If you see something, say something: Structural vulnerability data and reporting in forensic anthropology casework

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1. Introduction

While forensic anthropologists have worked across the globe in varied and distinct contexts, recent discussions of the duties and scope of forensic anthropology have amassed attention, particularly for those working in the United States. Of interest here are debates over the merit of acknowledging "structural vulnerability" [1] or "structural violence" in forensic casework [2,3]. This paper draws on anthropological scholarship and autoethnographic analysis to argue for utilization of forensic anthropology skills to evaluate sociocultural information - particularly that of structural violence and vulnerability. The idea of expanding forensic anthropological analyses is enmeshed within concurrent critiques of the overall role of the forensic anthropologist and the problematic use of biological profile estimates [4–6]. Typically, in contemporary casework, anthropologists examine decomposing and skeletal remains to assist in identification vis-a-vis estimations of age, sex, stature, and ancestry; postmortem interval; and information that may contribute to cause and manner of death conclusions. The argument presented here moves forensic anthropology toward inclusion of additional routes of potential forensic anthropological inquiry. The positionality of the two authors brings unique applied experience to the academic debates as the first author has experience in both domestic casework and ethnographic forensic human rights research abroad. The second author works as a forensic anthropologist within law enforcement to routinely track missing persons and search, locate, and recover unidentified human remains (UHRs). Both recognize the practical and ethical assistance that a structural vulnerability or structural violence lens provides.

Structural violence, social vulnerability, and marginalization have diverse and deep-seated bodies of literature that showcase the nuance of these frameworks. For the purposes of the analysis presented here, structural violence is loosely defined as it is found in the literatures of Galtung [7,8], Scheper-Hughes and Bourgois [9], and Farmer [10] – policies, practices, and beliefs that deny members of a (non-dominant) group access to resources, and thus place members of that group in harm's way. Limited access to resources can be manifested in forensic casework, so it follows that forensic anthropologists are uniquely positioned to capture potential policy-changing evidence (in addition to forensic evidence). At the same time, public health and disaster literatures often frame marginalization in terms of social vulnerability, underscoring factors that make particular social identities more at risk in times of public health crises and disaster mitigation/relief [11]. This paper draws on both of these concepts, but the theoretical minutiae are beyond the scope of our primary focus: What data related to marginalization should be collected and what do we do with it in forensic casework?

There has been growing interest in the use and applicability of both skeletal and non-skeletal data that could be gathered by the forensic anthropologist to generate sociocultural inferences [12]. As law enforcement and medical examiners increasingly call upon anthropologists to assist in search and recovery efforts, anthropologists have the opportunity to analyze contextual information from the scene that could contribute useful information to understanding the dynamics and/or circumstances that contributed to delayed discovery [13]. Furthermore, health indicator data from skeletal analyses may reflect resource voids or structural issues that impact the lived experiences of the deceased [14]. This piece recognizes the burgeoning ethical pressures to reimagine forensic anthropology for the twenty-first century [15] and contributes to the debates that explore repositioning casework in a more comprehensive anthropological approach, buttressing recent publications on structural violence (i.e., lack of access to resources) and social vulnerability witnessed in forensic investigations [16]. This piece considers the ethical duties of anthropologists as agents in society, discuss what is meant by structural vulnerability data in forensic anthropological literature, and then unpack the challenging question of what meaningful action can an anthropologist take with said data.

2. Ethical dilemmas: anthropologists as agents in society

The first hurdle in determining structural vulnerability's place in forensic work is clarifying the positionality of all anthropologists—are they or are they not agents in society? Structural vulnerability and structural violence frameworks are particularly salient issues when bridging the divide amongst those who view forensic anthropology in a positivist light as a discipline of specialized technicians [17] and those who situate forensic anthropologists as anthropologists first [18]. Forensic anthropology may be an applied science, but as a discipline it is not isolated from society. The tenor of professional conferences, academic meetings, and workshops reflects a division within forensic anthropology with some staunchly against the notion and some recognizing it as a fundamental truth. The ethical concern persists despite the divide, asking practitioners to acknowledge the dangers of practicing forensic anthropology as if the forensic scientist exists in isolation from the rest of society [19]. Anthropologists are social agents whose decisions and actions are entangled within legal systems and society as a whole. Because of this, the ethical questions impressed upon practitioners regarding what to report (or not report) and how to report it have sociocultural consequences [20]. If the anthropologist is a social agent, burgeoning questions emerge: *How might forensic anthropologists hinder victim identification because of ancestry, its problematic methodologies, and its conflations with social race? What does an anthropologist observe but not report? How does biological profile impact law enforcement ability or dedication to identification? How does the use of "ancestry" or "race" further social beliefs in biological race? How does biological profile impact law enforcement response? What analyses should anthropologists perform and not perform; report and not report?*

When considering the sociocultural impacts or responsibilities of forensic anthropologists, anthropologies of science and technology, which largely focus on non-US contexts, can provide insight. Scholars in these areas have analyzed both anthropologists as stakeholders and ongoing forms of indirect violence - with most ethnographic and case studies originating in forensic investigations of human rights violations or humanitarian forensic action around the world [21–23]. In international forensic investigations, rich scholarship has challenged when and if anthropological analysis of human remains is helpful or harmful, how top-down or grassroots investigations may be wielded politically, and the merits of anthropological analysis when evidence gathering is not prioritized. Misrepresentation, underrepresentation, and homogenization of populations and experiences during international interventions has been underscored in studies of survivors of mass violence [24]. These literatures clearly exemplify the interlocutors as agents, be they forensic anthropologists or other aid providers. Because anthropologists do not exist in a vacuum, Rosenblatt [25] cautions against attempts to narrowly interpret the role the forensic anthropologist has in knowledge production or to dismiss the creation of political narratives based on anthropological findings. Actions and interventions of the anthropologist impact survivor experiences, mold historical narratives, influence economic networks and are unavoidably tied to political agendas. In this vein, in an interview with *American Anthropologist*, Mercedes Salado Puerto, a twenty year veteran of the Equipo Argentino de Antropología Forense (EAAF), emphasizes that identification work is not a momentary step that provides closure to families. Instead, she describes the relief created for families that comes with knowledge and recognition, the circulation of information, the creation of space to discuss what has happened, and other psychosocial dynamics of anthropological inquiry [26,27]. Similarly, Kim uses the example of Uganda to illustrate the complex influences of forensic intervention on surviving populations and cultures, as well as the importance of using the breadth of anthropological training to minimize harm [28,29]. These same questions concerning the social power of forensic anthropological methods, analyses, findings, and communications *should* be applied to domestic homicide investigations, such as those found in the United States.

When looking abroad, it can also be seen that forensic anthropologists' self-perception in post-conflict and post-disaster contexts has taken a humanitarian-focused, rather than legally focused, turn. The "forensic" in forensic anthropology is so labeled because of collection and analysis of evidence. Yet, identification and repatriation of remains (i.e. humanitarian work) often necessitates work outside of analysis of trauma and documentation of crime, which may occur secondarily or not at all. These scenarios are particularly evident in disaster contexts in which mass death occurs independent of criminal activity. Practitioners now underscore the increasing focus on identification and the sociocultural, political, economic, and psychological impacts of the investigative process under the umbrella of humanitarian forensic action or forensic human rights [30]. For instance, beyond identification, DNA sampling of remains often carries with it symbolic meaning for survivors, influences creation of the historical narrative, and can serve to provide a form of recognition. The DNA sample itself can be a meaningful tie between those who are lost and those who have survived [31]. The very act of choosing to identify or not to identify human remains in and of itself can reveal systemic inequalities, continued marginalization, and political will (or lack thereof) [32]. In the case of post-Apartheid Africa, DNA identification served multiple purposes that range from reclaiming remains to restoring "social, political, and historical identity" of the missing [33]. Thus, engagement in the identification process impacts lived realities of communities and survivors regardless of one's role, be they a scientist, advocate, or government official. Studies of humanitarian forensic action or forensic human rights anthropology demonstrate the power and impact of anthropological interventions on living communities - because the anthropologist is inescapably a social agent. It is these questions and critiques that this paper brings to discussions on domestic US forensic casework.

The role of the anthropologist in US domestic homicide investigations has arguably undergone less sociocultural scrutiny than international counterparts. Of late however, in individual domestic homicide investigations, ancestry estimation has shown to be contentious precisely for its potential structural, social, and political implications. Estimates of ancestry are theoretically intended to show biologically rooted and distinguishable groups, with the term "ancestry" suggesting inheritance of physiological traits influenced by adaptation to geographic environments. However, problematically these do not necessarily correlate to phenotypic expression of socially constructed races. For instance, malaria resistance is a popular example used to describe adaptations in response to selective pressures. The HbS allele, or sickle-cell variant, is often credited with providing Africans and their descendants protection from malaria; however, mutations of this gene (and others) are present in southeast Asians and their descendants as well. This is not a "racial" adaptation, but rather one in response to an ecosystem with a high prevalence of malaria [34]. Similarly, it is intended that "ancestral" skeletal traits can be assessed to identify their (continental) region of geographic origin, thus providing an "ancestry" estimate, but this doesn't necessarily reflect culturally constructed race categories. As with the example of the HBB gene, morphological adaptations are not restricted to a singular geographic region [35]. If within the field there is conflation of social race and genetic ancestry, then this further muddies the issue when trying to distinguish between the two when discussing skeletal assessment with the lay public and law enforcement. Additionally, in the US there is particular emphasis in estimating European-descent and African-descent American individuals to the exclusion of other groups. Because ancestry estimations can only be validated when a victim has been identified, it is understood amongst anthropologists that practical accuracy of biological profile methods often cannot be determined. Moreover, morphoscopic traits, or craniometrics for that matter, will not provide phenotypic information which is truly the core question for most law enforcement investigators when inquiring about anthropological ancestry estimation [36]. This plays a definitive role in societal understandings of race as law enforcement, media, and the public reason that skeletal "ancestry" estimation must

tell us critical phenotypic information.

To further complicate the conflation between "race" and "ancestry" and its merits in forensic anthropology, depending on the culture, individuals may ascribe racial identities to others (and themselves) in inconsistent ways. For example, in the United States, Latinx folks have been found to identify as White or Black (not Latinx), with many in the Latinx American communities aligning themselves with ethnic or national origins, rather than racial categories, despite having "Latinx" ascribed to them by others [37]. Behavioral science studies also point out that perceived racial identities in the US can conflict with how an individual self-identifies; in other words, people misidentify the race of others [38]. This problematizes the use of "ancestry," as it has the potential to exclude potential identities or mislead search endeavors. Despite efforts to hold positions as neutral investigators, the very act of analyzing will influence and be influenced by social factors regarding interpretation of race, ancestry, and the meaning those terms have in communities and individual identities.

Some scientists raise similar concerns regarding the estimation of biological sex to the potential exclusion of transgender, gender nonconforming, and non-binary individuals. Just as ancestry is intended to be rooted in geographic origins, biological sex is intended to be rooted in skeletal anatomy. Yet, in reality, scientists understand that biological sex exists on a spectrum and can be described in terms of an array of characteristics such as hormone levels, skeletal morphology, reproductive organs, and genetics. Anthropologists target skeletal morphology for biological sex estimations, but skeletal sex does not provide information about gender identity or gender expression, which, like race, are socially constructed. Research on how surgical or hormonal interventions impact sex estimation is not fully developed. These factors have the potential to obscure folks with gender non-conforming identities from the identification process– similarly to those who have social race identities that do not correlate with estimated ancestry. Such estimations propagate notions of binary biological sex and reify popular belief in biological race [39–43]. At a disciplinary level, the nuances can be well-understood by practitioners, but efforts to mitigate public confusion or damage to investigations must be responsive, consistent, and clear for the public.

Aside from misclassifying aspects of the biological profile and contributing to fallacies of race and sex, it is unknown how providing race or sex data may negatively influence medicolegal investigations, if not due to overt discrimination, then due to implicit bias and structural forces [44,45]. Implicit bias functions as a form of subconscious judgment or ideas that individuals are unaware they may be applying to their interpretations and interactions. These unconscious notions sometimes have unintentional negative outcomes. Individuals may apply enculturated stereotypes to various social identities. Numerous studies have demonstrated implicit biases against racialized minorities in the criminal justice system, and anthropologists and investigative colleagues are not immune from this. A particularly controversial study by Dror and associates [46] argues that forensic pathologists may express implicit racial bias when determining manner of death, with deaths of Black American children more likely to be ruled homicide. While the deliberations concerning that study are beyond the scope of this paper, it has reignited fervent discussion amongst forensic practitioners on potential biases that can exist in scientific processes. These biases may shape outcomes in the criminal justice system for surviving family members if an estimated ancestry is provided for the victim and racial biases are at play. Bethard and DiGangi [47] ask anthropologists to consider the phenomenon, "Missing White Woman Syndrome; " this describes the fact that missing Black, Indigenous and People of Color (BIPOC) women do not receive the same resources and media representation as White women. Extensive attention has been drawn to this aspect of American culture through the Missing and Murdered Indigenous Women (MMIW) social movements in the United States and Canada. This movement has pointed out that Native American women have homicide rates ten times that of the national average, with homicide

being the third leading cause of death amongst Native females aged 10–24, yet their investigations are under-resourced and under-represented in the media [48,49]. If ancestry estimations classify a victim as BIPOC, then how might that intentionally or subconsciously impact the investigation? Despite some forensic anthropologists' adamance that anthropologists are akin to technicians and are restricted to providing information, the information provided and the expertise wielded are vulnerable to both implicit and conscious biases [50].

Ideas of ancestry and biological sex serve as just a few illustrations of the engagement that forensic anthropologists have with sociocultural issues. Acknowledging anthropologists as social agents that influence cultural concepts and events leads to the pressing questions: What information are anthropologists not providing? And how does absence of reporting shape events and narratives? What data or analyses are omitted that may contribute to better understandings of modern human populations or histories of oppression [51]? How do omissions of information shape sociocultural, economic, or political factors? Then, of note, how are already vulnerable populations impacted by or obscured by the analyses anthropologists could - yet do not - conduct? How could use of structural vulnerability data cause harm to or assist populations? Here, this paper considers additional types of information, beyond biological profile that could be gathered by the anthropologist that also can capture structural violence or structural vulnerability.

3. Sociocultural implications and vulnerability seen in case data

Continuing to work under the premise that anthropologists are social agents whose work has sociocultural implications, this paper now offers examples of how structural violence and structural vulnerability can be assessed in casework. Archaeologists and bioarchaeologists interpret contextual data gleaned from a geographical location and material objects at that location or study remains of populations to understand health and status in past communities. As we have discussed, international forensic humanitarian action or forensic human rights anthropology also relies on gathering information from a scene to determine what events transpired and if those events align with witness accounts and other evidence [52]. Anthropological analytical skills used in these contexts can be transferred to domestic criminal investigations of homicides and humanitarian identification efforts through analysis of scene information, artifacts or material objects associated with the remains, and skeletal health indicators that could suggest structural forces at work. Similar limitations and cautions apply (e.g., homogenizing lived experiences, stigmatizing group identities, causation versus correlation) and should also be taken into account when determining the use of structural vulnerability data.

3.1. Social vulnerability and scene data

In many jurisdictions, policies, laws, and workflows do not call for forensic anthropologists to be at the scene to recover human remains, despite an understanding *within* anthropology that anthropologists bring highly specialized skills in locating, preserving, documenting, and collecting human remains [53–55]. Additional information, like ambient temperature, whether the thermostat for a furnace was on, or the presence of pets may be of interest to the anthropologist when considering postmortem interval and taphonomic events. While there is often prioritization of skeletal recovery and biological evidence preservation, scene information is equally as important in reconstructing the life and death experiences of the individual or community in which they are found. In such scenarios where anthropologists do not conduct scene analyses or remains recovery, reports provided by medical examiner's investigators or law enforcement agents may provide information relevant to marginalized identities.

For example, Kim [56,57] discuss the location of where remains are found in Wayne County, Michigan, observing that anthropological cases are often found in vacant residences. The prevalence of vacant

residentially zoned buildings in Detroit, the county seat, reflects a history of outmigration and economic hardship atypical for a metropolitan area of that size. For many of the individuals, the deposition location also functioned as a residence for the deceased. This information, when combined with the concept of delayed discovery (requiring an anthropological consultation) implies that no individual was physically checking on the deceased. Within the scene itself, remains located in vacant residences provide insight into access to housing, heat, and other resources. If an individual has taken up residence in an abandoned space, what do features of the space expose about access to food, healthcare, or safety? Scene reports from medicolegal death investigators may indicate visible infestations of bed bugs or cockroaches, animal droppings, rodent inhabitation, lack of electricity or water, and other adverse living conditions.

Patterns in the locations of decomposed or skeletonized remains can reveal the socioeconomic hardships faced by the individual and their community. For remains found in the US-Mexico borderlands, information beyond the body reflects greater geopolitical events. In 2012, the number of migrants dying in or near Falfurrias, Brooks County, Texas rose sharply due to changes in border enforcement policies in Arizona and California [58]. Transcending the bounds of analysis of the body, the location of where remains are being found fits within broader contexts of mobility and violence. A similar absence of resources can be attributed to the lives of migrants at the US-Mexico border. Documentation regarding structural inequality seen in forensic casework is sparse in the US, but can assist in humanitarian concerns of accurate historical representation of marginalized communities, or accurate data for policy-makers and other interventionists. In addition to the scene context, material artifacts also can provide information on access to resources.

3.2. Social vulnerability and material artifacts

Recent publications have highlighted the benefits of examining material artifacts found when human remains as part of the humanitarian identification process of migrants at the US-Mexico border [59]. For instance, as part of Operation Identification, an effort based at Texas State University, artifacts in the form of clothing and personal effects are cleaned, photographed, and uploaded into the US National Missing and Unidentified Persons System (NamUs) to assist in tentative identification [60]. Similarly, anthropologists working as part of Michigan's humanitarian identification effort, Operation Unknown Names Identified through Exhumation and DNA (UNITED), use material evidence to assist in determining which interred skeletal remains should be sampled. In addition to biological profile and trauma assessments, anthropologists compare personal effects to autopsy, police, or NamUs records [61]. Indicators of autopsy or funerary practices such as eye caps suggest the individual was not an unidentified burial. Consistently, anthropologists in diverse contexts utilize the information provided by material artifacts, here it is suggested that those artifacts be examined for evidence of structural vulnerability.

Individual homicide or identification cases outside of the large-scale operations also process clothing, personal effects, and often property in the immediate vicinity of the remains. The position, location, and condition of the items can provide insight into the living situations of the individuals– including evidence or indicators of social marginalization. For instance, wrapping in blankets could indicate that the individual was sleeping at the location where the remains were found, and if it is an outdoor space or abandoned building, it could point to lack of access to shelter. In these scenarios, it is not uncommon for individuals to also be wearing many layers of clothing. When combined with scene location information (e.g., condition and weather), these could imply lack of access to heat. Other physical items can indicate health complications or reduced access to healthcare. Improvised bandages or dressings show an absence of formal medical treatment and drug paraphernalia suggests drug use or addiction. In combination with autopsy analyses or medical

records (once identified), these variables can reveal life experiences of the victim yet have no place in the typical anthropological report.

3.3. Social vulnerability, health indicators, and trauma

Perhaps for the traditional forensic anthropologist, the most obvious information on structural vulnerability can be found in skeletal examinations. Skeletal indicators of trauma and pathology in forensic investigations should not be understated or downplayed, yet these reports tend to weigh less heavily in the biological profile than other estimates, such as ancestry, biological sex, and height, which, for example, law enforcement can hone in on to narrow candidate pools for tentative identification. Historically, biological anthropologists have devoted much of the discipline to paleopathology and skeletal biology. In common practice, bioarchaeologists evaluate past populations' skeletal health and analyze what those health conditions mean for communities in terms of health practices, technology, and other social factors. At an individual level, forensic anthropologists can conduct similar examinations of remains to document pathology and trauma. This information sometimes contributes to medical examiner conclusions on cause, mechanism, and manner of death. For law enforcement, these principles are important to casework, but without a greater understanding of the implications of pathological and traumatic skeletal analyses, the impact of these findings can fall flat.

In individual homicide cases, characteristics of antemortem trauma and pathology can indicate neglect or withholding of medical care, which would directly influence not just notions of structural vulnerability or structural violence, but potential criminal charges. Along the same lines, analyses of peri- and postmortem trauma can assist in piecing together whether or not an individual was tortured or mutilated. For example, in the United States, the severity of the crime and of the punishment can be influenced by evidence of "depravity" in the commission of the murder. The Depravity Standard may include factors such as an intent to "maximize damage" to the victim or an "intent to cause physical disfigurement" [62]. Reinhard and colleagues point out that repeated blunt force damage to the craniofacial bones in a case they studied supports an intent to disfigure [63]. The influence that anthropological findings have on legal procedure reinforces the forensic nature of the biological analysis and is understood by practitioners. However, there is ambiguity regarding documentation of information that is considered part of humanitarian work or within the bounds of international human rights law instead of domestic criminal law.

If one were to document systematic marginalization or vulnerability, then it should be acknowledged that forensic anthropological records have the potential to reveal information about forensic and unidentified remains as a population of a geographic region. While it is true that anthropological cases will not represent the population of a city or county in a statistical sense, they have the ability to show patterns amongst those who end up being assigned as an anthropological case due to their delayed discovery. For instance, in the US-Mexico borderlands, research has suggested that remains of migrants may be distinguished, at least in part, by skeletally manifested physiological stress indicators that present in lower frequencies amongst American nationals [64,65]. Another humanitarian crisis in the US manifests as an opioid epidemic. Andronowski and Depp emphasize the fact that poverty, housing insecurity, access to healthcare, and other indicators of marginalization correlate to deaths of opioid overdose. Of note, osteological changes can evince addiction or substance abuse. Osteological research is limited, but case studies and clinical literature argue that chronic opioid use has osteoporosis-like effects on the bone [66]. If a high number of cases in a particular area have indicators of opioid addiction or substance abuse, then that could show patterned marginalization. This can allow medicolegal personnel to draw conclusions about persons of interest who may be identifiable from these skeletal nuances and could be relevant to policies and practices of local government and authorities.

Similarly, the structural violence or social marginalization that people experience as homelessness, limited access to health and dental care, drug addiction, and/or malnutrition can present osteologically. When findings related to marginalization are present at an individual level as well as a case population level, correlations and statistics on the sociocultural and socioeconomic happenings within the community at large can be drawn. Health indicators may reveal gaps in service areas, resource deserts, and other social factors that could be addressed through policy changes and local initiatives. However, at this time, it is not clear how and where health indicator information could be reported, aside from under the pathology and trauma sections of an individual case report. It also is not clear how such data should be collected, to what extent, and how it is to be stored. Anthropologists frequently collaborate closely with law enforcement and medical examiner personnel, yet these groups may not have use or space for structural vulnerability data within their organizations – despite the fact that this information could be crucial to helping a law enforcement based anthropologist interpret the findings from medical examiner counterparts, could aid law enforcement in population studies or assessments of missing persons in an attempt to narrow identification(s) of descendants, and could impact policy change.

4. Consistency in social vulnerability data collection

Another consideration when discussing the expanding role of contemporary forensic anthropology is the logistics of conducting structural vulnerability assessments especially considering where, when, and how anthropologists are employed. Structure of employment influences the responsibilities with which anthropologists are tasked and how much data they may have access to for evaluating marginalization indicators (were they to be recorded). Deploying forensic anthropologists into the field for medicolegal or criminal investigations largely stems from contracting forensic anthropologist practitioners from medical examiner offices (MEO) and/or universities [67].

As discussed, these personnel are called at the request of the MEO and provide supplemental reports that inform cause and manner of death determinations in fresh, decomposing, and skeletonized remains [68]. Anthropologists may (in)consistently conduct their own recoveries or may be restricted to the laboratory. Interestingly, despite highly specialized training possessed by anthropologists at the masters and/or doctoral level, only two states (e.g., Michigan and New Jersey) have gone as far as incorporating forensic anthropologists as full-time, civilian employees of the state police [69]. Jurisdictionally, state police are responsible for enforcing state-level laws, including assisting county and city-level jurisdictions in death investigations, which can position the anthropologist as support staff but also may limit investigative autonomy. The anthropologist, viewed as an asset, works as a liaison and pre-determinant between law enforcement and medical examiners (and their contracted anthropologists) for identification of scenes, remains analysis, biometric data collection and evaluation, and socio-cultural and biosocial details gathered from casework. The specific capabilities, position description, and roles of a police-funded forensic anthropologist are outside the scope of this paper, but general knowledge of their work can 1) provide insight into what anthropological training may be viewed as useful in the eyes of law enforcement collaborators and 2) lend insight into potential contributions of a forensic anthropologist outside the traditional analysis of skeletonized remains. That being said, ability to consistently gather, report, and use structural or social vulnerability data could vary significantly depending on how and where the anthropologist is employed. If inconsistent employment of anthropologists is logistically overcome and the information is gathered, the lingering question of what should or could be done with the data remains.

5. Possible uses of social vulnerability data

Acknowledging forensic anthropologists as social agents whose documentation matters not just legally, but also socioculturally and politically is the first step in determining how structural vulnerability and structural violence can be integrated into applied practice. The expanding role of the forensic anthropologist could include analyses of scene data, contextual information, and interpretation of skeletal conditions beyond the basic biological profile. Indeed some anthropologists already undertake this work. If these analyses lead to documentation of structural violence or vulnerability, then there are diverse applications of this information. Potential uses of structural vulnerability information include: assistance in missing persons cases, documentation of health and safety data, and addressing justice concerns.

5.1. Tracking social vulnerability for missing persons

The second author serves as the Michigan State Police (MSP) Forensic Anthropologist and is responsible for applying broad anthropological training to track missing persons believed to be deceased or homicide victims; investigate cold cases, missing persons cases, and unidentified human remains cases (UHR); aid other agency team members, such as the MSP Canine Unit, on active search and recovery operations (e.g., probing and shovel testing at areas of investigator and canine interest); assist crime scene response team personnel with the recovery of human remains; support fatal fire recoveries and investigations; aid in biometric data collection and NamUs input; and assist on cases protected by the Native American Graves and Repatriation Act (NAGPRA). A law enforcement-based forensic anthropologist adds experience and expertise to field work in the absence of (or in conjunction with) medical examiner's anthropologists, including the search, location, and recovery for human remains. When requested by law enforcement personnel, a state forensic anthropological asset has the capability to respond to a potential scene 24/7 with law enforcement personnel without straining the resources of the partnering agencies. Duties such as these and close partnerships with police investigators can potentially inform or limit engagement in assessments of social marginalization. Governments frequently do not consider limited access to resources a domestic legal matter (as opposed to international human rights law). Yet, sociocultural training allows an anthropologist to frame both modern/forensic and cold case work in humanitarian models that consider factors such as marginalization or vulnerability. As social agents, the choices in what to document or not have powerful cultural implications. That being the said, one logically asks how could social vulnerability be tracked throughout the course of an investigation?

The NamUs [70] database allows for the storage of information on missing persons and UHR cases within the United States. The system was built to track, compare, and aid US law enforcement and medicolegal personnel in cross-referencing police-registered missing persons and medical examiner's UHR cases. There is a third section of NamUs for unclaimed remains, which will not be discussed in depth in this review, but which contains identified persons who are unclaimed by next of kin (NOK), or whose NOK cannot be located by medical examiner personnel. Algorithms within the database automatically cross reference missing persons and unidentified human remains (UHR) cases within certain parameters predetermined by the database [71].

Currently, thirteen of the fifty US states have legislation concerning NamUs, and use of the system is inconsistent. NamUs features both a public and professional (e.g., law enforcement, medicolegal personnel, and forensic subject matter experts) interface. The information displayed in the various facets of the system allow for controlled information sharing and protection of sensitive information related to the cases stored. The public-facing aspects of the database have been used internationally, specifically by Canadian counterparts, for tracking possible border crossers. Domestically, public users are privy to basic information, such as name, age, height, weight, eye and hair color, and

basic circumstances of the case. This is beneficial for NOK next of kin and others who may be searching for missing persons. Nevertheless, law enforcement and medicolegal sensitive information is kept secured from public persons to prevent breaches in information sharing and criminal investigation casework.

Information that can be stored on NamUs, but may not be public, includes biometric information on persons entered, both living and deceased, as well as photos, medical and dental records, notations on family reference DNA samples (or direct samples), clothing and accessories, case notes, vehicle information, and more. Registering professional users, vetted through NamUs via the requesting agency, allows for sensitive information to be shared between agencies for linking or excluding cases. To be a registered user, one must be employed by a medical examiner's office or law enforcement agency, unless there is special dispensation provided in extenuating circumstances. The privacy mandate thus prevents forensic anthropologists who conduct casework on behalf of a university entity to enter information into NamUs, even though a significant number of cases may have been referred to an university-based anthropologist [72]. Rather, data entry typically falls on the responsibility of the medical examiner investigators. Depending on the relationships between forensic anthropologists and MEOs, this could substantially limit anthropological ability to enter data on homelessness, health indicators, and other information indicative of structural vulnerability.

When cases are added into NamUs, the information stays open and active until the case is either closed out by the owning party or, hidden by the system due to recovery of partial remains, or at the request of an investigator based on the investigation. This also presents a challenge to tracking, storing, and making useful structural vulnerability-related data. If information becomes inaccessible, then it also cannot be used for meaningful research related to structural issues [73]. Hawes and colleagues [74] point this out as problematic using the public health concern of a disproportionate number of Missing and Murdered Indigenous Women in the US as an example of using NamUs to clarify what vulnerabilities mean for Indigenous women. The authors also argue that resolved cases be kept accessible in NamUs to assist in monitoring demographic traits of missing persons. Could NamUs reveal that some systemically excluded groups are more vulnerable to being missing and murdered? In a similar sense, we put forth that NamUs could be a place to store additional social vulnerability data (e.g., found in a blighted residential building) that reveals characteristics about those who are missing and/or murdered.

NamUs' primary use is for storing case information and allowing for tracking and comparison of missing persons and UHR cases for investigators nationwide, due in part to the high mobility of current populations. NamUs itself allows for the linking, tracking, and progressions of previous case work to be contained in one database, inclusive of modern/forensic cases and cold cases. NamUs personnel can actively help law enforcement agencies and medical examiner personnel facilitate the collection of submission of DNA across state borders from, as well as recently accepting forensic genetic genealogy (FGG) casework on a case-by-case basis. For those interested, setting up a NamUs profile for law enforcement agency or ME personnel is relatively simple, but requires authorization/confirmation of association with an agency via supervisorial support. This access must be reapproved every year. For a forensic anthropologist, NamUs can provide a wealth of information on casework, including geographic coordination and the possibility to draw conclusions between the association of at-risk populations and skeletal markers, bio-cultural observations, and socio-economic status of missing persons and UHR known traits. Much of this information could exist in the "notes" section of NamUs, but discussions with regional NamUs coordinators could potentially lead to additional search fields.

Forensic anthropologists employed full-time with law enforcement agencies are particularly well-positioned to ensure the data is entered consistently as they are able to interpret medical data and simultaneously serve law enforcement priorities. However, it should be noted

that NamUs requires that regulates only those employed by the medical examiner's office can enter UHR cases, a downfall of the system, as those medical examiner investigators or anthropologists are not always on scene recovery or have the same information the law enforcement anthropologist possesses. Of course, this opens other limitations, such as lack of information flow between agencies and poor communication. As discussed, researchers have suggested potential racial bias (akin to Missing White Woman Syndrome) in law enforcement and medical examiner personnel that could influence the course of an investigation. An anthropologist working full time for a police agency would bring the perspective from a behavioral science field and perhaps utilize databases such as NamUs in a different way or consider structural vulnerability as part of the identification lens.

Utilizing information gained from field work (scene work) in modern/forensic cases, and initial field estimates based on basic osteological data, the law enforcement anthropologist can hit the ground running by taking that estimated information (knowing it is not certain until a full write up at the medical examiner's office is complete) and search databases, such as NamUs, for possible UHR identifications. Other law enforcement sensitive databases can be utilized too, such as those which hold information on all missing persons statewide. Additional resources, such as state fusion centers, can be outreached or networked within to check on missing persons associated with other states of interest (e.g., did this person cross the Ohio-Michigan border? Was there found evidence that points to this person being from out of state? Can that be cross-referenced?) With these benefits also comes potential for misuse of information, and using NamUs in a modified manner in no way would be a perfect resolution for structural vulnerability data, but it provides one route to explore.

5.2. Tracking structural vulnerability for public health and safety

As social agents, in both international and domestically rooted investigations, anthropologists have an ethical obligation to document and report uncensored skeletal observations and analyses in both forensic and humanitarian cases. Survivors are particularly vested in documentation, though it may not always be "forensic" [75], and it may be viewed in a humanitarian disposition. There are diverse and nuanced theoretical lenses to do this, such as structural violence, structural vulnerability, and social vulnerability, and all would facilitate more thorough documentation of the human experience and potentially pressing social issues. Such lenses of systemic inequality and inequity may generate clearer pictures of problematic trends in victimology, biased use of media resources (e.g., Missing White Woman syndrome), or systematic violence and exclusion. In addition to this though, there is important public health data embedded in anthropological analyses of scene, artifacts, and skeletal remains.

Diverse public service organizations and governmental units track social vulnerability and use it to inform decision- and policymaking, particularly in relation to disasters and disease outbreaks. In these contexts, social vulnerability could refer to "potential negative effects on communities caused by external stresses on human health," [76] or "the socioeconomic and demographic factors that affect the resilience of communities" [77]. Perhaps most well-known is the US Center for Disease Control's (CDC) social vulnerability index which uses 16 variables to identify high-risk groups. Their factors include four major categories: racial and ethnic minority status, poverty/socioeconomic status, housing type/access to transportation, and household characteristics. Arguably, anthropologists are observing similar data in their casework. Limited access to resources, homelessness, or makeshift medical treatments seen in cases reflect socioeconomic status and sometimes housing contexts (e.g., Detroit cases found in vacant residential properties). The CDC gathers its data from the US census – again leaving anthropologists in an unclear position of what should be done with social vulnerability data that is collected.

From the standpoint of public safety, not only are anthropologists

potentially witnessing public health and safety crises through the embodiment of marginalization, but also in terms of *where* remains are found. In cities with swaths of vacant homes, these become prime areas for preying on individuals as well as disposing of remains clandestinely (obfuscating the crimes of violent offenders). However, it is unclear in the "workflow" to whom an anthropologist would report such patterns outside of law enforcement agencies. This forces forensic anthropologists to rethink collaborations and data-sharing outside of the medicolegal system.

5.3. Tracking structural vulnerability in human rights and transitional justice

When we look again to those who have been entrenched in conversations of humanitarian forensic action or forensic human rights anthropology, ethnographic studies have shown the sociocultural impacts of forensic intervention in the aftermath of mass violence and disaster. Studies such as these can provide insight into possible types of documentation and reporting on structural vulnerability in the US—particular in the context of international, rather than domestic, law. These models and approaches have been embedded in justice frameworks that developed alongside international human rights law. Historically, humanitarian law has focused on the rules of war, or violence committed by the government of one nation state against citizens of another. Complementing this, international human rights laws focus on crimes committed against citizens by their own governments. In cases of mass violence, forensic investigations not only collect evidence of genocide, but serve the aims of international transitional justice frameworks that seek justice, accountability, and reconciliation through goals such as prevention of historical revisionism, memorialization, and truth-telling [78].

Vast literatures describe the imperative role of forensic documentation in preventing historical revisionism. When governments commit atrocities, such as massacre, torture, kidnapping, and disappearance of citizens, these acts are frequently accompanied by narratives that mask the events. Witness statements and physical evidence of the violence delineate factual events from fictional narratives. As mentioned previously, governments may claim that a massacred group fought as armed combatants when in actuality soldiers murdered men, women, and children en masse. Anthropological analyses of the biological profile and trauma can assist in explaining what actually happened to the deceased, preventing a narrative of innocence on the part of the offender. Often offenders obscure past crimes through erasure.

The US has a deep history of erasure of marginalized groups which emphasizes the need to take critiques of anthropological intervention seriously-it is not a phenomenon confined to non-US contexts. For example, in the case of Canada and the US, both settler colonial governments established Indian Residential Schools and Indian Boarding Schools to forcibly assimilate Indigenous children. As part of the assimilation process, schools forbade use of Indigenous languages, customs, or cultural practices. Recently revealed historical documentation evidences medical experimentation and survivor statements provide recounts of sexual assault, physical abuse, and medical testing [79]. For the duration of the schools and into the recent past, the use of the schools and their true nature were omitted from public education, with many non-Indigenous citizens in both countries ignorant of these violent acts and the subsequent, long-lasting, detrimental effects. This erasure facilitates Canada's stigmatization of impoverished Indigenous communities and the US's myth of the "vanishing Native" (e.g., Indigenous communities are extinct). Meanwhile, Indigenous survivors grapple with the impacts of these human rights violations [80].

In yet another example, displacement and sterilization of the Appalachian poor remains an untaught silenced portion of US history. In the 1930s, the US Farm Security Administration removed residents of Virginia's Appalachian mountains, ostensibly as part of an effort to "fight poverty" and make way for the Shenandoah National Park [81]. The

policies and practices, touted as humanitarian, include the forcible removal, separation, institutionalization, and sterilization of impoverished communities [82–84]. This occurred at a point in history when the US sterilized citizens that it deemed "unfit to procreate," a state-level practice that was supported by the 1927 US Supreme Court in the case of *Buck v. Bell*. Under this particular provision, an estimated 70,000 US citizens were forcibly sterilized. Despite the vast number of families impacted and generational effects, this part of history is masked. Similar policies of eugenics have targeted the mentally ill and disabled people and diverse policies and laws disproportionately impact ethnic and racial minorities negatively in the United States.

Indirect violence that countries carry out through policies and practices (e.g., structural violence), like the direct violence of mass human rights violations, falls under the auspices of international human rights law and would be addressed through the reparative ideals of transitional justice. When considering this, forensic anthropologists often serve in contexts as those who document and gather evidence of the violence experienced. Without such documentation, events are obscured and oppression can be hidden from history – carried on through survivors' memories. As forensic anthropologists encounter casework that may evidence marginalization and structural violence that documents poverty, lack of access to resources, homelessness, and other states of suffering, they are positioned to document suffering that otherwise can be easily ignored in dominant narratives. However, where and how this documentation fits within record-keeping is not clear since structural violence or concerns over historical revisionism and erasure are not domestic US medicolegal concerns and these are the arenas in which forensic anthropologists predominantly work.

6. Concluding remarks

Whether practitioners want to be or not, forensic anthropologists are social agents whose decisions and interactions with the public shape social perceptions. There is an ethical obligation to be conscientious about when, how, and for whom forensic anthropology and its findings are used or omitted. This is particularly consequential as forensic anthropology has expanded, and will continue to expand, outside of historical definitions. Increasing humanitarian demands have drawn forensic and biological anthropologists into issues of migration, diaspora, disasters, and warfare as experts in documentation, analysis, and identification of human remains. Such analyses (or lack of) have real and lasting impacts on historical narratives, policies, laws, and human experiences. This urges those in the field to determine what else could be documented and what information is omitted that perhaps should not be. At the same time there are limitations to the use of structural vulnerability analyses that should not be taken lightly.

Fortunately, increasingly anthropologists are trained as "big picture" researchers when assessing data, be it gleaned from crime scene reports, on scene search and recovery operations, or assessment of skeletal markers. Using all available data will provide a thoroughly documented narrative–with the caveat that knowing more information has the potential to bias the examiner. The conversations in the field concerning documentation of marginalization do help identify gaps in communication that will vary based on how forensic anthropologists are employed. The law enforcement anthropologist (or partnership between the medical examiner's MEO and LEA anthropologists) model has the potential to streamline data communication and tracking efforts and reveal what kind of vulnerability data law enforcement agencies might be able to use.

Creating a repository for large casework data sets on scene, artifact, and osteobiographic information presents an obstacle, though NamUs could be a potential platform. At an individual level, this data could assist in identification efforts and at a population level reveal systemic marginalization or scarcity of resources. At this point in time the general public can submit missing persons reports in NamUs which could also be used to request information that aligns with social vulnerability for

comparative purposes on the LEA/ME side of the investigation. However, NamUs first takes user-created reports and contacts the appropriate law enforcement agency to vet the information which could complicate matters regarding qualitative information. At the same time, NamUs already suffers from underreporting by medical examiner's investigators and law enforcement agencies, even within the thirteen states that mandate NamUs use. Again, a designated law enforcement anthropologist could potentially fill this communication gap and assist in validating public entered NamUs data (though would still be prevented from entering MEO data). At the individual level it would require very clear guidelines on how to flag health history indicators in a database that are drawn from medical records so that the computer can match them to health indicators found by pathologists and anthropologists. The terminology would need to be identical, and the algorithms would need to be designed not to exclude due to a lack of matching. For instance, someone may not have in their medical record that they are malnourished, but their skeleton may exhibit osteological traits associated with malnutrition. While this would help reaffirm potential identities, it should not be exclusionary. This also only assists with the medicolegal side of using contextual and biological data and still does not address to whom to report case population data to document structural vulnerability or systemic marginalization, which may actually be in the realm of public health rather than of medicolegal interests.

In the United States, anthropological analyses of remains for humanitarian and forensic purposes continue to evolve and do not yet consistently employ methods seen in other forensic or biological anthropology contexts. While many in the field are exploring and employing use of scene, artifact, and osteobiographic data there remain several questions–in particular, how it can be stored or reported and how it can be used. In efforts to acknowledge and record other forms of violence beyond direct violence, anthropologists must first determine for what purpose will data be used (e.g., missing persons, heath, justice), how harm can be minimized, and what limitations can be identified. To answer these, deeper collaborations and inquiries should be made with law enforcement and health agencies so that anthropologists know who to say something to, when they do see something.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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