



## Professional Practice Report

## Pressing need for national governmental recognition of forensic anthropology in South Africa as illustrated in a medico-legal case

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## ABSTRACT

Forensic anthropology in South Africa is well developed in the higher education sector, with advanced training and research programmes. Despite this and decades of academic involvement in casework, forensic anthropology still lacks a defined framework and mandate at a governmental level. Therefore, the involvement of forensic anthropologists' expertise varies markedly between cases, provinces, and among various stakeholders within the country, to the detriment of dispensation of social and criminal justice. The lack of clearly defined guidelines for the rendering of the service was exemplified and demonstrated through a recent forensic case. Here, contextual information was absent, and the remains posed a challenge to analyse, ostensibly due to missing information. Numerous questions were raised during the analysis of the remains, and broader concerns about the investigative involvement of a forensic anthropologist within South African casework were brought to the fore. Through the analysis of this case, we describe the deductive processes that led to the formation of an opinion that the skeletal linear defects were the result of taphonomic changes. In addition, we highlight how these efforts were constrained and each step in the process unnecessarily hindered. Finally, we demonstrate the capacity and willingness of forensic anthropology practitioners to be involved, and how, without governmental support, it is a great potential lamentably untapped.

## 1. Introduction

South Africa had 19,972 murders in the 2020/2021 financial year [1] and was the tenth highest country for homicides globally in 2017 with 36 per 100 000 [2]. These figures correspond with a high level of unidentified persons in South Africa, where a single medico-legal mortuary Salt River has reported dealing with 4000 bodies per annum, with nearly 10% of these remaining unidentified [3,4]. In the Gauteng province, the most populous in South Africa, it is estimated that one in every ten bodies remain unidentified, equating to thousands of unidentified persons per annum [5,6]. Unidentified deceased persons are a global issue, in South Africa the numbers are very high, reasons cited are an overburdened and underfunded medico-legal death investigation system, migration, socio-economic disparities, poor antemortem records and taphonomic factors impacting preservation [6–8]. In addition, poor communication, and territoriality among stakeholders in death investigations are barriers. Identification of the deceased is of socio-cultural, religious, ethical, and of judicial importance, as it provides

closure for the decedents and their loved ones [4–7,9,10]. Naidoo [7] states identification of the deceased is one of the main purposes of a medico-legal death investigation and forms part of South Africa's human rights legislation while the legal principles can be inferred in law, they exist without any practical means of application.

Baliso et al. [8] detail reasons for the high number of unidentified persons in South Africa, and how forensic anthropologists can assist in such cases. In this paper the authors also outline forensic anthropology in the country. Their summary illustrates the localisation of services primarily in five forensic anthropology service providers in the higher education sector, which are run by academics assisting the state through service consultation. Mainly it is the police or forensic pathologists who request and pay for forensic anthropology service consultation. These service providers are principally covered through the higher education sector and charge a minimal fee for recovering the cost of consumables. There are a handful of forensic anthropology positions in the service sector, inclusive of the National Prosecuting Authority and South African Police Services in South Africa. Forensic anthropologists

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prepare a forensic affidavit, which is a legal court testimony and rarely are requested to give testimony in court. Across South Africa there are 50 forensic pathologists employed to conduct autopsies on 70 000 unnatural deaths per annum, the projected number of pathologists required for the local population is 774 (based on 1.29/100 000 for a population of 60 million) [11]. These data illustrate the deficit of qualified pathologists related to annual caseloads. Salt River Mortuary is one of the busiest medico-legal laboratories in the country, where nearly half of all medico-legal autopsies across the city of Cape Town are performed (with approximately 3500 post-mortems conducted annually) [4].

The broad perspective and holistic approach of forensic anthropology can add valuable information to forensic death investigations, especially those involving heavily decomposed, burnt, fragmented, or skeletonised remains. Whilst anatomists and biological anthropologists have assisted in South African casework since the 1940's [12], it was only established formally as a discipline in the higher education sector in the early 2000s [5,8]. Despite exponential growth of the discipline, and the local forensic need as outlined above, the interdisciplinary approach to forensic casework and full potential impact of forensic anthropology for case resolution in South Africa is underutilised [8,10]. The Regulations Regarding the Rendering of Forensic Pathology Services [13: pp 12] make provision for forensic anthropologists (as “qualified professionals”) to be invited to participate in postmortem examinations but does not clearly delineate the scope of their role therein. Nor does it explicitly provide for death scene attendance by forensic anthropologists. This lack of specificity results in a paucity of field-specific and standardised guidelines for local practice [5] and creates confusion regarding the mandate and extent of the forensic anthropologists' investigative role. Provincial independence of the Forensic Pathology Service and the personal preference of the police and/or forensic pathologists with respect to requesting this service contribute to this confusion. Therefore, the role of a forensic anthropologist and their scope within local South African forensic death investigations is still poorly defined and unregu-

lated. Communication issues within and among stakeholders including, but not limited to police, pathologists and forensic anthropologists limit case resolution [3,5,8,10]. These factors impact the value forensic anthropology can contribute to case resolution. In this respect, South Africa is an international anomaly. Many countries have specific legal frameworks for forensic anthropological casework, which facilitates the discipline's growth beyond the “traditional” role within forensic medico-legal death investigations, where consideration of the circumstances surrounding an individual's death (*i.e.* manner of death), inclusive of timing (postmortem interval) and postmortem alteration of the body, are now a commonplace in the field, and highly valued [14]. This can be attributed to the complexity that some cases pose, requiring interdisciplinary collaboration and the ability to draw upon diverse knowledge. In this paper, using a recent case study, we illustrate the need and value of an interdisciplinary approach to certain forensic cases in South Africa. We also advocate for national and formal recognition of forensic anthropology as a discipline in medico-legal death investigations and its value to assist with identifying the missing and murdered.

## 2. Case study

Ethics for publication of this case have been obtained from the Faculty of Health Science's Human Research Ethics Committee at the University of Cape Town (reference number 555/2020). Skeletonised human remains were recovered from an open field in Table Bay Nature Reserve, Cape Town, South Africa. The field, a then-dry, open, and sloped section of a riparian flood plain, had recently been burnt, with new vegetation regrowth. The remains of a single individual were discovered by a shepherd walking his cattle. Some bones were exposed on the surface and the remainder were buried in a shallow grave with some clothing protruding (Fig. 1 shows evidence found with remains). The remains (Fig. 2) were recovered by members of the police's Victim Identification Centre and handed over to the Western Cape Forensic



Fig. 1. Case images A: Torso as recovered, close-up. B: Note reeds penetrating the clothing and body. C: Example of reeds (*Phragmites australis*).



Fig. 2. Skeletal inventory, upper right is an image of the skull as received, lower right is skull after reconstruction.

Pathology Services. Authors 1, 2 and 4 are part of a forensic anthropology service provider, were engaged by Author 3 from the Forensic Pathology Services to assist with determination of identity and the estimation of the postmortem interval. Initial assessment of the remains highlighted complexity. Firstly, taphonomically, the remains had evidence of differential discolouration resulting from the effects of burial but also fire. Further, some of the skeletal elements were penetrated by vegetation, and others were extensively fragmented (particularly the cranium, which had been damaged between recovery and presentation in the laboratory). Secondly, there were linear defects on some of the bony elements – particularly the vertebrae – resembling sharp force injuries (cut marks). The combination of these factors posed an investigative challenge. Following the initial assessment, questions were raised: What was the nature of the fire that burnt the exposed remains (i.e. temperature, duration and fuel source)? When did the fire occur? What was the nature of the tool (or tools) used to inflict the linear bony defects (i.e. type of tool, number of tools used, and manner of use)? When were the linear defects inflicted and could it have contributed to cause of death? And can any of this information be used to estimate the post-mortem interval? These questions were not easy or straightforward to answer. This forensic case was challenging and resulted in the remains being analysed on several occasions. Presented below are the results of these analyses and a discussion surrounding the deductive process used to answer these questions. These highlight the important role of a forensic anthropological approach with a multidisciplinary ethos, as well as the hindrance which a lack of formal recognition of the discipline can pose to such efforts.

Anthropological assessment an adult male corresponding with an age range of 43–64 years of age-at-death [15,16], his height was estimated to be 167–170 cm [17]. Due to extensive fragmentation of the cranium and pelvis, some analyses could not be assessed. The fragmentation of the cranium was noteworthy, as initial photos from the scene

showed it was largely intact. Between the recovery and our consultation/assessment of the remains was 40 days, the fragmentation occurred post-recovery during the storage time. Fragmentation may have resulted due to mishandling of the remains. Skeletal remains like these, that have undergone heat alteration, are prone to fragmentation and, as a result, specific protocols have been suggested for the handling of burnt remains [18]. This aspect of the case was pre-involvement of the forensic anthropologists; however, it raises the question if proper protocols were followed in the management of these remains and importantly highlights and reinforces the need for experts trained in skeletal recovery to assist at the scene. Despite the fragmentation, reconstruction of the cranium was undertaken, and further analyses conducted (see Fig. 2). Detailed results and a discussion surrounding the more in-depth analyses are outlined below.

### 2.1. Differential bone colouration & heat-altered fragmentation

The skeletal remains had diverse colouration. Most bones were stained a matt brown colour owing to the clay-like soil conditions of the burial. However, some bones exposed on the surface were stained a reddish orange colour and some with a uniform black discolouration, both on the surface and internally. At least three bones – the sternum and both calcanei – presented with all colours simultaneously. Regions of these bony elements appeared to have been burnt, displaying some charring but no calcination, heat-lines or heat-borders (Fig. 3). Little-to-no warping was evident.

Symes and colleagues [19] describe how the presence of soft tissue over fresh bone produces a characteristic burn pattern. Different regions of the skeleton burn at different rates proportionate to the degree of soft-tissue coverage and the position of the body, resulting in differential burn patterns on the skeleton. The molecular and chemical changes in fresh bone also produce a heat border with a heat line as a



Fig. 3. Example of differential bone colouration using the feet and the sternum, reddish, black and white colouration can be observed.

function of dehydration and heat-driven molecular alteration of the bone's organic content. Organic content ultimately ignites, producing charring. Sustained heat (and/or higher temperatures) results in complete destruction of the organic content, leaving only the inorganic component, which is progressively broken down into fine ash. This process is known as calcination. The uniformity of colouration on the burnt bones, the presence of limited charring and the absence of heat-lines, heat-borders, and warping suggest the remains were burnt post skeletonisation in a low-heat (<800 °C) fire for a short duration. The internal burning of some long bones also suggests fragmentation had already occurred at the time of the fire. Therefore, heat alteration likely occurred postmortem, but there is no evidence to suggest it as a destructive act of concealment of the remains – a useful investigative guide for the police.

The presence of reddish-orange colouration on burned bone is interesting. Colour change in bone during burning is affected by the environment, principally oxygen availability, the temperature and duration of the fire [20]. Under most circumstances, bone will proceed from its endogenous pale cream, through yellow and brown as the oil and grease component is burnt out, then black as the bone chars, and ultimately a greyish-blue colour as the marker of calcination [19]. Colours as variant as yellow, green, and pink have, been described [21]. These are usually the result of various metallic components being burnt in the presence of bone: yellow has been linked to zinc, green to iron, and pink (variously lighter or darker) to copper. The reddish-orange discolouration (also could be called pinkish) of the present case may be the result of the presence of copper or copper-containing artefacts near the remains. Copper is a widely used additive in many metal alloys including those found in shoelace eyes on shoes and belt buckles, like those found with the remains. Alternatively, the reddish-orange colouration may be staining from iron-rich components of the soil from which the remains were recovered. The geology of the Diep River catchment largely comprises the Malmesbury Group generating highly weathered clay-rich soils including the red and yellow iron-rich Hutton and Clovelly forms [22,23]. Ayeni et al. [24] also previously found highly elevated levels of iron in soil samples from the Diep River bank and adjacent sites 5 km downstream from the recovery site. However, without the benefit of scene attendance where the soil could be examined, we are unable to confirm a specific source of the colouration, limiting our inferential capacity.

## 2.2. Linear defects

Linear defects (grooves) were found on several lower vertebrae and the lateral epicondyle of the left femur (e.g. Fig. 4A). The internal as-

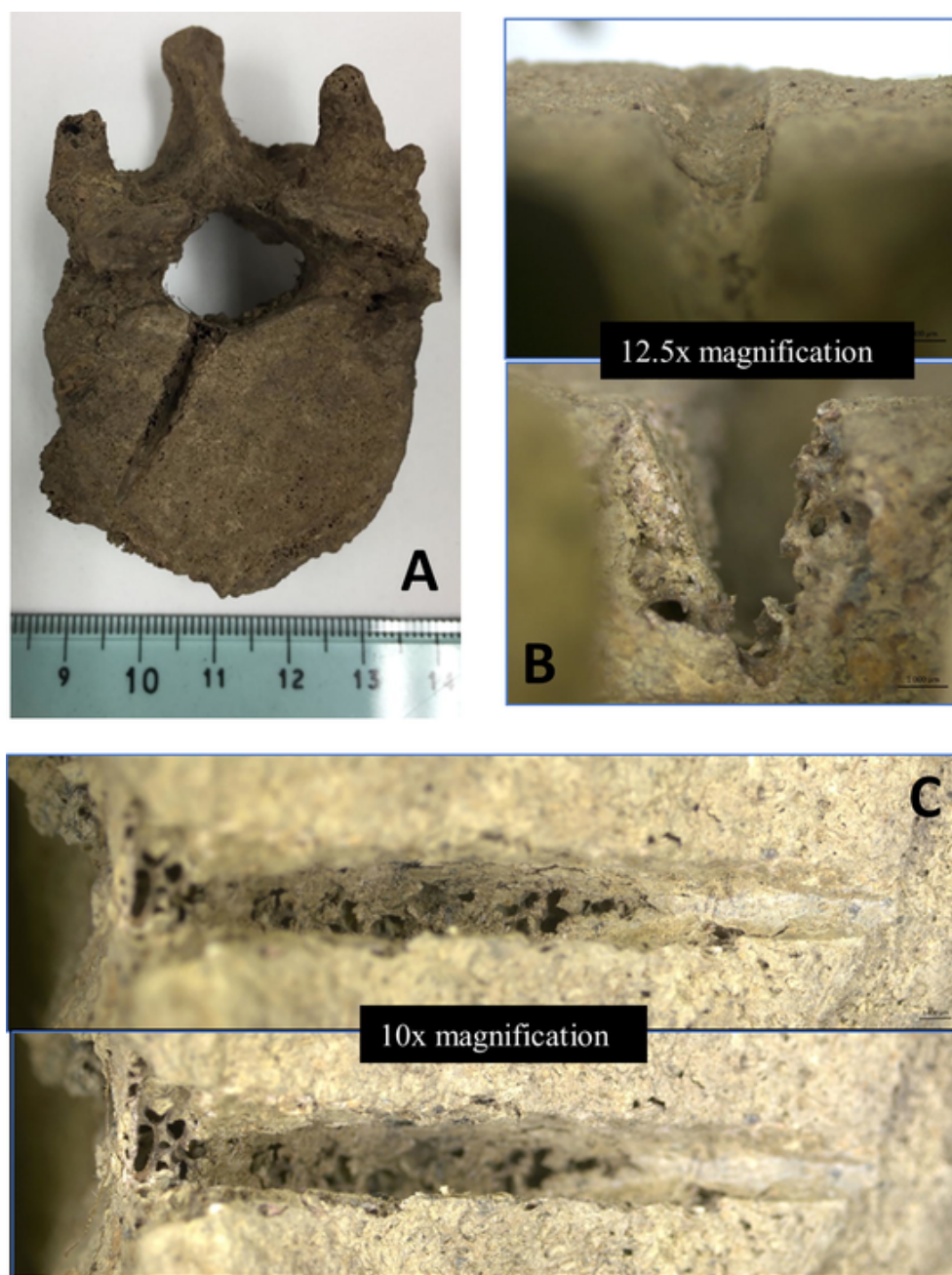
pects of these marks were uniformly coloured with the surrounding bone, signs of healing were absent, and soil particles were present within the internal portions of the marks (e.g. Fig. 4B, 5A). All grooves were straight, U- or square-shaped at the base, with lipping of the upper edges (“shouldering”) and polishing of the bone along the base of the groove (without striations). The grooves were deep (>5 mm), penetrating the cortical bone on every affected bone (Figs. 4, 5B). Anatomically, the location of the linear defects was inconsistent with the deceased being articulated when the linear defects were inflicted. This can be seen on the first lumbar vertebra wherein the angle of the linear defect was perpendicular to the surface of the vertebral body with deep penetration, without any effect to the adjacent vertebra (Fig. 4A). This suggests the force was delivered from above and not from the side. Disarticulation of the remains causing these marks were unlikely given the apparently random locations on the affected bones. Moreover, the depth of grooves and polishing of cortical bone suggests considerable force was associated with their infliction, and the width of the grooves (3 mm) suggests a tool edge thicker than most knives and axes.

The characteristics of these grooves show similarities to those reported with trampling of bone by wildlife. Indeed, numerous authors have reported that trampling lesions on bone may mimic sharp-force injury (e.g. [25–28]). The known presence and activity of cattle in the area suggest the remains may have been trampled post skeletonisation. Criteria exist for differentiating trampling (abrasive) from sharp-force injury marks (see review by [29]). Sediment type, time of exposure to trampling, and specific features of the marks themselves (e.g. the trajectory, shape, depth, shouldering, and presence of microstriation patterns of the grooves) are all important considerations. Numerous characteristics of the marks in this case are congruent with trampling; they include an absence of flaking on the shoulders of the grooves, the presence of polishing at the base (associated with prolonged trampling), and the square/flattened base. The depths of the grooves are considerably deeper than those reported for trampling, however, no literature exists analysing marks created by cattle hooves on direct contact with non-fossilised bone, so this option cannot be ruled out.

Another potential cause for these linear defects is a rotary cage tiller. These machines, which are attached to tractors and pulled through reed beds as part of invasive vegetation control, have a sequence of several irregularly spaced and angled blunt, square-edged blades designed to hook the root systems of invasive plants and pull them from the soil. The width and shape of these blades are consistent with the dimensions and shape of the linear defects observed, particularly those on the lumbar vertebrae. The irregular patterning of the linear defects may be ascribed to the irregular arrangements of the blades on this machine. However, the absence of any holes on the clothing accompanying the remains casts doubt on this scenario, unless the cut bones were already exposed on the surface due to taphonomic scattering processes. Similarly, it is not possible to rule out these linear defects from being caused by another edged instrument, such as a shovel. Or postmortem damage caused by impact with digging instruments (e.g. shovels, picks, or hoes) during burial or excavation is well-known (e.g. [30]). However, in this case, the uniformity of colouration of the bones and the impacted soil suggest that their presence predate recovery. Therefore, it occurred post skeletonisation, but prior to discovery.

## 2.3. Botanical evidence

The remains were encased in clothing penetrated by a plant (reed) that had grown through the body and clothing, producing holes in the clothing upon removal (Fig. 1A, B). Species identification is a well-established method to facilitate estimation of the postmortem interval [31]. In this case, the remains must have been deposited prior to the plant's growth, therefore, analysing the botanical remains would provide an approximate minimum PMI estimate. We consulted with a botanist who identified the reeds as the indigenous (but invasive) com-



**Fig. 4.** Linear defects to a lumbar vertebral body. **A:** Macroscopic image **B:** An anterior microscopic view at 12.5x magnification highlights the shape and depth of the groove at the distal (top) and proximal (bottom) ends. **C:** A superior microscopic view at 10x magnification with the inferior (top) and superior (bottom) aspects in focus highlights the bone polishing at the distal shallow end of the groove.

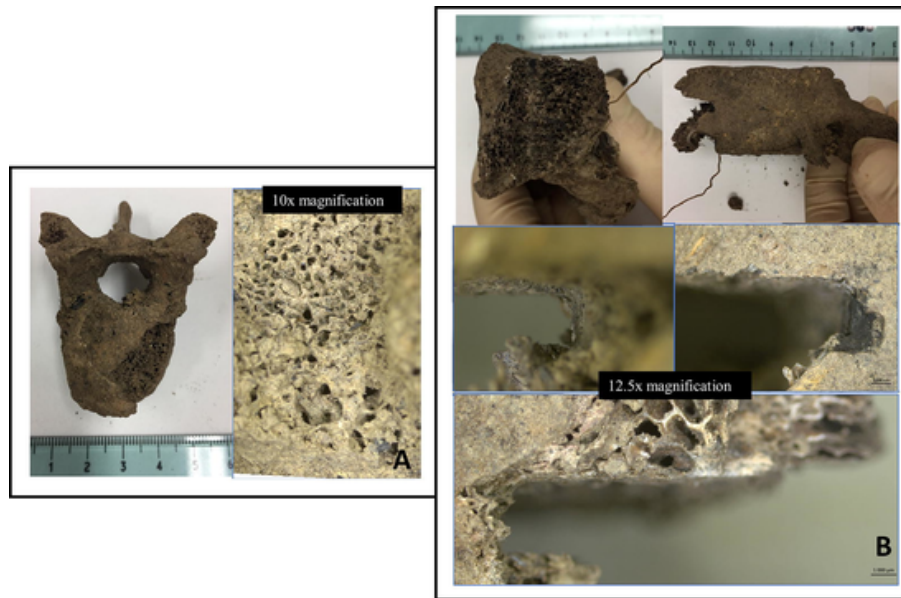
mon reed *Phragmites australis* (Fig. 1C). Cape Town experiences a hot, dry summer and is prone to wildfires, which are closely monitored and mapped. With the known date of the last wildfire and the reed's growth rate, these data combined may be used by the police to narrow the range of the postmortem interval estimate. Accordingly, we made this recommendation in our final report, though it is not clear whether this was followed up.

The extent of speculation regarding the cause of the interesting postmortem linear defects in this case, and our inability to resolve it to a single probable cause, is common in forensic anthropology. Lacking the benefit of attendance at the death scene and assisting with the recovery of the remains limited our access to relevant discipline-specific contextual information, which may have helped answer our questions more conclusively. Formal inclusion of forensic anthropological expertise at

all stages of the investigation of relevant cases may help provide useful information and investigative leads, which may otherwise be missed without the lens imparted by specialist forensic anthropological training.

### 3. Discussion and conclusions

The scope of forensic anthropology has evolved in considerable breadth and complexity [14]. The holistic approach with knowledge from diverse disciplines of study may prove advantageous, especially where investigative resources are limited, as in South Africa. The authors' combined knowledge and experience from biological anthropology, bioarchaeology, palaeoanthropology, botany, ecology, zoology, and pathology enabled a clearer understanding of the presented case



**Fig. 5.** Linear defects to a thoracic vertebral body. **A:** Shows colour consistency and presence of sand crystals within the trabecular bone and absence of healing. Signs they occurred postmortem, but not as a result of recovery. **B:** Linear defects on the lateral aspect of lumbar vertebra showing partial polishing through crushing of the trabecular bone at the base of the groove (top left), and the square-shaped base of the groove with straight sides at 0x and 10x magnification.

from muddled circumstances. Deductive reasoning and processes of the interdisciplinary collaboration facilitated attribution of the linear defects as postmortem processes. These analyses improved the understanding of the circumstances around death, and thus, chances for identification. This case highlights the important holistic approach of forensic anthropology and the value of converging interdisciplinary knowledge. Its presentation here will hopefully also stimulate more interdisciplinary collaboration in medico-legal death investigations and encourage practitioners to continuously pursue skill development and diversification. However, of more importance, the case illustrated the limitations in the role of a forensic anthropologist in case work within South Africa, and the investigative process for identification. The full impact of the discipline on this case resolution was inhibited and underutilised, despite the active role the forensic anthropologists undertook. For a variety of reasons including lack of formal recognition in medico-legal death investigations, late consultation, poor communication, and territoriality among stakeholders. The presentation of this case raises further discussion and reinforces the need, for a nationally recognised framework for the practice of forensic anthropology within South Africa.

Formalisation of forensic anthropology would facilitate a collaborative response among stakeholders (including South African Police Service and Forensic Pathology Services) to improve forensic identification. This has been advocated for by Steyn et al. [33] and others [3, 7–10]. Since the early 2000's there has been an expansion of higher education, formal programmes dedicated to the training, development, and research for forensic anthropology in South Africa [5,12]. Programmes have increasing enrolments per annum and have resulted in a plethora of research to improve local medico-legal death investigation practice. Despite this, and since it is not formally endorsed or funded, the inclusion of forensic anthropology in medico-legal death investigations is adhoc and based on discretionary inclusion. There are also no national standards of practice in the country, unlike the American Academy of Forensic Sciences [32]. Until formalisation is achieved, territoriality and poor communication will continue to prevent the full potential and realisation of the impact of forensic anthropology in case resolution. The absence of structure also limits career opportunities for well trained and experienced experts, who often leave South Africa contributing to loss of local expertise. As illustrated in the introduction, the burden of death and high caseloads in South Africa would result in job

creation, we predict there is potential for ten forensic anthropologists within South African Forensic Pathology Services alone. An advantage of this would be a reduction of the work and case load burden on individual forensic pathologists - a position in critical shortage. Additionally, in accordance with Daubert standards the formal recognition of the discipline, would force the development of nationally adhered to standard operating procedures and would provide an avenue for inclusion of these data and information into the judicial system. Formal recognition would create the requirement for forensic anthropology to occur within Forensic Pathology Services.

Academically the status of forensic anthropology is well established, however, those in the higher education sector are limited with respect to their capacity of time to assist in casework [10], and the State allocates a limited budget for specialist analyses by external experts. Despite these limitations, local research initiatives have been implemented. For example, the Western Cape Cold Case Consortium (W4C), an interdisciplinary team of expert research-practitioners based in academic institutions in the Western Cape that are committed to the application of scientific and visual analysis in cases of the unidentified deceased. International and non-governmental organisations such as, Pink Ladies and the International Committee of Red Cross Africa, make important contributions to case outcomes in South Africa, they focus on identification as a human right aiming to provide closure for both the deceased and the living. Research-based initiatives like W4C and others like the DNA project (<https://dnaproject.co.za/press>) can identify solutions to gaps and problems and organisations can lobby for improved practice, and to government for policy change. Ultimately, implementation requires government recognition on the value of forensic anthropology in medico-legal investigations. “The state must therefore acknowledge that the crisis it faces concerning unclaimed bodies is a consequence of its inability to fulfil the rights of previously disadvantaged people” [7: pp 48]. With an appeal to the Republic of South Africa, our numbers of unidentified deceased are at a critical scale, to the point of a humanitarian crisis. How we treat the dead, burying those unidentified *en masse*, reflects the ill-health of our society and country. There is local capacity, willingness, and expertise to provide solutions, but without government support in the form of recognition and policy, our impact as forensic anthropologists will continue to be limited, minor and consist of untapped potential.

## 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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