbar spine and femoral neck. Researchers found that during GnRHa treatment, there was a decrease in bone turnover accompanied by decreased BMAD z scores, though absolute BMAD did not decrease. 24 months after the initiation of cross-sex hormone therapy, BMAD measurements indicated that while bone mineral density increased from the initial scores taken following the halting of puberty, individuals still had low z-scores for their age group (Vlot et al. 2017). Vlot et al. concluded

from their data that using GnRHa to suppress puberty leads to a decrease in bone turnover and lowered bone mineral density for age. This situation is improved by the use of GAHT, but GAHT does not return individuals to the average bone mass density for their age within a two-year period. These researchers advocate for the continued yearly DXA scans to monitor BMD.

As individuals continue to transition and have regular DXA scans during GnHRa treatment and subsequent GAHT therapy, more retrospective studies can occur. Until then, we can conclude that GnHRa does influence bone mass density. However, this is not usually a matter of absolute bone density loss, but of decreasing z scores reflecting delayed bone growth, meaning they have lower BMD than others of their age group who have not undergone GnHRa therapy. Additionally, individuals are treated with supplementary hormones (GAHT therapy) during and after transitioning. This triggers puberty and then maintains the desired transition results, but it also prevents further loss in BMD for age and partially or completely reverses losses during GnHRa therapy. The effects of puberty blockers on the skeleton are important to understand for insight into current gender affirming care. However, they do not offer a useful tool for forensic identification. Given the many factors involved in bone mass, any bone mass effects of these treatments cannot serve as a reliable clue to transgender identity.

4.1.2 Oral Contraception

Puberty blockers and cross-sex hormone therapy are not the only BMD-affecting hormone treatments used by transgender individuals. Some male-to-female individuals will use oral contraception, also known as birth control, for its feminizing side effects. Oral contraception is so common that the CDC reports approximately 9.2 million women using it in the United States in 2015-2017 (Daniels and Abma 2022). As a result, the effects of oral contraception have been studied in depth by clinicians, including research on BMD loss and increased risk of

osteoporosis in its users (Almstedt, Shoepe and Snow 2005). Oral contraceptives are easily accessible to adolescents in Canada through walk-in clinics that do not require individuals over 16 to have any kind of adult accompany their appointment, with pharmacists in Alberta, Saskatchewan, Quebec and Nova Scotia being able to prescribe forms of contraception without consulting a primary physician (Di Meglio and Yorke 2019; Soon et al. 2021). As a result, oral contraception can also be taken by individuals who wish to regulate their hormone levels themselves to appear more feminine and induce side effects like the growth of breast tissue (Idrus and Hymans 2014; Barakat et al. 2021). This practice has been portrayed in popular television shows like *Grey's Anatomy* (S. 2 E. 13, Yu 2006) and *Glee* (S. 4 E. 19, Murphy and Falchuk 2013), and has also been discussed in blog posts on why individuals choose to take this route despite the health risks (Amato 2016; Hoyt and Kirkpatrick 2022). Literature on oral contraception and bone mass is a large area which has been well reviewed, the following section will briefly consider a few of these reviews.

Lopez et al. 2014 conducted a review of 19 randomized controlled studies of oral contraception and bone mass in various languages with a wide variety of results. Most of these studies looked at two hormonal contraceptives and compared them. Lopez et al. (2014) summarized that while some of the medications had no effect on BMD, other formulas had more effects. Overall, they concluded that the effects of lifestyle and diet are too variable between individuals to assess associated fracture risk from oral contraception alone. Randolph and Karvonen-Gutierrez (2021) provide a more recent review and found the majority of studies found either no effect or a small positive minimal effect of oral contraception on BMD.

Ricker et al. (2024) is a United States military review studying the effects of various forms of contraception on bone health. They found that depending on the study in question, the

use of oral contraception resulted in increases, decreases, and no change in BMD in study participants. This aligns with previous findings from the other reviews cited here that found oral contraception can have varied effects on BMD and bone turnover. The application of this data to the United States Military is for the use of oral contraception by female soldiers. The data from this review is intended for women in the military with regulated diets and active lifestyles leading the authors of the report to conclude that effects on BMD will likely be minimal in this group but this may not be the case for all users.

Based on this brief review, the bone mass impacts of oral contraception when used as a method of gender affirmation are too poorly known to be a potential factor for forensic anthropologists to use in identification. The studies of oral contraception and bone mass have been done on cis women; biological males have a different hormonal baseline as well as differences in bone size and bone mass, meaning that more research is needed on the extent taking oral contraception can have effects on the male body, including effects on BMD. As well, the variable effects found in cis women suggest that the effects of oral contraception would also vary between male-born individuals.

The results of this review suggest that conducting further research on bone mineral density focusing on its utility for identification as a skeletal indicator of a transgender individual would not be an effective use of resources. This is because transition-induced changes to bone mineral density appear to happen on a relatively small scale and are often countered by cross-sex hormonal therapy. Any changes to the bone would not likely be noticeable given the number of factors that can impact bone mineral density in life. This makes reduced bone mineral density a non-starter for the identification of trans individuals. The research done by clinicians is currently interpreted as confirming that while some gender-affirming care can cause lower BMD there is

not a large risk to individuals, meaning that this change is not going to present substantially in the skeletal record.

4.2 Surgical Interventions

Surgical intervention is another method of altering the physical body to seek gender affirmation. These procedures take a variety of forms but often focus on the secondary sex characteristics and cultural ideas of feminine and masculine presentation to help an individual achieve their desired appearance. Surgical procedures vary in their intention and extent; some are purely cosmetic (often the procedures performed on the face or the use of breast implants) while others have larger medical implications like the removal of the breasts or the addition of a penile implant. It is important to note that surgery is not a requirement for transgender identity, rather it is a method through which those with economic means can choose to affirm their identity.

Facial feminization surgery is the common name given to surgical procedures where individuals opt to have more masculine cranial skeletal traits surgically minimized. The scope of this surgery can vary from patient to patient, depending on their existing facial structure. These procedures encompass both bone and soft-tissue operations as the goal of these surgeries is to cure gender dysphoria in life, rather than to specifically alter bone structure.

Current approaches to facial feminization surgery date back to the 1980s with the work of Dr. Douglas Ousterhout Dr. Ousterhout published a series of works beginning with the 1987 "Feminization of the Forehead" where he considered anthropological work on sex determination of this part of the face (see Chapter 3.2) and traditional cultural conceptions of feminine and masculine to develop treatment protocols unique to each patient in which supraorbital contours would be reduced to achieve the desired feminine appearance. He divided his subjects into three groups based on the treatment required and the initial forehead contour. Group 1 was individuals

with normal (meaning minimal) bossing of the supraorbital area in a way that could be described as flat or slightly anterior-projecting supraorbital rims, a small torus and thick bone of the frontal sinus (704). Group 2 was individuals with relatively normal or slightly anteriorly placed supraorbital rims but combined with thin frontal bossing over the sinus (704), and Group 3 was individuals with excessive anterior projection of supraorbital bossing, so much so that reducing the bone would not be possible without entering the frontal sinus (705). Surgeries for both Groups 1 and 2 were considered minor procedures under local anesthesia (Ousterhout 1987). Dr. Ousterhout used this study to create standards of forehead protrusion and practices of filling down the supraorbital rim to appear more feminine.

These procedures were all clearly outlined by Ousterhout, including where surgeons should cut into the skull, in his 2010 book called *Facial Feminization Surgery: A Guide for the Transgendered Woman.* The book outlines what procedures are available, the risks involved, and images of how procedures are performed in consumer-friendly ways to inform the transgender reader planning to undergo these operations (Ousterhout 2010).

In addition to surgical interventions on the forehead, reduction of the mandibular angle is the other mainstream procedure that would be evident in skeletal remains. This procedure is most efficiently performed on individuals with moderate or mild mandibular angles; for those with larger mandibular planes, an out-cortex splitting is necessary (Hann and Kwon 2022). What this means is that in some patients, the

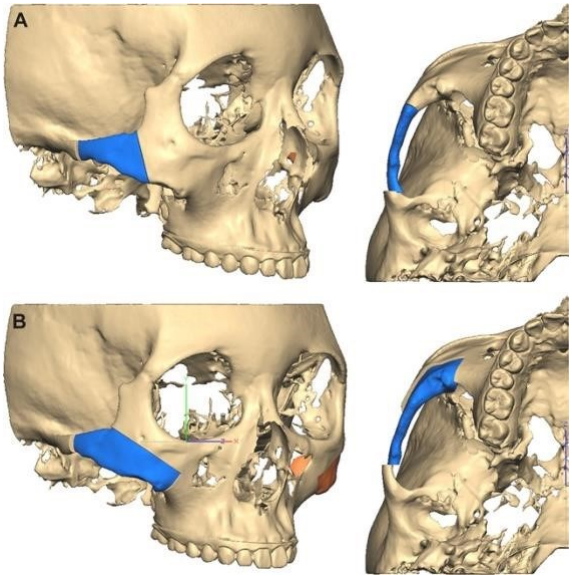

Figure 1 A) is an I-shaped osteomy. B) shows a L-shaped osteomy. (Hann and Kwon 2022)

procedure on the mandible is accompanied by surgery on the zygomatic. In these procedures, shown in Figure 1, a piece of the zygomatic is removed to change the overall angle of the bone to create a more feminine appearance while maintaining a proportional appearance to the cheek and jaw angle (Hann and Kwon 2022). To reduce the chin, a similar osteotomy is performed in which the angle of the chin's protrusion is measured from the antegonial notch to the midpoint on each side and a small vertical piece of bone is taken from the chin to increase the angle while reducing the overall surface area of the chin (Keyhan et al. 2015).

After studying rhinoplasties and facial reconstruction under Dr. Paul Tessier in the early 1970s, Dr. Ousterhout applied his new knowledge of reconstruction to facial masculinization surgery. These surgeries are easier to identify as they often are accompanied by bone grafts, screws, and prostheses, all of which can be evidenced in the skeletal record. To masculinize the forehead, surgeons look for ways to increase the bossing around the frontal sinuses and increase the superior lateral orbital angle. This is almost the reverse of the procedures done for facial feminization surgery in terms of desired appearance, but the actual operation is very different.

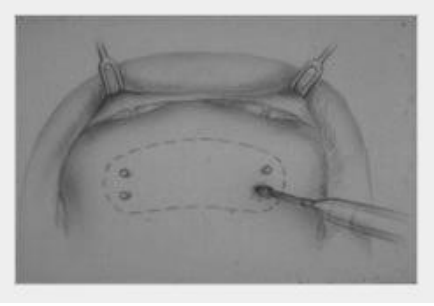

Figure 2 Forehead Masculinization in Ousterhout 2011, P. S11.

Methyl methacrylate is applied to the forehead and then held in place by the locking holes seen in Figure 2 (Ousterhout 2011). The methyl methacrylate is then cooled and contoured; this stage can be repeated if a more intense look is desired (Ousterhout 2011). For chin masculinization surgery, a forensic anthropologist would see evidence of screws and plates as the chin is cut, repositioned in 2 segments, and then plates and screws are used to stabilize the chin in place Figure 3 (Ousterhout 2011). This technique has been used to augment the chin in 3 directions and is often referred to as a sliding genioplasty. The space created by the repositioning can be

filled with a mixture of hydroxyapatite, the patient's blood, and Avitene to create a stable segment with the potential to have some subperiosteal calcification (Ousterhout 2011). From the images of the procedures provided by the surgeons, it appears that forensic anthropologists should be able to observe cut marks, metal equipment, or the presence of methyl methacrylate on the skull which can be included in their reports.

In 2017 Dr. Ousterhout and a team of plastic surgeons at Deschamps-Baly Clinic conducted research in order to find a way to create the appearance of an Adam's apple in female-to-male transgender individuals. The surgery they developed involved harvesting the patient's rib cartilage and repurposing it into an Adam's apple (Deschamps-Baly et al. 2017). Should forensic anthropologists encounter rib cartilage grafted onto the decedent's thyroid cartilage it is likely that the odd location of the cartilage fragment would be noted, but if the anthropologists in question did not know these procedures, they might not realize that the graft could be a sign of facial masculinization surgery.

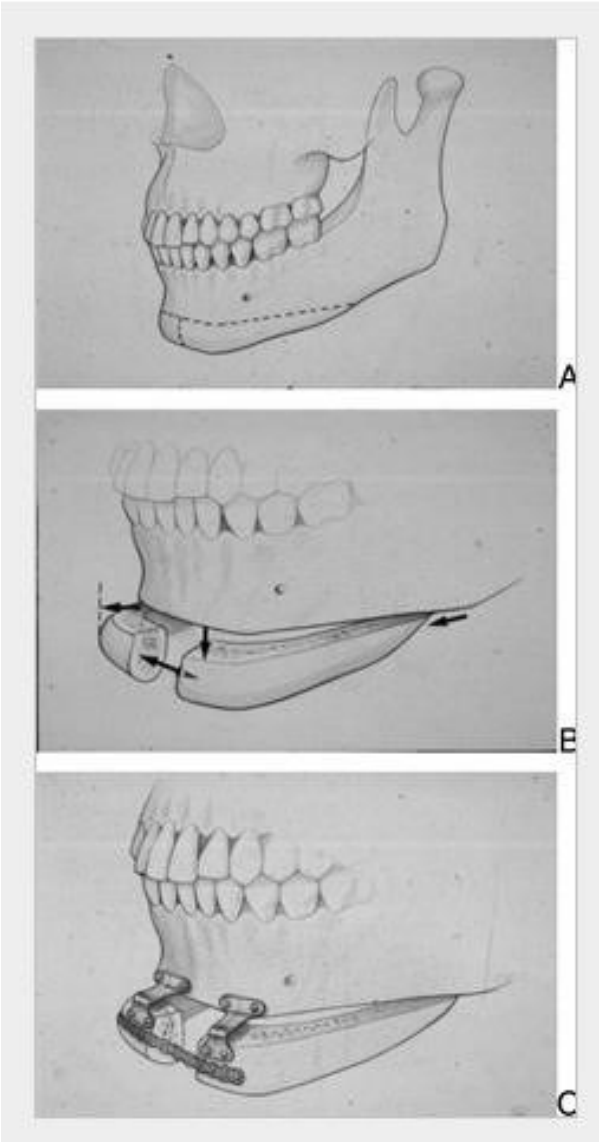

Figure 3 A Sliding Genioplasty presented in Ousterhout 2011, p. S12.

A cartilage graft is not the only surgical implant a forensic anthropologist may encounter in a transgender decedent. Three other major implants are common for gender affirmation: Medpor implants, saline/silicone implants, and penile implants. In previous medicolegal cases,

implants have made an appearance in court proceedings and helped in the conclusive identification of remains as the serial number associated with the implant was used for individuation. The potential importance of implants to identification is not news to forensic scientists. Applications in the published case literature include using manufacturing stamps to backtrack to the hospital the individual received an implant in (Khartade and Meshram 2020), comparing dental records to crowns and other dental prostheses recovered with remains (De Angelis and Cattaneo 2015), and identifying individuals from the prosthetic limbs present in partially incinerated remains (Simpson et al. 2007). Implants may provide anthropologists with a serial number that is tied to the decedent's lived identity and can be used as a method of identification. It is easy to ignore the details of these surgeries in favour of this serial number, but each procedure is unique and affects the body in different ways.

The Medpor implant is a medical-grade polyethylene implant that has a more solid structure than silicone. Because of this, it is opted for during some procedures where the goal is to mimic bone. Mandibular angle masculinization can be done using a silicone implant, a Medpor implant, or a bone graft, but Medpor is the most common and recommended method due to its quick healing time compared to a bone graft and solid consistency making it appear more natural than silicone (Ousterhout 2011). The procedure is done by splitting the mandible and inserting the implant. This forces the pterygomandibular ligament to stretch over the new implant causing a more natural appearance. A bone graft, when placed under the lateral aspect of the mandibular angle, will often be resorbed and therefore is only used when the patient specifically requests that they do not want an artificial implant. The results of a bone graft are also less dramatic as the angle was limited to 6mm of augmentation at the time Ousterhout's book was written (Ousterhout 2011).

Saline and silicone implants are surgically placed within a patient at three standard locations, the breast, hip, and buttock. The most common use of silicone and saline implants is in breast augmentation. Breast augmentation refers to the overall use of surgical methods to change the appearance of the breast (Ramachandran 2008). This can include implants or cosmetic surface changes to the nipple or temporary injections to make breasts appear fuller. Modifications can also include the removal of the breasts (a mastectomy) or reduction depending on the desired appearance of the patient (Ramachandran 2008). Surgical implants, made of saline or silicone, also do not affect skeletal anatomy, leaving behind no skeletal markers, but they do leave behind the physical implant itself. Silicone implants are very durable and resistant to decomposition and are imprinted with a serial number (Lanzarotta and Kelley 2016). This serial number is recorded and if found with remains, can help to determine who the individual was regardless of their gender. This is the same for hip and buttock implants; if the remains are intact, the serial number on the implants can be used for identification.

There are three standard penile implants currently being used, which vary depending on the individual's needs and desires: 3-piece inflatable, 2-piece inflatable, and non-inflatable semirigid implants. A 3-piece inflatable device has three parts: “a pair of corporal cylinders, scrotal pump, and abdominopelvic reservoir” (Krishnappa, Fernández-Pascual, and Martinez-Salamanca 2022, 8). This implant is desirable for individuals who wish to simulate erection when the scrotal pump sends the reservoir fluid to the head of the corporal cylinders (Krishnappa, FernándezPascual, and Martinez-Salamanca 2022). The 3-piece implant is also the only model that can be inserted both peno-scrotally or infra-pubically (Krishnappa, Fernández-Pascual, and MartinezSalamanca 2022). The 2-piece inflatable implant has a pair of corporal cylinders and a scrotal pump, but not the abdominopelvic reservoir, rather the fluid is free-

flowing inside the pump. This device works by squeezing the pump to move saline to the cylinders (Krishnappa, Fernández-Pascual, and Martinez-Salamanca 2022). The last kind of implant, a non-inflatable implant, is limited to only one or two positions as it is a simple rod that can be concealed within the body. It is important to note that the presence of one of these implants does not mean that the individual is necessarily transgender, this procedure is also, and often, performed in biological males suffering from a penile insufficiency (Krishnappa, Fernández-Pascual, and MartinezSalamanca 2022). That being said, the presence of a penile implant will also be accompanied by a manufacturer number that should have been documented when the procedure was performed. If recovered, this number can be used to help identify the individual. If the number is obliterated, the presence of an implant should be noted and presented in the case report; this information can then be used in tandem with other potential transgender skeletal markers.

Surgical body modification can take a variety of forms. Descriptions of the ones outlined in this section all suggest they would be visible in the skeletal record, but more research is needed to confirm this. Implants and surgical equipment remaining in the body can provide clear indicators of human intervention. Surgical scarring on the other hand does not have the same assurances, instead, it may be confused with pathology due to the remodelling nature of bone. One case has been presented where a Computed Tomography (CT) scan was taken of a living transgender woman and discussed in terms of its forensic implications. This offers a chance to explore how obvious some procedures may appear and what they could be confused for.

4.2.1 Case Study – Flaherty, Byrnes and Maddalena (2023)

Flaherty, Byrnes, and Maddalena (2023) were approached by a 38-year-old transgender woman, called 'Patty' for privacy, who has had 12 procedures, listed in Table 1, as part of her facial feminization surgery journey. Patty approached the University of Nevada's Forensic Anthropology and Bioarchaeology Laboratory to learn more about the identification of transgender people and how the computer system FORDISC evaluates sex. Patty returned to the lab with a 3D replica of her skull created using computed tomography (CT) taken in 2019 (Flaherty, Byrnes, and Maddalena 2023). The craniometrics of Patty's skull were interpreted by FORDISC as indicating a male, despite the substantial work that has been done to feminize her appearance. The research team compared these findings to the only other published study on transgender women and FORDISC which analyzed the pre- and post-operative 3D models of eleven transwomen who had facial feminization surgery; that study also found that the individuals were all classified by the program as male (Rogers, and Deschamps-Braly 2020; Flaherty, Byrnes, and Maddalena 2023). These studies show the inability of the computer program FORDISC to distinguish between transwomen and cis men even when facial feminization surgery has taken place, but the images the studies provide also allow us the

Figure 4 Patty's 3D-printed skull. (Flaherty, Byrnes, Maddalena 2023)

opportunity to look at non-metric traits that are associated with the procedures and determine which of the operations are likely to leave traces visible to the observing anthropologist's eye. Although I have no experience in plastic surgery, I can speculate using the data presented by Flaherty et al. 2023 in Table 1 and Figure 4 as to what procedures caused the abnormal markings on the skull and how they might be misinterpreted.

Patty had two procedures focused on the forehead region, orbital rim shaving and forehead contouring. From the procedure descriptions, provided in Table 2, I speculate that the visible line above the supraorbital margin that is seen on both left and right is the result of a cut line caused by the forehead contouring which is described as removing a section of the glabella, reducing it or replacing it entirely with new bone. This line provides an example of situations where it would be useful for anthropologists to have more knowledge about healing and remodeling following plastic surgery. The line is more remodeled and less visible on the right side of the temporal than on the left. The symmetrical appearance of these lesions would strongly suggest some sort of cultural modification to the examining anthropologist, but the nature and extent of the modification might only be clear after further research. The forehead lesions might also be misinterpreted as indicative of an extreme sinus infection (Buikstra 2019).

The mandible has a distinct contour line in image D; this could be a result of the sliding genioplasty or the gonial angle reduction that Patty had performed. The two procedures occurred a year apart making it impossible to tell more information about which procedure caused which markings without further research. Images A and C show what appears to be a bone spur on the right side of the mandible. When compared to the left side of the mandible, there is a noticeable lack of symmetry that could be included in the individualizing factors of an osteological report. With more research on specific chin procedures and their healing, we could gain more insight

into why the marks of the procedure are not symmetrical, how these two procedures varied, and the role of bone remodeling following the procedure to determine if that is indeed a bone spur or an angle left by reducing the mandible.

The cheeks provide the most obvious sign of cultural modification by presenting something unique: a symmetrical series of small bony circles along the zygomatics. Patty had a cheekbone reduction followed by a reconstruction 4 years later. Although I could not find details on these procedures, I can only speculate that the circles visible along the cheekbones are the result of a reconstruction in which additional bony material was added. The symmetrical appearance of these markings and their uniqueness compared to what occurs in natural human variation make this procedure the most easily identifiable as a cultural modification. The visible additions and illustrate a need for more research on the materials surgeons use in their procedures to build up bone contours.

Patty's nasal bones also feature an unusual contour and irregular surfaces resulting from her three rhinoplasties. Without knowledge of Patty's history of rhinoplasty, the contour and additional bone growth could be confused with a history of breakage and remodelling. The lack of knowledge about healed rhinoplasties creates its own issue in identification, without previous knowledge of the procedure and its healing process can create conclusions not just in the identification of transgender women like Patty, but the many cisgender individuals who have received the procedure.

The procedures Patty underwent make her skull distinctive, and while Flaherty et al. (2023) found that they did not alter the FORDISC sex identification, there are multiple signs of surgery that an observing anthropologist could note. Patty's case is unique, as few people can access the number of cosmetic procedures Patty has, but when looking at all of the skull

modifications together, it becomes clear there is a level of cultural modification at play, even without knowledge of plastic surgery. Moving forward, learning to identify these features in isolation, and becoming familiar with the healing patterns and the procedures and products used by surgeons will help prevent confusion when these traits are observed.

Table 2 History of Facial Feminization Surgery (FFS) procedures undergone by Patty (Flaherty, Byrnes, and Maddalena, 2023).

Procedure	Year	Description
Primary Rhinoplasty	2002	Alters the size and shape of the nose, including the nasal bones.
Secondary Rhinoplasty	2003	Alters the size and shape of the nose, including the nasal bones; alters areas of concern from previous rhinoplasty procedure.
Tertiary Rhinoplasty	2009	Alters the size and shape of the nose, including the nasal bones; alters areas of concern from previous rhinoplasty procedures.
Sliding Genioplasty	2010	Reshapes and realigns the chin region.
Tracheal Shave	2010	Reduction of the thyroid cartilage (Adam's Apple).
Gonial Angle Reduction	2010	Reshapes the width and flare of the gonial angle of the mandible, generally reducing the broadness of the overall jaw.
Upper Lip Reduction (Lip Lift)	2010	Reduces and lifts the upper lip.
Orbital Rim Shaving	2010	Shaving, filing, and/or general reconstruction of the orbit.
Browlift	2010	Raises eyebrows to a desired position on the face.
Forehead Contouring Type 3	2010	Reduces the overall size of the glabella region on the frontal bone by removing a section of bone, reducing the bossing, and replacing the bone.
Hairline Lowering	2010	Moves the hairline and associated soft tissue forward on the face.
Cheekbone Reduction	2014	Shaving and contouring of the zygomatic bones to reduce the width of the face.
Cheekbone Reconstruction	2018	Shaving and contouring of the zygomatic bones to reduce the width of the face; alters areas of concerns from previous procedure(s).

Like the cultural modifications seen in archaeological remains, surgical interventions reveal details about individual lives. With future research, specificity in identification can be increased through better knowledge of these procedures. Some plastic surgeries include a prosthesis with a serial number, but when that is not the case, there is very little for forensic anthropologists to use in their assessment. Symmetrical and unusual lesions, like those on Patty's

cheekbones, provide an obvious indicator of a cultural modification but would be difficult for an anthropologist to interpret without knowledge of the surgical causes of what they are seeing. Other procedures may be easily confused for trauma when not presented in a symmetrical fashion. In cases like Patty's where the right side was more altered than the left, knowledge of how the skeleton responds to plastic surgery would help to understand the lesions more. While not every transgender individual will undergo plastic surgery, this area of research will potentially benefit those who do as well as the larger cisgender population.

4.3 The Archaeology of Castration

One example of major hormone alteration that can be seen in the archaeological skeletal record is castration. Unlike modern transgender individuals, castration was historically often not a choice made by these individuals, rather it was associated with the role they served in society. The handful of archaeologically documented castrates provide insight into what happens to the skeleton if a dramatic alteration to hormones, in this case, a reduction in testosterone production, occurs. Testosterone is the primary androgen in men, 95% of which is secreted by the testes (Mohamad, Soelaiman, and Chin 2016). Testosterone has a direct impact on several aspects of bone metabolism and tends to promote bone formation (Mohamad, Soelaiman, and Chin 2016).

Castration is defined as any action, be that surgical, chemical, or any other means that results in the loss of testicular function accompanied by a dramatic reduction in testosterone production (Eng, Zhang, and Zhu 2010). The magnitude of the effect is influenced by the age at which castration occurs, as the younger an individual is at castration, the longer epiphyseal fusion is delayed resulting in individuals of above-average height (Eng, Zhang, and Zhu 2010). Evidence of castration on the skeleton has been studied throughout the world, beginning with German scholars Tandler and Grosz (Tandler and Grosz 1909; 1910; Zanatta et al. 2016).

They studied members of a living group called the Skoptzy who reported being as young as 10 years old when they were castrated. This castration was the result of a radical Christian idea that if the number of Skoptzy castrated reached 144,000 they would trigger the second coming of Christ (Wilson and Roehrborn 1999). This idea led the Skoptzy to castrate children and prisoners throughout a large area of Russia into Rumania and Bessarabia; however, only medical examinations of adult Skoptzy castrates have been recorded. Patterns of kyphosis in the spine were observed in multiple participants and x-ray revealed thinning of the bones of the skull in the adult Skoptzy (average age 64), who reported being castrated at an average age of 18.

Another country where castration is tied to religion but in a very different way is in India. Unlike the Skoptzy's practice of castration as a religious sacrifice while the castrated individual remained socially male, in India, there is a longstanding tradition of biological men who are castrated and live as women, considered a third gender known as Hijra (Nanda 1986; Lal 1999; Hinchy 2019). This varies from other cultures where eunuchs were still considered to be male; in India, these individuals occupy a different social space and undergo a transformation of gender, more similar to the modern-day transgender individual. The term Hijra itself has a complicated and colonial history and has become the overarching term used to refer to castrated individuals by Indian elites and colonial officers (Hinchy 2019). Despite this, the term is still used today in Indian communities, but the practice has become less common in the post-colonial era as Western ideas about gender were imposed on India along with other ideologies by the British Imperial Army (Porter and Louis 1999; Brown and Louis 1999; Al-Mamun et al. 2022). Hijra were once thought of as teachers and disciples but in the post-colonial era they have become shunned, and synonymous with prostitution (Hinchy 2019, 1; Nanda 1999). "Hijras were apparently effeminate and unable to perform strenuous labour, while such 'eunuchs' were

assumed to be incapable of moral improvement due to the physical changes castration produced." (Hinchy 2019, 11). Colonial officials would use the term eunuch interchangeably with Hijra only noting the difference in their way of dressing; Hijra dress in traditional women's clothing and represent a sacred third gender, rather than the term eunuch which just refers to a castrated male. Unfortunately, the process of becoming a Hijra was not always consensual with individuals as young as seven being kidnapped, castrated, and initiated into the world of the Hijra (Hinchy 2019).

One of the primary reasons for individuals to be castrated in the West was for social roles like serving high-born women, working in harems, or religious positions; this is believed to have begun in the late Roman Empire and continued through the Byzantine and Ottoman Empires (Wilson and Roehrborn 1999). Wagenseil examined 10 surviving Ottoman court eunuchs in 1927 and conducted an autopsy of another eunuch who died of presumptive typhus. After the autopsy and 3 additional examinations, they obtained the anthropological measurements and xrays of 4 eunuchs' skulls (Wilson and Roehrborn 1999). These individuals were castrated in service of their role within the courts as harem keepers and had lived for an average of 30 years following their castration, meaning most were castrated before puberty (Wilson and Roehrborn 1999). Throughout their review, Wilson and Roehrborn noted kyphosis of the spine in the living Skoptzy and failure of epiphyseal closure in the skeleton examined.

Farther east, the practice of castration began in China over 4,000 years ago and ended in the early 20th century (Eng, Zhang, and Zhu 2010). Wagenseil again had the opportunity to examine eunuchs, this time in a German hospital in Beijing, and found that of the 31 individuals he examined, the average time since castration was 38 years (Wilson and Roehrborn 1999). He observed that 20 of the 31 men had kyphosis of the spine which they suggest is connected to the

development of osteoporosis (Wilson and Roehrborn 1999). Kyphosis is defined by an increasing forward curvature of the spine along the sagittal plane (Lam and Mukhdomi 2023). Kyphosis is often related to underlying osteoporosis and its accompanying fractures that result in disc fractures and the signature curvature kyphosis presents with (Lam and Mukhdomi 2023). In 1960 Wu and Gu examined 26 eunuchs living in Beijing, they found that the average age of castration for these elderly men ranged from 10-26 (Eng, Zhang, and Zhu 2010). Nearly half of the men developed gynecomastia resulting in the men being heavier than non-castrated men of the same population.

Due to the role castration played in the social roles of these individuals, their castration was often a choice made after the onset of puberty and the closure of the epiphyses. However, there are a handful of bioarchaeological studies of known castrated individuals. The studies provide insights into how the skeleton may change in individuals who halt hormone production without the supplementation of cross-sex hormones to maintain healthy bone mass. As detailed below, these individuals have delayed growth resulting in tall postures and visible epiphyseal lines, and low bone mass unique to castrated individuals.

The Castrati were opera singers from the end of the 16th century throughout the 18th, who were castrated at a young age to maintain their higher young voices (Zanatta et al. 2016). The Italian opera singer, Gaspare Pacchierotti (1740-1821), was one of the most famous castrati of his time, and when his remains were exhumed in July of 2013, his became the first castrato skeleton ever analyzed (Zanatta et al. 2016). Pacchierotti was described to be quite tall, and his stature was estimated to be approximately 191 cm using length of the femurs, tibiae, and humeri; this aligns with the remarks of the era that the "castrati" were particularly tall individuals (Zanatta et al. 2016). His skull featured visible fusion lines at the iliac crest epiphyses despite his

advanced age (Zanatta et al. 2016). After performing CT scans on Pacchierotti's spine, the researchers found indications of low bone mass (Zanatta et al. 2016). Pacchierotti's was the first whole castrato skeleton ever analyzed, but he was not the first to be excavated; Carlo Broschi, more famously known as Farinelli (1705-1782), was studied in 2006. His partial remains notably had an epiphyseal line present on the iliac crest, reflecting the fact that he was castrated at a young age (Belcastro et al. 2011; Zanatta et al. 2016). Similar to Pacchierotti, Farinelli was estimated to be 190 cm using the ulna and also featured notable signs of low bone mass (Belcastro et al. 2011).

Some researchers argue that Hyperostosis Frontalis Interna, or HFI, a disorder seen most often in middle-aged women, is another result of castration. HFI is the result of a hormonal disturbance that can present as the thickening of the frontal bone, excessive hair growth, epilepsy, and disturbance of the sex glands or gonads (Hershkovitz et al. 1999; Chaljub et al. 1999). A skeleton of a castrated individual curated in the Medical University Anatomical Museum, Lyon, France shows evidence of HFI (Reusch 2013). The Lyon Castrate, who died in his early twenties, appears to have been in the first two stages of HFI, often the stage associated with women in their thirties today (Reusch 2013). Farinelli also had indicators of HFI as his frontal bone had a thickened diploe and appositional bone adjacent to the sagittal sulcus (Belcastro et al. 2011). However, Pacchierotti did not show cranial table thickening and when Zanatta and colleagues examined radiographs from the Skoptzy, they found cranial thinning. Because HFI is a hormonal disorder typically seen in menopausal women, Reusch (2013) argues that when combined with other skeletal factors this could be used as an indicator of castration when looking at ancient remains; Zanatta et al. (2016) however argues that the variation of

cranial thinning and thickening in the skulls of castrated individuals is too variable to associate with castration.

Reusch (2013) evaluated the Lyon castrate and the skeleton examined in 1909 by Tandler and Grosz and found that both had pelvises which appeared masculine in the morphology of their subpubic angle and sciatic notch but also had feminine-appearing features, including shape of the obturator foramina, which are triangular, a shape associated with females; males have a more large and oval shape (Ridgeway, Arias, and Barber 2008; Reusch 2013). The pelvis also featured posterior flaring of the ilia, resulting in a more typically feminine shape when examined from the superior view (Reusch 2013). This, combined with evidence of delayed epiphyseal fusion, begins to create expectations of the skeletal changes we should see across individuals who were castrated prepuberty.

Eng, Zhang, and Zhu examined two documented eunuchs excavated from a cemetery in Wutasi, Beijing in 2003. These individuals, one whose name was not preserved and the other whose tomb inscription identifies him as Huang Zhong, lived during the Ming Dynasty (13681644) a time when eunuchs were called one of two things, huanguan or taijian, indicating if they were castrated as juveniles or adults (Eng, Zhang, and Zhu 2010). This was done for one of two reasons, to raise men to be safer servants for royal women, or as a punishment for prisoners of war (Eng, Zhang, and Zhu 2010). The first burial, Burial M1, is of a male believed to be in his mid-30s at death (Eng, Zhang, and Zhu 2010). This individual had typically masculine sexually dimorphic features and full epiphyseal closure, indicating that he was castrated after undergoing puberty. The dentition shows three hypoplastic lesions on a left upper incisor, two on a right upper incisor, and one on a right upper molar, which Eng and colleagues argue was not the result of castration, but rather the result of the stressful social factors that potentially led to M1's

castration, "to escape poverty, to serve as tributes, or as prisoners of war." (Eng, Zhang, and Zhu 2010, 114). Burial M1 had a number of degenerative changes in postcranial joints and the left mandibular condyle was more bulbous than the right which they suggest indicates temporomandibular joint disease (Eng, Zhang, and Zhu 2010). The age at death of Burial M2, Huang Zhong, was not as easy to determine. The epiphyses of the long bones were unfused or partially fused, making it seem as though this individual would be in his mid-to-late teens, but the presence of fully erupted third molars with evidence of slight wear, along with auricular surface age, indicate he was more likely between 20 and 24 at the time of death (Eng, Zhang, and Zhu 2010). Burial M2 also had some sexually ambiguous cranial morphology, though the pelvis was determined to be male in morphology and considered "relatively diagnostic considering his young age" (112). Burial M2, Huang Zhong, was estimated to be approximately 188 cm in stature compared to Burial M1's 179 cm approximate height using femur length. The authors suggest this is not unusual given that Burial M2's delayed long bone epiphyseal fusion indicates the individual was castrated before the onset of puberty (112). Burial M2 also had evidence of enamel hypoplasia but the authors again do not attribute this to the act of castration, rather the living conditions leading up to it as the crowns of the teeth would have formed before the individual was castrated.

Throughout the limited skeletal remains of castrated individuals available to researchers, a few patterns can be seen, the clearest and well-agreed-upon being a lack of epiphyseal fusion of long bones and the iliac crest as an indicator of castration before puberty. It is important to note that some of these castrated individuals analyzed lived in specific contexts that also could have affected their development, including the intensive breathing exercises of the castrati (Zanatta et al. 2016). Multiple individuals showed signs of kyphosis and had lower bone mass than others of

the same age. Morphologically, these skeletons are still sexually dimorphic enough to determine they are male based on pelvic morphology, but there are some more typically female traits including outward flaring ilia and triangular obturator foramina (Reusch 2013).

While the archaeology and history of castration are different than the lives of modern transgender and gender-diverse individuals, the skeletal effects of delayed epiphyseal fusion for an individual's age combined with increased stature are consistent findings resulting from the prepuberty halt of testosterone production. However, as discussed in section 4.1, modern transgender individuals are typically treated with cross-sex hormones which will allow growth to continue on a more normal trajectory and prevent the poor bone mass found in eunuchs. While this area of research is not useful for transgender identification in practice, understanding how the abrupt halt of testosterone during development affects bone growth provides insight into why transgender individuals are treated with lifelong cross-sex hormones.

4.4 Conclusion

Like defining sex, the identification of transgender individuals is multifaceted and does not have any one answer. Modern pharmaceutical methods of transitioning do not appear to have any effect on bone development. The use of supplemental cross-sex hormones prevents the dramatic effects seen in castrated individuals whose puberty was halted, and most modern methods of transitioning are a gradual process designed not to disrupt the body's development, but rather to alter it to affirm an individual's desired gender expression. Surgical intervention holds more promise for identification but is limited by socio-economic factors preventing individuals from accessing treatments. Despite that, research in this area would still be beneficial for identification as plastic surgery becomes more accessible on a global scale to both transgender and cisgender individuals. Treating plastic surgery as a cultural modification, similar

to how it is practiced in archaeology, would better allow forensic anthropologists to interpret what they are seeing and avoid misinterpretation. The research presented by Flaherty et al. (2023) shows that modifications are visible to observation and the potential to continue using CT to increase research in this area with living individuals.

Chapter 5: Interview Component: Methods and Results

After assessing the need for research in this area in Chapter 2, reviewing our understanding of sex and sex estimation in Chapter 3, and looking at potential skeletal identifiers of transgender individuals in Chapter 4, this chapter addresses how this knowledge relates to the field. I wanted to better understand how the proposed terminology changes, methods I researched, and current discussion around sex and gender fit into the medicolegal side of forensic anthropology, outside of the classroom and published literature. In developing my research questions, I looked to the existing literature and found a research project that surveyed forensic anthropologists on their opinions about the need for transgender-related research (Tallman, Kincer, and Plemons 2022). This survey asked participants about their experiences in performing sex estimation, casework experience with transgender remains, and student engagement in this topic. Responses to the survey reinforced the need for research in this area. This led me to wonder exactly what sorts of research could be done, and which directions would be the most beneficial to those who are assessing the decedent's remains. Making use of their survey results, I incorporated these and other questions into an interview script intended to get more in-depth answers than a survey could provide.

Interviews were conducted one-on-one over Zoom or in person with a small group of practicing forensic anthropologists. These anthropologists were of various levels of familiarity with the subject of transgender identification and recognized the desire for more research in this area. After our conversations, multiple themes emerged including a focus on terminology use, community engagement, identification methods, and where they see the benefits of future research given the status of research in this area thus far.

5.1 Study Design and Methods

To provide an informed perspective, participants all needed to be well-versed in the medicolegal system and to have practiced as forensic anthropologists within it. Knowledge of issues surrounding transgender identity was considered to be an asset in participant selection but was not an absolute requirement. Before contacting prospective participants, I secured my research ethics approval from the University of Alberta Research Ethics Board, under the project name "Beyond Binary Identification: New ideas of gender and how they fit into forensic anthropology", No. Pro00133307 (Appendix A). The initial participants I contacted had publicly mentioned their interest in the topic of transgender remains in forensic anthropology or had vocalized an interest in advocacy for disenfranchised groups. Further potential participants for my interviews were identified using snowball sampling, an approach that makes use of the connections of study participants to help with studying a hard-to-reach population (Johnson 2014; Goodman 1961). Participants were invited to share my letter of initial contact (Appendix B) with others they thought might be interested, and those individuals could contact me for more information.

In the end, I conducted four interviews, one in person and three using the online platform Zoom. The interviews took place between October 31, 2023, and January 19, 2024, with transcripts being returned to the participants for review within two weeks of the initial interview. Participants were at this time given the opportunity to remove, alter, or add to the transcripts but aside from clarifying the spelling of a last name, all participants opted to leave the transcripts verbatim. The interview data was stored on a secure Google Drive shared with only myself and my supervisor Dr. Sandra Garvie-Lok.

Participants were given the option to remain anonymous or have their names associated with the following results: one participant, Participant 2, wishes to remain anonymous but is a practicing professional forensic anthropologist in Canada as well as an instructor at a university. The remaining three participants were Dr. Sean Tallman, an Assistant Professor at Boston University; PhD Candidate Ashley Smith at the University of Toronto; and Dr. Joel Cahn, an Assistant Professor at Trent University. This group is representative of a variety of locations across Canada with an additional American perspective from Participant Tallman in Boston and from Participant Smith's personal experience as an American practicing in Canada. These individuals, however, are a very small and non-random sample, and reflect the opinions and experiences of four individual forensic anthropology practitioners who are operating in the field at the time of writing; they are not intended to serve as a representative sample.

5.2 Results

The interviews began with questions on participants' positionality, asking them for their names, pronouns, and official titles. Participants were asked about their existing knowledge on the conversation of transgender decedent identification, with which all were in some way familiar; two participants been involved in the conversation themselves, Participant Tallman and Participant Smith (Flaherty et al. 2023; Adams et al. 2024). The interviews continued following the interview guide (appendix C) and as they progressed themes emerged, and additional questions were asked to explain and explore participants' answers in depth. The following sections present the key responses of participants organized by theme.

5.2.1 Using Cultural Context and Evidence

The Tallman, Kincer, and Plemons survey asked participants multiple questions about using cultural or contextual evidence like items of clothing at the scene of a crime in their

interpretation of the evidence. This question had mixed responses, with a 50% split between those who see any information as useful and those who think only skeletal evidence is within the scope of the forensic anthropologist's analysis and report. My participants generally agreed that if they have access to that information then they would consider that an asset, however, due to the nature of some investigations, forensic anthropologists are not always brought onto a case until after the remains have been removed from the scene. One participant, Cahn, emphasized his concerns about over-emphasizing evidence and assigning meaning where there may not have been, giving the example, "they could be found with clothing, but they might have just been shopping for their sister or something" (Cahn Transcript 7:01-8:58). This was echoed by Participant 2 who voiced concerns about overstepping the boundaries of forensic anthropology in their investigation by looking at evidence outside of the skeleton.

This ties into the theme discussed in 5.2.3, participants' concern about overstepping their expertise and negatively affecting an investigation.

5.2.2 Plastic Surgery

In the case of gender-affirming surgery resulting in implants, while none of my participants had encountered this in their casework, they agreed that the presence of a serial number on the implant would suffice for identification. Participants agreed that clinicians rather than forensic anthropologists are the best to do further research in this area. Participant 2 argued that any additional knowledge about the decedent can be useful to an investigation and highlighted that increasing knowledge on plastic surgery, how it can present, and how it heals could prevent the examining anthropologist from confusing surgical scars with other pathologies. Participant 2 cautioned against using any one surgical procedure as an indicator of transgender status, rather advocating that evidence of a past surgical procedure is an individualizing

characteristic regardless of its tie to gender expression and is therefore useful to the investigation and should be reported alongside individuating characteristics.

Regarding future research, I asked participants about plastic surgery as an identifying factor. Most participants responded that while facial surgical scarring may be evidence of genderaffirming surgery, only a small minority of the transgender community has access to those surgeries, so participants are hesitant to call surgical scarring a one-and-done identifying factor. In Canada and the United States, cosmetic procedures, which Smith points out gender-affirming surgery is considered to be, are inaccessible to most due to financial barriers and the long and draining process that getting coverage for these surgeries can require. Additionally, as Participant 2 noted, gender-confirming surgery is not a legal or social requirement for transitioning which also impacts the number of individuals who feel they need these surgeries to complete their transition.

Participants were asked about how they would currently report evidence of plastic surgery, and what research they would need to see in order to begin to feel confident in assertions about gender from this evidence. All participants agreed that they would note signs of cultural modification, including plastic surgery; what varied was where they would report on this information. They agreed that this information would be noted with other individualizing characteristics, but Participant Smith said she felt confident enough to include this information in the initial summary if she believed the surgery aligned with evidence of facial feminization surgery or facial masculinization surgery. She said she would include that information alongside the summary table in her report. While others felt the lack of research in this area made these interpretations challenging, Smith believes there is enough published now to allow a practitioner to explain the reasoning behind the report and explain why certain specific signs constitute an indicator of transgender status in life.

All participants noted that it is not only transgender individuals who receive some of these surgical procedures, but when asked about this as a problem, they all made a similar point: the skeletal indicators are still evidence that the person had plastic surgery. While we may not be able to say if that surgery was done for gender-affirming reasons, we can still provide the police with the knowledge that the individual had a history of plastic surgery and providing that information to the police has the potential to reduce the number of missing persons. Future research may improve our ability to say what surgery was performed, further increasing this potential.

5.2.3 Concerns about Overreaching

Concerns about overstepping the boundaries of forensic anthropology were commonly voiced by my participants, not only in terms of the role the participants occupy in the investigation but also regarding identifying the decedent. Participants all voiced concerns about creating a transgender profile for individuals to fit into for identification, creating overgeneralization or a constricting image of what classifies someone as transgender. This concern was raised not only about items found at the scene but also the potential indicators created by plastic surgery. Participant 2 commented on the dangers of using some kinds of plastic surgery as an identifier of transgender status because of the prominence of these surgeries among cisgender wealthy individuals as well; examples of this are procedures like nose or breast augmentation. Participant 2 was also concerned that the current lack of knowledge about plastic surgery scarring on the skeleton could lead to additional confusion for both the anthropologist and the investigator interpreting the report, and warned those who encounter it to consider all the potential reasons surgical scarring may be present.

Participant Tallman and Participant Smith both noted that the majority of transgender individuals do not have access to gender-affirming plastic surgery. There is a substantial socioeconomic barrier preventing individuals from accessing non-emergent plastic surgery, even more so in the United States where Participant Tallman is located. When asked about images from Flaherty and colleagues' 2023 article (reviewed in Chapter 4) showing that there are indeed physical manifestations of facial plastic surgery on the skull, at least in living individuals, some participants did not see potential value in the future of this research. Participants generally agreed that future research on the identifying marks of plastic surgery could be pursued to inform forensic examiners but felt that it should not be done from the exclusive perspective of transgender identification. Rather, they felt that if examiners can establish that any individual has undergone plastic surgery, they can inform investigators that the decedent had undergone cosmetic procedures, increasing the likelihood of identification.

5.2.4 Considering Gender in Anthropology

Touching on other concerns, participants noted the complexities of gender in the Western world. Participant 2 voiced concerns about looking for transgender identifiers not matching the quickly moving ideas of gender in society. This was seconded by Participant Cahn who was concerned that creating guidelines would lead to implications of individuals not being 'transgender enough' if they cannot access gender-affirming care. It also does not take into account the number of individuals who identify as non-binary. Non-binary identity is often grouped with transgender identity as this too is a gender transition, however, it is a transition to a neutral state as opposed to a transition to the other side of the gender binary (Vincent 2020).

5.2.5 Terminology Use

These expressions of gender are more varied than our definition of sex, which leads into another interview question: how do my interviewees feel about proposed changes in the terminology used by forensic anthropologists to better reflect the complexity of gender? At the time of the interviews, one piece had been published on this discussion, arguing for a shift in terminology from "sex" to "assigned sex at birth, ASAB," on medicolegal forms to reflect that your sex is 'assigned' to you when the doctor writes it down on the official form at birth (Adams et al. 2023). This has since been followed by publications supporting the call for this change, including one article featuring two of my participants as co-authors (Flaherty et al. 2023; Adams et al. 2024). In my interviews, I asked all participants about their opinions regarding the shift from "sex" to "ASAB" to which I received mixed responses. Unsurprisingly, the two participants whose article was published shortly after the interviews were conducted both supported this call and mentioned their upcoming article. Participant Smith mentioned that sometimes at birth ambiguous genitalia are surgically altered to fit an assigned sex (Creighton 2001; Carpenter 2018; Dickens 2018). The altered genitalia do not always match the sexual organs of the individual or the gender identity they would come to display. My other two participants were concerned about the implications of using the term "assigned sex at birth" as they feared it could potentially add further implications and confusion to cases where confusion was not present before. Participant 2 was hesitant about using the term "assigned sex" because they felt it was not their place to assign sex to this individual. They said unless there are distinct morphological changes, it will not change the way they apply the Phenice traits to the remains. They continued by saying they were hesitant with terms like assigned sex because they said they were not qualified to interpret the individual's lived history this way. Dr. Cahn was concerned that saying "assigned sex at birth" would reinforce the idea that gender is tied to biology. These small

changes in terminology lead to connotations and inferences that forensic anthropologists should be aware of moving forward.

While discussing this subject, Participant Smith also mentioned her argument for the shift towards the term "osteological sex" as opposed to just "sex" when reporting sex estimations based on skeletal remains. She argues that "assigned sex" as a term used for living people is important because it acknowledges intersex individuals and those whose sex was ambiguous at birth and surgically assigned one sex or the other. Smith pointed out that on legal documents there may be downsides to using the term in case reports in situations where the term is not used universally across government documents, providing the example that in her home state of Tennessee, death certificates must reflect the assigned sex at birth, not the gender of the individual. She continued that when discussing the deceased, using the term "osteological sex" when reporting findings may help to alleviate some confusion and provide a very exact description of what forensic anthropologists are providing in their reports. "Osteological sex" also alleviates another issue highlighted by Smith who mentioned that biological sex actually may refer to four things - chromosomal sex, hormonal sex, anatomical sex, and osteological sex - as discussed in Chapter 3.1. This shift in terminology would allow reports to reflect exactly what forensic anthropologists are able to interpret.

5.2.6 Increasing Assessment Confidence

In regards to reporting, I also asked my participants about what they would need to feel more confident in assertions of transgender status should they be presented with a case in which the decedent appears to have been transgender. Responses varied. Overall, all participants agreed that more publications on the matter would help them with identification, however even this varied. Participant 2 wished for more general research publications on topics like plastic surgery

from the perspective of overall improved identification for all individuals. Participant Smith said she feels confident in every report she sends because it is done to the best of her ability, so her confidence does not vary between reports, and it is not a matter of assurance in her reporting. Participant Cahn said, "I would need to have a skeleton that says one thing and the clothing or other assortments of things that says another to say that and even then, I'd couch it. I'd have to be careful." (Cahn Transcript 32:04-32:22). Participant Tallman said he would call in a plastic surgeon for a second opinion if he saw evidence of surgical scarring.

The majority of participants exercised caution around making identifications and desired more knowledge before making concise, affirmative, decisions because they worried about narrowing a suspect pool too far. The other participant, Smith, mentioned that her report is her professional opinion and when questioned on it she would draw upon whatever sources she could; this suggests that she also believes we would benefit from more publications as it would increase the number of studies she could cite in her arguments. This confirms what we already knew from Tallman 2022's survey, that there is a desire for more research projects in this area, but perhaps we would also benefit from more published forensic cases by those who do encounter these decedents.

5.2.7 Collaboration with Transgender and Gender Diverse Communities

Another question posed to participants came from the statistic that 97.3% of forensic anthropologists surveyed said that research on transgender individuals within forensic anthropology should be done in consultation or collaboration with transgender communities (Tallman, Kincer, and Plemons 2022). Going past studying the community, there is a desire to involve the community in all steps of the research process. When I asked my interview participants about the role they think transgender communities should play in forensic research,

they agreed that working along with communities would be beneficial and they gave a variety of reasons. Participant Tallman noted that he thinks this impetus comes from the younger generation of anthropologists and their desire to incorporate social justice into their work; he continued that he believes older generations are more apprehensive about engaging in this research. Tallman said he believes this is rooted in anthropology's history. He mentioned that the work of anthropologists has historically led to negative impacts on many communities we have engaged with and points out that in many ways anthropologists are still complicit with the subjugation of some communities by not acknowledging the impact we have.

When participants were asked why they viewed community engagement as important, answers began to vary. Generally, they followed the same two lines of thought, looking at anthropology's history as a discipline and using cultural anthropology's method of working with communities and highlighting their voices rather than speaking for them. Participant 2 noted the famous phrase "nothing about us without us," a mantra of various rights movements dating back to the South African disability rights movement in the 1990s (Charlton 2000; Pfeifer 2022). When prompted about why they feel this way, Participant 2 referred to their experience working with Indigenous communities and the focus being brought to ensuring that we as anthropologists, as well as governing bodies, are listening to the voices of the individuals we are discussing.

One potential method participants were asked about was approaching community engagement by contacting local transgender alliances on a city level, but also working with groups like the Trans Doe Task Force in the United States. The latter is a group who identifies themselves as a task force that "finds and researches cases of LGBTQ+ missing and murdered persons, especially focusing on unidentified individuals who may have been transgender" (Trans Doe 2024). The task force shares the hashtag #**IfIGoMissing**, a social media outlet for

individuals to share their – If I go Missing – folders including their personal details, which are then either in a secure location or entrusted to a loved one (Trans Doe 2024). The Trans Doe Task Force also adds a statement that addresses the concerns of multiple participants interviewed: what if it is not a safe environment to share that information, online or in the home? The Task Force has made their own database in LAMMP where people can include their information, personal details, how they would like to be represented, and identifying factors to be used if someone goes missing (Trans Doe 2024). This provides individuals who are not in a position to identify themselves openly online with the security of knowing their identity will be defended by the task force in the event that something should happen and a missing persons case is opened (Trans Doe 2024). The Task Force notes that while the police can also use the database LAMMP, they do not have automatic access to the part of the database where this information is stored; they stress that this information will only be shared after the Task Force has also made efforts to contact the individuals provided in the form. In exchange for sharing this information, the Trans Doe Task Force makes the promise "we will look for you" (Trans Doe 2024).

When participants were asked how we can begin to either better merge or ally the information the Trans Doe Task Force has with that held by the legal institutions forensic anthropologists work in, most simply the answer was allowing an indication on the form that this individual might fall outside the gender binary and therefore the police can reach out and share resources. As for how to begin to make that change, participants agreed with the suggestion of workshops or guest speakers at police training events but also indicated that it should not be entirely the Trans Doe Task Force's responsibility to facilitate this conversation. Participant Tallman noted that forensic anthropologists need to do a better job of communicating our role and the complexities of it with both the stakeholders and the general public. One way to change this that he suggested is training, but he also recommended having conversations with those we

work with in order to begin to reverse the oversimplifications in some of our practices. He went on to describe anthropologists being asked to summarize their work in a table or paragraph with one-word answers to make it easily understandable, the focus being on something easily entered into a database, a set of keywords. This again reinforced the argument that there is an issue with the current database system that working with communities and having conversations with stakeholders can potentially solve.

When discussing community involvement, Participant Cahn referenced historical fashion trends used by the LGBTQIA2SL+ community to communicate with each other covertly. He noted the value of involving the transgender community in investigations to help identify coded items at a scene. This kind of information sharing would be potentially challenging as Participant Cahn notes that "maybe the tensions are icy, that if you've been bitten or hurt before, you're going to be shy to approach it. So maybe there's some reservations there." Additionally, fashion communication was historically used to communicate queerness with others while avoiding the detection of the police, for example, the alleged use of a green carnation in the jacket buttonhole to indicate homosexual status in late 1800s Paris (Davies 2022), thus sharing similar coded information with the police may be a challenging hurdle to overcome. Aside from Davies' academic publication, discussion of these trends exists primarily in community spaces like blogs and in-person conversations, using flagging methods like the handkerchief code, a system using coloured handkerchiefs coded to sexual desires and fetishes (Peoples 2019). These methods of communication were designed to keep verbal communication minimal and secret from the police at a time when being gay was criminalized (QueerEvents Editorial Staff 2018).

5.2.8 Future Research and Conclusions

Participants agreed on the importance of including transgender communities in the research process and ensuring that our role in the conversation is advocacy for their voices, not speaking for the community. Similar to the suggestions of Adams et al. (2024), using the correct pronouns if known when referring to the decedent and correcting others involved in the investigation is one way anthropologists can advocate for decedents on an individual level. Participants also agreed that care around your language in reports and in discussions is crucial to respect the lived experience of each individual.

Participants all agreed that a specific focus on facial feminization surgery and facial masculinization surgery is not the best course of action in future research on signs of plastic surgery; rather, forensic anthropologists should focus more broadly on understanding how plastic surgery affects the skeleton. Until forensic anthropologists can better understand modern cultural modifications caused by plastic surgery, we should focus our efforts on this understanding and apply the knowledge to gender later. Participant Cahn did not see much value in this research because of the rarity of these surgeries and the likelihood that implants with serial numbers will accompany common plastic surgery procedures. He noted that any case involving a serial number, whether on an implant or a prosthetic, will be accompanied by a record tying the serial number to an individual, negating the need for additional work in the area. Participant 2 noted in their interview that plastic surgery is not just for transgender individuals, and is becoming more accessible and commonplace, potentially resulting in an overall increase in plastic surgery procedures. For this reason, there may be value in establishing potential patterns of surgical indicators. Participant Cahn commented that variation in procedures between surgeons may make research in this area challenging; this suggests the research will require a larger sample size

with a variety of surgeons having performed the same procedures to compare the levels of variation.

To learn more about participants' opinions on the future of research, I asked about the potential for longitudinal studies of skeletal changes in individuals who transition. When discussing this topic, multiple participants mentioned the practical challenges of any long-term longitudinal study following individuals who are taking hormone therapy. As two participants pointed out, a longitudinal study on the required time scale is practically impossible at the student level given the time constraints of traditional doctoral or postdoctoral programs.

On the topic of bone mass research, participants all agreed with the conclusions drawn in Chapter 4 that the existing clinical studies in this area did not consider enough of the additional lifestyle factors that contribute to fluctuations in BMD. Three of the participants agreed that research in this area by forensic anthropologists is not feasible. They all argued that BMD is far too variable to evaluate consistently between individuals with differing habits and personal traits and that it would be impossible to determine what caused BMD loss in each individual if it did present. They also agreed that BMD loss would have to be very substantial to be noticeable at a level observable to forensic examiners, making the relevance of the studies to forensic practice questionable. One participant, Participant Smith, did see a future in similar work and mentioned her desire to do a post-doctorate on the microscopic composition of bone to see the effects of puberty blockers and other gender-affirming hormone treatments on individuals. Smith discussed her desire to pursue this research and look at the changes occurring to bone mass on a microscopic level from gender-affirming hormone treatment.

In the end, all of the participants agreed that BMD research was not a viable path for forensic anthropologists' research based on the preliminary findings of minimal BMD change,

and that the limited resources of the forensic community would better be spent elsewhere. Participant Cahn strongly felt that work in this area would do more harm than good, spending valuable resources on something he believed could endanger transgender lives by spreading the ideology that gender is fundamentally tied to biology. He continued by saying that research may be valuable in this area for the living as part of monitoring transgender individuals' health, but from a forensic standpoint, this area of research should not be pursued. He went on to discuss his concern that it would limit the transgender profile to individuals who take puberty blockers. He said "You're going to restrict it to just people who can take the puberty blockers. It's not going to be effective! […] You're not helping. You are harming because, at the very best, you're taking away resources and you are fooling people into thinking, and you're potentially engendering these ideas that transgender is fundamentally a biological thing that we can tell you are advancing it!"

The themes present throughout the four interviews provided additional insight into the research of the previous chapters. There is a desire to work with transgender communities and advance research that will benefit more than just transgender individuals, and working with communities aligns with the participants' voiced concerns about overstepping boundaries as forensic anthropologists in investigations. Participants also expressed concerns about assigning perceived sex to an individual, instead, they favoured the traditional osteological sex estimation methods which work on a sex continuum and note unique characteristics as identifying features. Moving forward guided by the opinions of those who are in the field performing identifications will provide the opportunity to maximize the effectiveness of future research.

Chapter 6: Conclusion

6.1 Summary

There are paths forward for conducting research to identify transgender individuals, but the future of this research needs to be deeply intertwined with the transgender community. If forensic anthropologists work with communities, it will improve our understanding of how the average transgender person transitions, whether they opt for surgery or just pharmaceutical intervention, the reasons behind these choices and potential socio-economic restrictions to transitioning, to help improve our understanding of what people are experiencing. The use of outside resources like the Trans Doe Task Force also shows potential future pathways to improve the identification of missing transgender persons. Working together requires levels of respect which importantly needs to translate to the descendant's care with proper pronoun usage and using your position to defend the descendant's right to proper identification as advocated by Adams et al. (2024).

Each core chapter in this thesis looked at a different area to help better understand of the process of transitioning and the role of the forensic anthropologist in a medicolegal investigation. Chapter 2 looked at why this research is important to conduct and a very brief look at some of the people who this work would benefit and why they are calling for it. Chapter 3 provides a review of the term sex and its use in developing forensic anthropology methods for sex estimation. In Chapter 4, the specifics of transitioning were evaluated when looking at the effects of pharmaceutical transition on bone mass as well as the looking at the archaeology of castration where pharmaceutical hormone care was not provided, to better understand the care modern transgender individuals receive. Chapter 4 also looked at the recent history of medical procedures designed for gender affirmation including implants and plastic surgery to see how they affect the skeleton and may be used by forensic anthropologists to assist in identification.

Chapter 5 featured the results of the interviews I conducted over the course of this thesis and provided opinions from practicing forensic anthropologists who provided insight into how this research can be useful in the field.

6.2 Some Ways Forward

Throughout this thesis, the desire for more research was made apparent to me time and time again. Adams et al. (2023, 2024) show the work being done by current forensic anthropologists to open the discussion of transgender identification. In my interviews, participants discussed that this is a question on students' tongues, with students approaching them to supervise projects on the topic as both Dr. Cahn and Dr. Tallman have. Smith, Cahn and Participant 2 mentioned seeing presentations at conferences on gender-diverse identification and calls for anthropologists to be aware of the role they play in the identification of an individual.

Students and anthropologists are not the only ones aware of this problem. The Trans Doe Task Force is organized to combat the long-standing problem of transgender individuals being the victims of violent crimes. Global statistics gathered by Wirtz et al. (2020) found that 2,343 murders of transgender individuals were reported globally between 2008 and 2016. Transgender individuals report being the victims of violent crimes 2.5 times more than cisgender people despite making up only 0.5-1.4% of the population in the United States (Herman, Flores, and O'Neill 2022). Estimates of data are compiled using self-reporting of sex and gender on government census, data from individual studies, and data from police-reported accounts which have been proven to be approximately half the actual experienced violence by transgender individuals (Flores et al. 2021; Gyamerah et al. 2021).

Community engagement emerged throughout the handful of publications and was reiterated by participants, most notably with the desire to follow the idea of "nothing about us

without us," ensuring anthropologists do not speak for the transgender community, but rather work alongside them to develop best practices. Flaherty et al. (2023) demonstrated research that aligns with these values, being approached by a transgender community member who was interested in her own identification. This concern is reiterated by the Trans Doe Task Force and its participants who are fearful of how they will be treated in death and utilize the task as advocates for their identity should something happen to them. This is something that Adams et al. (2023, 2024) call on anthropologists to help with; they call upon practitioners to take care with terminology, using the preferred pronouns of an individual once identified, advocating for proper pronoun usage in the field and in reports, and suggesting shifts in terminology to help reflect this.

Shifting terminology within the practice of forensic anthropology is an additional call to action made by Adams et al. (2024). They advocate for the shift to assigned sex at birth, with the secondary idea of a shift to osteological sex, rather than just stating sex on medicolegal forms. When asked about this in interviews, Smith suggested that osteological sex is a more concise way to describe exactly what forensic anthropologists can assess without the concerns voiced by Participant 2, that assigned sex at birth may imply transgender status when it is not necessarily evident. The use of the term osteological sex is the most concise way for anthropologists to relate exactly what they can assess from the skeletal record.

In regard to the identification of transgender individuals, interview participants were asked about both the skeletal record and the role they feel cultural items serve as identifiers. Participants all agreed that the items found at the scene of a crime play an important role, but voiced concerns of over relying on these objects and assigning a cisgender individual as transgender further confusing a case. This is particularly due to the variability of evidence at the

scene and the ability of perpetrators to manipulate this evidence. Participants favoured what they could see in the skeletal record for their analysis.

Looking at the role of hormones in bone development, research on the role of puberty blockers and gender-affirming hormone therapy in bone development was perceived to be a nonstarter in identification. When presented with research published on the role of pharmaceutical development, three participants agreed that this is not an area where research should focus. They concluded that the changes would be too minimal to perceive and too hard to attribute specifically to the use of puberty blockers. Smith however saw the value in microscopic bone analysis and desired to conduct research in the future in this area to look for indicators on a microscopic level.

On a macroscopic level, the most promising research found was plastic surgery scarring. The evidence presented in Flaherty et al. (2023) aligns with the preliminary findings presented throughout Chapter 4.2, that evidence of healing surgical scars should be evident in the skeletal record. When presented with the idea that facial feminization surgery or facial masculinization surgery may be evident in the skeletal record and the preliminary findings, interview participants had reservations about continuing this research; not due to the lack of need, but a fear of the implications it could create. All participants warned future researchers to be clear in their writing to be careful to avoid grouping all transgender individuals together and accidentally creating a narrative that there is a right way to be transgender. Participant 2 was the most enthusiastic about this research stating that more knowledge on how plastic surgery appears in the skeletal record would help identify any individual who has had a procedure and cautioned rather than focus on facial feminization surgery or facial masculinization surgery, future research should be more broadly look at each procedure individually, how it presents and the stages of healing of the

skull. They suggested that this knowledge would be a useful identifying factor in any individual and would benefit identification.

In summary, the conversation of transgender identification is only continuing to grow as transitioning and gender-affirming care becomes more accessible. Initial calls to action for forensic anthropologists have been made to help aid in navigating this shift, but the lack of skeletal effects from transitioning makes the future in this research challenging. Instead, while only some individuals have access to surgical gender affirmation, continuing research in this area would benefit the cisgender community as well. Moving forward with research in this area needs to be done with the consent and help of the transgender community, including community members in the research planning stage as well as in writing academic publications to ensure we avoid speaking for the community to ensure we follow the feedback we have been given of "nothing about us without us" (Charlton 2000; Pfeifer 2022).

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Appendices

Appendix A – Ethics Approval

UNIVERSITY OF ALBERTA

RESEARCH ETHICS OFFICE

2-01 North Power Plant (NPP)
11312 - 89 Ave NW
Edmonton, Alberta, Canada T6G 2N2
Tel: 780.492.0459
www.uab.ca/reo

Notification of Approval

Date:	Septebmer 25, 2023	
Study ID:	Pro00133307	
Principal Investigator:	Brianne Bertram	
Study Supervisor:	Sandra Garvie-Lok	
Study Title:	Beyond Binary Identification: New ideas of gender and how they fit into forensic anthropology	
Approval Expiry Date:	September 24, 2024	
Sponsor/Funding Agency:	SSHRC - Social Sciences and Humanities Research Council	SSHRC

Thank you for submitting the above study to the Research Ethics Board 1. Your application has been reviewed and approved on behalf of the committee.

Approved Documents:

Letter of Initial Contact
Updated Letter of Initial Contact
Consent Forms
Updated Consent Form Version 2
Questionnaires, Cover Letters, Surveys, Tests, Interview Scripts, etc.
Interview Guide Re-Upload

Any proposed changes to the study must be submitted to the REB for approval prior to implementation. A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the REB does not constitute authorization to initiate the conduct of this research. The Principal Investigator is responsible for ensuring required approvals from other involved organizations (e.g. universities/colleges, community organizations, school boards) are obtained, before the research begins.

Sincerely,

Dr. Theresa Garvin, PhD, MUA, BA
Chair, Research Ethics Board 1

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix B – Letter of Initial Contact

UNIVERSITY OF ALBERTA

FACULTY OF ARTS
DEPARTMENT OF ANTHROPOLOGY

Letter of Initial Contact

[DATE]

[INTERVIEWEE NAME]

Subject: Requesting permission to conduct an interview

Dear Dr. [LAST NAME]

I hope this email finds you well. I am Brianne Bertram, a master's student from the University of Alberta in the Department of Anthropology. I am contacting you to inquire about scheduling an interview for my master's thesis. My research revolves around looking at gender in forensic anthropology. More specifically, I'm interested in how we can potentially identify transgender individuals from their skeletal remains. I am reaching out to you because I have noted from your academic publications and presentations that you are also interested in this topic.

My research study is titled *Beyond Binary Identification: New ideas of gender and how they fit into forensic anthropology* (Pro00133307). My objectives are to discuss current ideas for identifying transgender individuals, the existing literature on this topic, how you would report on potentially transgender remains in a case report, and where you believe research in this area should go next.

This interview will be audio recorded and transcribed for the purpose of my master's thesis, but you will have the choice to be completely anonymized in your answers if you wish. You will receive a copy of the transcript to approve, adjust, or update as needed before it is used in the final thesis.

To assist you in reaching a decision, I am attaching the following letters:

a) A copy of the consent document, as approved by the University of Alberta Research Ethics Board.
b) A copy of the approval for the study provided by the Research Ethics Board.

Please reach out with any questions. If you know of anyone who you think would be a good fit for this study, please forward them this email and they can reach out for more information at bbertram@ualberta.ca

I look forward to hearing from you!
Brianne Bertram
she/her
bbertram@ualberta.ca

Principal Investigator:
Brianne Bertram,
Graduate student,
bbertram@ualberta.ca

Supervisor:
Sandra Garvie-Lok,
Professor,
sandra.garvie-lok@ualberta.ca

Appendix C – Interview Guide

QUALITATIVE RESEARCH – INTERVIEW GUIDE DRAFT 3

INTRODUCTION

- Greetings
- Informed Consent
    - The informed consent form will be sent as a pdf ahead of time, this is to ensure there are no further questions or mind changes. At this stage, I will also confirm their anonymity status.
- Who are you? And positionality
    - Ask preferred pronouns for the meeting and future correspondence.
    - Job position etc.

INTERVIEW GUIDE

1. Background
    a. You were chosen for this interview because of your public interest in transgender status and forensic anthropologists. Why do you believe this research is important?
        i. High-risk community
        ii. Social stigma
    b. Can you identify any physical skeletal markers, either established or potential, that you think could be used to assist in the identification of a transgender individual?
2. Existing literature and my own review
    a. Tallman 2021 reported that 97.3% of the forensic specialists they surveyed agreed that research on this topic in forensic anthropology should work WITH transgender communities.
        i. Do you think this is beneficial? Why?
        ii. Which communities do you think we should be working with? Local transgender alliances? Or larger scale groups?
            1. Trans doe Task force….
    b. This is not the first-time forensic anthropologists have been faced with calls for radical change in how we operate and perform identifications… I'm referring to the use of the term race and the shift to ancestry.
        i. Forensic anthropologists have widely accepted the difference between ancestry and race, with race being a cultural construct. Do you think we will see a similar shift in how we report sex identification?
    c. One argument against the use of puberty blockers for transgender children is that they cause a loss of bone mass density. Are you familiar with this idea?
        i. Klink et al. 2015 studied 34 individuals aged 22 who had transitioned by using puberty blockers in adolescence. They found decreased areal BMD in the femoral neck.
            1. They also found that cross-sex hormone therapy resulted in increased areal BMD scores but it was still not as high as those who had not undergone any treatments. However, this study did not take into account lifestyle and diet

and found varied results with an overall small increase in BMD from the control.

iii. Hormonal Birth control – are you familiar with the idea that transgender women will use oral contraception to assist in their transition even without doctor supervision? Are you familiar with oral contraception's BMD effects?

1. Almsetdt, Shoepe and Snow 2005 performed a DXA study on 18-25-year-old women and found a lower BMD than controls.
2. Alternatively, Garnero et al. 1995 found that in women over 39.5, those experiencing perimenopause, oral contraception dramatically decreased BMD loss.
3. DeCherney 1996 repeated the study on women over 35 and found virtually no effect on BMD from the use of oral contraception. He concluded that while it may slow down BMD loss, it does not lead to an increase.
    a. What do you think this means for individuals who are transitioning? Do you think this will combine with other ideas about BMD loss and transitioning?
    b. The majority of this research is older, from the late 90s or early 2000s. Do you think it is sufficient? What do you think we can do to find a more conclusive answer to this question regarding hormonal effects on BMD?

c. Isa and Michael 2022 argue for a shift to ASAB–assigned sex at birth – This would be a minor terminology change that removes one of the structural barriers for transgender identification.
    i. If something like ASAB was included in official reports, how would you then indicate that the person's legal sex may vary from the ASAB?
    ii. Do you think there would be backlash? Either from academic communities, the police who read your reports, or the broader community?
d. Flaherty et al. 2023 used a CT scan of a transgender woman who had undergone 18 gender-affirming surgeries.
    i. **Show image** If you were presented with this skull with no other information, what would your report say?
    ii. They then ran her, measurements through FORDISC to see what the individual was classified as. FORDISC still determined the individual to be male, what do you think this means?
    iii. In my thesis, I am proposing that forensic anthropologists can become familiar with signs of surgical scaring that can be indicative of gender affirming surgeries
        1. How would you propose we report that information? → as pathologies? This is consistent with…
        2. What would you need to be able to say consistent with?
        3. What do you think is the future of this research? Thus far CT seems to be the only option, any other ideas?

3. Cultural Context
    a. How often, if ever, do you receive additional information about a scene?

1. … or would you prefer to make your report based purely on skeletal assessment?

4. Reporting
    a. When presented with the signs discussed throughout this interview, what do you feel you need to feel confident in your analysis of transgender remains?
        i. What about the difference between probable and possible? What word choice would you use and why?
        ii. What could change or increase this confidence?
            1. More published studies?
            2. More inclusive wording?
5. Finishing up
    a. Is there anything else you would like to add?
    b. What do you think the next steps of this research should be?
    c. Is there anything you would have asked me if you were the interviewer?
    d. Thank you and inform the participant they will have a copy of the transcript within the next month. After receiving the transcript copy, they will have two weeks to ask for any alterations, omissions, or additions, as well as a change to their anonymous status if desired.

Appendix D – Informed Consent

UNIVERSITY OF ALBERTA

FACULTY OF ARTS
DEPARTMENT OF ANTHROPOLOGY

PARTICIPANT CONSENT FORM

Title of Study: *Beyond Binary Identification: New ideas of gender and how they fit into forensic anthropology*

Contact Information:
Principal Investigator and Research/Study Coordinator: Brianne Bertram
Name & Affiliation: Brianne Bertram, Department of Anthropology, University of Alberta
Mailing Address: 13-5 Tory Building, Edmonton, Alberta, Canada, T6G2H4
Phone: 780-492-3879
Email: bbertram@ualberta.ca

Supervisor:
Name & Affiliation: Sandra Garvie-Lok, Supervisor
Mailing Address: 13-5 Tory Building, Edmonton, Alberta, Canada, T6G2H4
Phone: 780-492-3879
Email: sandra.garvie-lok@ualberta.ca

You are invited to take part in a research study. Before you take part, a member of the study team is available to explain the project and you are free to ask any questions about anything you do not understand. You will be given a copy of this form for your records.

Why am I being asked to take part in this research study?
You are being asked to participate in this interview because of your position, title, and experience as a forensic anthropologist. You are being approached specifically because your record of publications and presentations indicates expertise and interest in gender issues in forensic anthropology. The goal of this interview is to discuss how you would report on the appearance of skeletal remains of transgender individuals and the nature of the evidence needed to report on potential transgender status in a forensic case. You will be presented with some classes of evidence that can potentially be used in this identification and how you would interpret and report them in an official police report.

What is the reason for doing the study?
The purpose of this study is to gather information on forensic anthropologists' opinions on the issue of unidentified remains and unsolved missing persons cases involving transgender individuals. The study builds on the limited existing work on this topic, which has included a survey of forensic anthropologists' opinions. This study's goal is to expand this information with detailed interview data, focusing on how forensic anthropologists would report evidence of transgender status or lack thereof, why they would use certain terminology, and what is needed to increase their confidence in these answers. The results of this interview will contribute toward the principal investigator's MA thesis in biological anthropology, with findings presented and published after completion of the research.

What will I be asked to do?
You will be asked to participate in a conversation with the principal investigator where you will be asked your thoughts and opinions on topics including potential indicators of transgender status in a forensic case, how these would be presented in a police report and what further research is needed to increase practitioners' confidence in this work. This interview will take place over the course of about an hour, either in person or over Zoom depending on your location. If the interview happens on Zoom, you have the right to choose whether your camera is on or off. The interview will be recorded and then transcribed by the principal investigator, who will explore your answers and those of other participants for themes important to our understanding of forensic work on potential transgender cases. Before this happens, you will have the opportunity to review and approve the interview transcript.

What are the risks and discomforts? The principal investigator recognizes that topics revolving around transgender issues can be sensitive and may attract public attention. You will have the option to remain nameless or to be mentioned by name in the MA thesis and resulting presentations and publications. Because this is a sensitive and potentially controversial topic, participants who choose to include their names must be prepared that they may be challenged on their opinions in the academic sector or in social media.

It is not possible to know all of the risks that may happen in a study when presented to the public sphere, but we have taken all reasonable safeguards to minimize any known risks to a study participant. If we find out anything new during the course of this research which may change your willingness to be in the study, we will tell you about these findings.

What are the benefits to me?
The main benefit of this study will be the advancement of a new topic in the field of forensic anthropology that is becoming more relevant every day. This research will work towards solving the gap in knowledge about the skeletal remains of transgender individuals and address the growing concerns of missing person identification for an at-risk community. As an active practitioner in forensic anthropology, you may benefit indirectly from this advancement. However, there may not be any direct benefit to you.

Do I have to take part in the study? Being in this study is your choice. If you decide to participate in the study, you are still free to change your mind and withdraw your participation until two weeks after receiving a copy of the interview transcript. After that point, we cannot remove you from the study because data from your interview will be incorporated into the ongoing analysis. To withdraw from the study before this deadline, please contact Brianne Bertram at bbertram@ualberta.ca. Similarly, if you wish to change your choice on the inclusion of your name in this study, this can be done any time up to two weeks after receiving the interview transcript.

During your interview, you may refuse to answer any of the individual questions as you wish. After the interview you may choose to withdraw or alter individual responses by contacting Brianne Bertram at bbertram@ualberta.ca. This will be possible up to two weeks after you receive a copy of your interview transcript.

Will my information be kept private?
During this study we will do everything we can to make sure that all information you provide is kept private. No information relating to this study that includes your name will be released outside of the principal investigator's office or published unless you give us your express permission. Sometimes, by law, we may have to release your information with your name so we cannot guarantee absolute privacy. However, we will make every legal effort to make sure that your information is kept private

You will have the option to have your name included in the final version of this study. Particpants may also choose not to have their names included and pseudonyms will be used (e.g. 'Participant A'). The only information that will be made known about these participants is that they are practicing forensic anthropologists. If you would like to use your real name, please indicate this on the signed consent form on the last page of this document.

For participants interviewed over Zoom, the call will be recorded to allow the primary investigator to make a transcript. This recording will be encrypted and stored on the primary investigator's secure Google Drive, not on the Zoom cloud. After the transcript is complete and approved by the participant, this video will be deleted and participants will be anonymized as they wish. The primary investigator will keep a document that includes the raw data from the study, including a document outlining which transcript is which in case of the need for follow-up questions.

During research studies, it is important that the data we get are accurate. For this reason, your data, including your name, may be looked at by people from the Research Ethics Board.

After the study is done, we will still need to securely store the data that was collected as part of the study. Your data will be stored on the principal investigator's secure Google Drive through the University of Alberta. It will also be stored on the research supervisor's secure Google Drive, as is the standard practice at the University of Alberta. At the University of Alberta, we keep data stored for a minimum of 5 years after the end of the study.

What if I have questions?
If you have any questions about the research now or later, please contact Brianne Bertram at bbertram@ualberta.ca

If you have any questions regarding your rights as a research participant, you may contact the University of Alberta Research Ethics Office at reoffice@ualberta.ca or 780-492-2615 and quote Ethics ID Pro00133307. This office is independent of the study investigators.

How do I indicate my agreement to be in this study?

By signing below, you understand:

- That you have read the above information and have had anything that you do not understand explained to you to your satisfaction.
- That you will be taking part in a research study.
- That you may freely leave the research study at any time.
- That you do not waive your legal rights by being in the study
- That the legal and professional obligations of the investigators and involved institutions are not changed by your taking part in this study.

SIGNATURE OF STUDY PARTICIPANT AND VERBAL CONSENT STATEMENT

Statement of Verbal Consent:
"I acknowledge that this research study has been explained to me. I have had the opportunity to ask questions and have them answered. I have been made aware that I can reach out with questions and who to contact. I agree to participate in the research study described in this document."

_____
Name of Participant

_____ _____
Signature of Participant Date

Do you wish to include your real name in the final versions of this study (including the accompanying master's thesis and any following publications? *Please indicate yes or no, if left unanswered, you will remain anonymous.*

☐ **Yes**, I would like to use my real name.

☐ **No**, I prefer not like to use my real name.

☐ No, I would not like to use my real name **but I would like to be thanked by name in the thesis acknowledgements.**

SIGNATURE OF PERSON OBTAINING CONSENT

_____ _____
Name of Person Obtaining Consent Contact Number

A copy of this consent form has been given to you to keep for your records and reference.