



Human Decedent Identification Unit: identifying the deceased at a South African medico-legal mortuary

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Abstract

The Johannesburg Forensic Pathology Services medico-legal mortuary perform postmortem examinations on all cases of unnatural deaths in the greater Johannesburg metropolitan area, in South Africa. Unidentified decedents can comprise up to 10.0% of the total number of annual admissions at this medico-legal mortuary. To address the identification of the deceased, the Human Decedent Identification Unit (ID Unit) was created to perform secondary examinations for identification purposes. The aim of this study was to report on the identification methods and success rate of the ID Unit. Over a period of 31 months (January 2018–July 2020), unidentified decedents comprised 8.1% ($n=693$) of all cases at the Johannesburg mortuary. The ID Unit processed 385 (55.6%) unidentified individuals during this period, who were mostly adult (100%), Black (94.5%), males (91.7%). DNA samples were successfully collected from most cases in the form of hair (96.4%; $n=371$), blood (92.2%; $n=355$), and nail samples (90.1%; $n=347$). Fingerprints retrieved in 65.5% of cases ($n=252$). Ultimately, 87 persons (22.6%) were positively identified. Fingerprinting was the most successful method of identification (98.9% of cases; $n=86$). One positive identification was facilitated through DNA analysis. The nationalities of the positively identified decedents were from South Africa (52.9%; $n=46$), Zimbabwe (5.7%), Uganda (1.1%), Mozambique (1.1%), Malawi (1.1%), South Sudan (1.1%), and undisclosed in 36.8% of cases. Through the collaborative efforts of all the agencies involved, the impact of the work of this ID Unit is vast—not only for South African authorities but most importantly for the decedents and their families.

Keywords Identification · Migrant · South Africa · Humanitarian · Mortuary

Introduction

The Forensic Pathology Services (FPS) is legally mandated to perform postmortem investigations of all cases of unnatural death in South Africa [1–3]. An unnatural death is legally defined as any death due to unnatural causes as contemplated in the Inquests Act 1959 (Act No. 58 of 1959) [3], which includes any death due to physical or chemical influence, death as a result of an act of commission or omission, procedure-related deaths and any death which is sudden and unexpected, or unexplained, or where the cause of death is not apparent.

South Africa's most populated province is Gauteng, which has an estimated population of over 12 million [5].

The province is serviced by 11 FPS medico-legal mortuaries, which are divided into two clusters. The Northern Cluster is comprised of three FPS facilities, and the Southern Cluster is comprised of eight FPS facilities. In the 2006–2020 period, these two clusters investigated an average of 15,702.5 cases of unnatural deaths per annum. The Southern Cluster processed approximately $\pm 17.5\%$ of all unnatural forensic postmortem investigations in South Africa. The most recent available statistics provided by to the authors by the FPS indicate that the eight Southern Cluster facilities performed 183,783 postmortem investigations between the years 2006 and 2020, which constitutes 78% of all unnatural deaths in Gauteng.

The Southern Cluster FPS mortuaries are associated with the University of the Witwatersrand's (Wits) Department of Forensic Medicine and Pathology. The academic seat of the department and the Southern Cluster is located at the Johannesburg FPS medico-legal mortuary, which services the greater Johannesburg area. The city of Johannesburg has a population of 4.9 million [6], making it South Africa's

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largest and most populous city. Consequently, the Johannesburg FPS Medico-legal Laboratory is one of the largest and busiest FPS facilities in South Africa. The Johannesburg FPS performed 42,681 postmortem investigations between the years 2006 and 2020, averaging 2845.4 cases per annum.

The city of Johannesburg houses a large migrant population; drawn from remote national and foreign regions, largely the result of the perceived notion that the city provides many economic opportunities [7]. Many of these migrants are not documented. Undocumented migrants include individuals who have entered the country through irregular means without the required, official documentation established by the country for entry, habitation, and economic activity in the country. The exact number of undocumented migrants in South Africa is unknown; however, estimates range between 2 and 5 million [8]. This affects the service delivery of the FPS because the bodies of undocumented migrants remain unidentified and unclaimed. The Johannesburg FPS mortuary constantly receives a disproportionately large number of unidentified cases relative to the other Gauteng facilities. In 2016, the Johannesburg FPS investigated 3106 cases of unnatural death, of which 319 cases were not identified—constituting 10.3% of the Johannesburg cases—a trend that has remains relatively consistent.

South African legislation [3] and regulations [2] direct that the inquest into unnatural deaths by the Forensic Pathology Services not only determine and record the cause of death but that the FPS must also assist in the process of identification of the deceased person. The Regulations [2] outline that at admission of a body, a clear photograph of the face of the deceased must be taken. Visual identification is the most common method of identification. The deceased may be visually identified by a spouse, partner, major child, parent, guardian, major brother, major sister, caregiver, or any person with personal knowledge of the deceased. Visual identification is considered an acceptable method of identification and is the most commonly used method internationally [9–11]. This is due to the pragmatic and time-saving benefits of visual identification. If a decedent has not been identified within 7 days, the body must be moved to a freezer after a set of fingerprints have been taken (Fig. 1). The fingerprints are compared to those recorded in the Home Affairs National Identification System (HANIS) (which are added to the system when individuals receive their identity document from the age of 16 years), and when this is unsuccessful, the prints are compared to the electronic SAPS's criminal fingerprint database using the automated fingerprint identification system (AFIS).

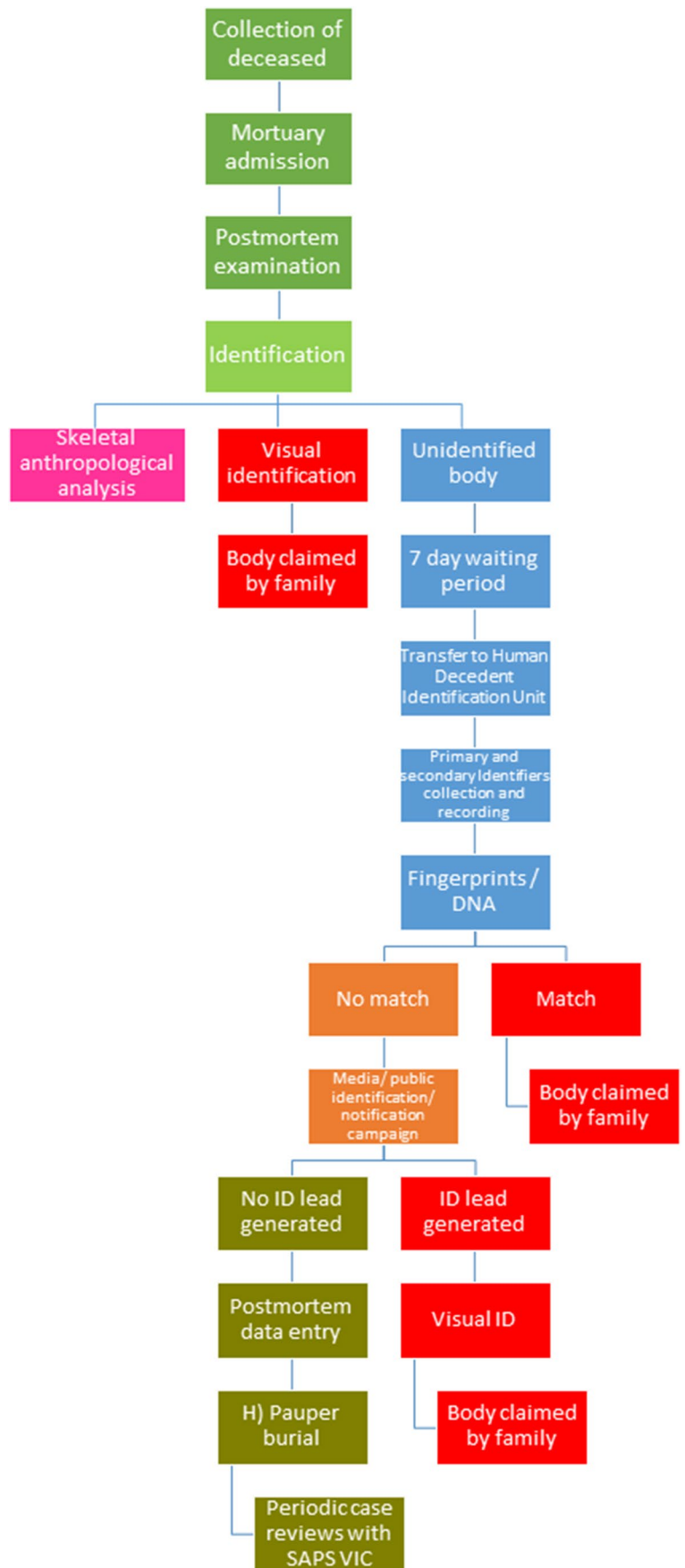
Where visual identification is not possible, such as in cases where there is trauma to the face and body or no presumptive identification is possible, and/or fingerprint identification is unsuccessful, other means of identification must be instituted [2]. Although the identification process

is the responsibility of the South African Police Services (SAPS), the identification process must be facilitated by the FPS who is the custodian of the bodies [2]. These methods may be instituted by the authorized medical practitioner, who is defined as including, but not limited to, forensic pathology officers, forensic pathology specialist investigators, scientists, and or any other person appointed in the Forensic Pathology Service to work in a support capacity in a medico-legal mortuary or designated Forensic Pathology Service facility. Prescribed methods of identification include dental and radiological examinations and DNA samples which are submitted to the South African Police Services Forensic Science Laboratory for analysis [12]. INTERPOL has determined that the most reliable methods of identification, termed primary identifiers, include friction ridge analysis (fingerprints), comparative dental analysis, and DNA analysis [13]. Secondary means of identification, termed secondary identifiers, serve to support primary identifiers. Secondary identifiers include demographic descriptions, tattoos, property, and clothing recovered on the body [13]. Primary methods of identification are accepted on their own for a positive identification; however, these are not always available (such as in severely decomposed cases and partial remains) [12, 13] (Fig. 1). Secondary identifiers can be used for identification purposes if primary identifiers are not available. Ideally, a combination of primary and secondary identifiers is used to make a positive identification when numerous identifiers are available [13].

If the decedent remains unidentified for 30 days and all prescribed methods of identification have been followed, the local authority (municipality) arranges for the state-sponsored burial of the decedent [1]. Unfortunately, this process is not always implemented according to the mandated timeframes and can be drawn out over months or even years [14] (Fig. 1). The decedent's level of decomposition determines which identification processes are employed. Skeletonized remains are referred for forensic anthropological analysis by the Human Variation and Identification Research Unit (HVIRU) in the Wits School of Anatomical Sciences. Decedents that are not yet in the advanced stages of decomposition are referred to the Human Decedent Identification Unit (ID Unit) for analysis. The purpose of the present article is to describe the creation and processes of the ID Unit.

The ID Unit was created in 2016 to help better address the growing issue of unidentified decedents in Johannesburg. This unit was created as a humanitarian effort to support the FPS and SAPS in the identification of the unidentified deceased. The unit's standard operating procedures and documentation were developed in a working group that involved the Forensic Pathology Services, University of the Witwatersrand, and University of Amsterdam. The postmortem data collection forms were adapted from the INTERPOL DVI postmortem Form for Unidentified Human Remains

Fig. 1 Workflow of identification processes at the Johannesburg Forensic Pathology Services



(“pink form”) [13]. The ID Unit currently runs as a collaborative effort between the Wits Department of Forensic Pathology Services, the Gauteng Southern Cluster Forensic Pathology Services, the International Committee of the Red Cross (as part of their Missing and Deceased Migrant Pilot Project), and the Victim Identification Centre (VIC) of the SAPS. The unit is a pilot program, which aims to expand in the future to other FPS facilities in South Africa and Africa.

Although the primary aim of the ID Unit is to perform secondary postmortem examinations for identification purposes, a secondary aim of the ID Unit is to provide practical training to postgraduate forensic students in the collection and recording of primary and secondary identifiers from unidentified decedents. The unit includes academic and technical staff of the Wits Department of Forensic Medicine and Pathology (including forensic anthropologists, forensic entomologists, and a forensic photographer) and their postgraduate students. The unit is supported by the forensic pathologists, medical officers, and forensic pathology officers of the Johannesburg FPS.

Bodies that have not been identified 7 days after admission to the JHB FPS mortuary and/or cases whose fingerprints, which were taken at admission, came back with inconclusive results are referred to the ID Unit for further processing (Fig. 1). Each body is first scanned using a LODOX StatScan X-ray machine to identify any internal features that could facilitate identification (e.g., healed fractures, surgical interventions or implants, etc.). Photographs of the body are taken, which includes the full body, upper body, lower body, facial profiles (profile and portrait), and the teeth. An external examination of the body is performed, whereby potential identification features are described, recorded, and photographed, including the individual’s height, weight, demographics, hair, scars, tattoos, and skin markings. DNA samples are collected in the forms of femoral blood, toenail, and pubic hair samples. Additional fingerprints are taken regardless of if fingerprints were already taken at admission or during the initial postmortem investigation because fingerprints taken at autopsy sometimes fail because of decomposition or poor-quality prints. The ID Unit employs additional fingerprinting methods not employed during autopsy, including degloving of the skin [14], photography of desiccated finger pads [15], and the use of rehydration and tissue filler techniques [16]. Basic odontological descriptions are recorded and photographed. These include simple descriptions of dental features that a family member might report (such as cosmetic modifications, gaps, missing teeth, and rotated teeth). There is no practicing forensic odontologist in South Africa due to the lack of dental records and the low socio-economic status of most citizens who do not have dental work and rely on traditional herbal remedies. For this reason, only simple dental descriptions and photographs are recorded. All clothing and

personal effects are also photographed and recorded. Digital copies of the photographs and the JHB PM ID forms, including copies of the case file forms (SAPS 180/death scene form and autopsy report), and the DNA samples are collected by the SAPS VIC for processing (Fig. 1).

Publications on the identification of the deceased in South Africa, within a medico-legal context, are lacking. One published study has provided a general overview of the unidentified cases in Cape Town, South Africa [17]. The present study aimed to provide an overview of the unidentified cases at the Johannesburg Forensic Pathology Services medico-legal mortuary and report on the success rate of the positive identifications made subsequent to processing through the ID Unit. This allows for the analysis and review of the identification methods used by the ID Unit. It will allow for comparison to other foreign identification units and facilitate discussion on the feasibility of identification methods used in different national and foreign contexts.

Methods

The records of the ID Unit were reviewed for a 31-month period from January 2018 to July 2020. Descriptive data was collected from the records including the demographics of the decedents, the type and frequency of fingerprint, and other identifiers collected (blood, hair, and nail). The frequency of positive identifications, their method of identification, and their nationality were recorded. Descriptive statistics were used to compare the data. Approval for the study was granted by the Human Research Ethics Committee – Medical (clearance number: M210235).

Results

Over the 31-month period between January 2018 and July 2020, 8560 cases of unnatural death were received at the Johannesburg FPS ($\bar{x} = 276$ cases per month). Unidentified individuals constituted 8.1% of all cases ($n = 693$; $\bar{x} = 22.4$ unidentified cases per month). The ID Unit processed 55.6% ($n = 385$) of all unidentified cases (Table 1).

The demographics of the 385 cases processed by the ID Unit were comprised mostly of adult (100%; $n = 385$), Black (94.5%; $n = 364$), males (91.7%; $n = 353$) (Table 1). Samples for DNA analysis were successfully collected from most cases in the form of hair (96.4%; $n = 371$), blood (92.2%; $n = 355$), and nail samples (90.1%; $n = 347$). Fingerprints were successfully collected in 65.5% of cases ($n = 252$) (Table 1).

Positive identifications (at the time of writing this article) were subsequently made in 87 cases (22.6% of cases processed by the ID Unit), with 77.4% ($n = 298$) of cases

Table 1 An overview of unidentified cases submitted to the Johannesburg Forensic Pathology Services medico-legal mortuary and processed by the Johannesburg Identification Unit (JHB ID Unit) from January 2018 to June 2020

Year	Total unnatural cases	Total unidentified cases	Total ID Unit processed	Identified by JHB ID Unit	Demographics					Samples						
					Race					Sex		Blood	Fingerprints	Nail	Hair	
					Black	White	Asian	Colored	Unknown	Male	Female					Unknown
2018 (Jan–Dec)	3348	279	116	51	111	0	0	1	4	106	10	0	100	103	115	114
2019 (Jan–Dec)	3550	296	202	32	187	11	2	1	1	181	19	2	188	121	174	193
2020 (Jan–Jun)	1662	118	67	4	66	1	0	0	0	66	1	0	67	28	58	64
Total	8560	693	385	87	364	12	2	2	5	353	30	2	355	252	347	371
% of total	/	8.1	/	/	/	/	/	/	/	/	/	/	/	/	/	/
% of unknown	/	/	55.6	/	/	/	/	/	/	/	/	/	/	/	/	/
% of processed cases	/	/	/	22.6	94.5	3.1	0.5	0.5	1.3	91.7	7.8	0.5	92.2	65.5	90.1	96.4

remaining unidentified at the time of publication of this study. The most successful method of identification was through fingerprinting (98.9% of cases; $n = 86$). A single positive identification was facilitated through DNA analysis (1.1%; $n = 1$) (Table 2). The nationalities of the positively identified decedents were confirmed to be from South Africa (52.9%; $n = 46$), Zimbabwe (5.7%), Uganda (1.1%), Mozambique (1.1%), Malawi (1.1%), South Sudan (1.1%), and undisclosed in 36.8% of cases (Table 2).

Discussion

Unidentified decedents constituted 8.1% of all cases received at the Johannesburg FPS and have in the past reached as high as 10% of all cases. This is similar to that reported at the Salt River Mortuary in Cape Town (9.2%) [17]. A similar trend has been reported internationally, such as in Australia’s Victorian Institute of Forensic Medicine who reported that 9% of their cases require primary and secondary methods of identification, since visual identification was not possible [9]. The Department of Forensic Medicine and Pathology (University Hospital R. Poincaré, Garches, France), who performs forensic autopsies of the west area of Paris, reported 9.1% of their cases as unidentified or of “dubious identity” [18]. These rates are higher than that reported in other international regions such as Milan (3.1%) and Fulton County (Georgia, USA), which recorded a rate of 44 unidentified decedents per 1000 deaths reported [11]. The unidentified cases at each of these facilities is likely a reflection of the population density and the population dynamics of their catchment areas. Despite these few publications, there is a lack of reporting on unidentified decedent rates—globally. Additionally, reviews and analyses of context-specific medico-legal identification processes also remain sparse [18, 19].

The ID Unit in Johannesburg, South Africa has facilitated the identification of 87 individuals over the stipulated research period. Were it not for the supplementary, humanitarian efforts of the ID Unit, these individuals would have remained unidentified and buried by the municipality. Most of the unidentified decedents were adult Black males. This population and sex group was disproportionately higher than the population statistics of the catchment area [5]. The unidentified cohort is most likely a representation of the migrant worker population that resides in the greater Johannesburg region. Many national and foreign migrants are drawn to the city due to the perception that there are greater opportunities and economic prospects [7]. Johannesburg houses a large migrant population with foreigners making up the majority of some Johannesburg neighborhoods [7]. A 2001 census reported that 35.2% of the Johannesburg population were South African internal migrants born outside of the Gauteng province, with 6.7% of the population were foreign migrants

Table 2 An overview of cases identified by the Johannesburg Identification Unit (JHB ID Unit) from January 2018 to June 2020

Year	Nationality							Method of ID	
	South Africa	Uganda	Zimbabwe	Malawi	Undisclosed	Mozambique	South Sudan	Fingerprints	DNA
2018 (Jan–Dec)	24	1	4	1	21	0	0	51	0
2019 (Jan–Dec)	19	0	1	0	11	1	0	31	1
2020 (Jan–Jun)	3	0	0	0	0	0	1	4	0
Total	46	1	5	1	32	1	1	86	1
% of processed cases	52.9	1.1	5.7	1.1	36.8	1.1	1.1	98.9	1.1

[20]. Unfortunately, this census is outdated and may not reflect the current migrant population and the census cannot account for the number of undocumented migrants. It is estimated that South Africa has between 2 and 5 million undocumented migrants; however, the exact number is unknown [8]. Cross-border migrants, refugees, and asylum seekers are more likely to be male [21]. These individuals often travel before their families to establish themselves before the family joins them [21]. This could also account for why females were underrepresented in the unidentified decedent cohort [5, 21]. The other population groups categorized by the South African government—White, Asian (includes Indian), and Colored populations—are also underrepresented in the unidentified decedent cohort [5]. This is likely a result of socio-economic status. Census data suggests that the incomes and living conditions of documented cross-border migrants are similar to South Africans; however, undocumented migrants are often more vulnerable and poorer [21]. Their lower socioeconomic status potentially increases their vulnerability to death by unnatural causes and certainly increases, if not guarantees, their chance of not being identified.

Most cases (77.4%) were not positively identified by their fingerprints, which strongly suggests that they are undocumented migrants, further highlighting the vulnerability of the undocumented migrant community [20]. A large proportion (48%) of the subsequently identified decedents in this study were documented foreign nationals originating from countries that historically and presently continue to migrate to South Africa either permanently or temporarily in large numbers [22–24]. Fingerprinting was the most successful method of identification—in all cases except one. The greatest obstacles to taking complete fingerprints, and subsequently the identification of the remains, include severe desiccation of the fingertips and scavenging of the fingers by vertebrate animals [25–28].

This study highlights the limitations of DNA analysis as a means of identifying unidentified decedents in South Africa. A presumptive identity is necessary for the deceased's DNA to be compared to possible biological relatives. DNA was used to identify a decedent in only one case in this sample. This emphasizes the rare occurrence

of this in the South African context. The case involved an unidentified elderly female. The investigating officer registered her as a missing person and regularly checked unidentified female bodies at hospitals and morgues. Based on her last known location and the clothing worn at the time she was last seen alive; a presumptive identification was made when compared to the data collected by the ID Unit. DNA was matched to her daughter. Successful DNA analysis for identification of the deceased is not common in the ID Unit due to the large migrant population (local and international migrants) in Johannesburg. DNA analysis relies on presumptive identifications, which is not always possible because the deceased's family is unaware of their location and the lack of regular communication between the parties. However, there is a positive outcome to collecting DNA samples. Matrices for DNA analysis were successfully collected from all cases in the form of hair (96.4%), blood (92.2%), and/or nail samples (90.1%). Currently, the VIC analyzes these samples and stores an electronic profile of each DNA sample in a database. When a presumptive identification is made, the SAPS will compare the potential family member's DNA to the digital profile or, with the acquiescence of the SAPS, the digital DNA profile can be provided to a private laboratory for comparison (at the request and cost of the possible family), which speeds up the identification process. As part of their Missing and Deceased Migrant Pilot Project, the ICRC is interviewing family members of migrants who have gone missing and collecting antemortem data. In the event that their antemortem data matches the postmortem data recorded by the ID Unit, the DNA samples could be employed for analysis.

The main limitation of the ID Unit is that it is structured as a supplementary service that assists the Johannesburg FPS in the identification of decedents, in addition to the fingerprinting and visual identification processes already employed at the medico-legal mortuary. The average turnaround time for primary identifier processing is approximately 3 to 6 months. The lag in processing is due to administrative steps required for the samples to be handed over to the VIC and then incorporated into the SAPS system and then processed. Since this laboratory also processes police

evidence and is one of the busiest forensic science laboratory systems in the country, there is very high pressure on their systems.

The ID Unit team is staffed and run by forensic science academic and technical staff and postgraduate students from the Wits Department of Forensic Medicine and Pathology. As a result, the time afforded to the ID Unit to function depends on the availability of the staff and students and the accessibility to the decedents and facilities afforded by the Johannesburg Forensic Pathology Services' mortuary manager and forensic pathology officers. This is why only 55.6% of unidentified decedents were processed by the ID Unit. Since the ID Unit is a pilot project, such limitations are important to highlight on review when the project is rolled out to other FPS facilities in South Africa. Ideally, the processes of the ID Unit will, in the future, be absorbed into the standard protocols of the FPS. This will increase the positive identification rates and the number of cases that are duly processed.

Since the ID Unit is an ongoing pilot project, the standard operating procedures (SOPs) are under constant review and modification. An annual review of the SOP and documentation is required to ensure that the processes are up to date, modified according to present procedures of the collaborating entities. Presently the processes that are being refined include the fingerprinting processes (since they are currently the most successful process of identification), the regularity of ID Unit sessions (impacted by the COVID-19 pandemic and the availability of postgraduate student participation) and the potential future linking of the data collected by the ID Unit directly to the SAPS Missing Persons database. This pilot project also aims to expand to other FPS facilities in South Africa and then to other countries in Africa, such as Zimbabwe.

In addition to the regular processes of the ID Unit, the unit also hosts annual training workshops. The aim of the workshop is to improve the identification processes at the various Forensic Pathology Services medico-legal mortuaries in South Africa. These workshops have been held since 2016. To date, the workshops have trained 115 individuals who are involved with the identification of deceased. This includes 38 forensic pathology officers stationed at 38 Forensic Pathology Services medico-legal mortuaries in four South African provinces (Gauteng, Kwa-Zulu Natal, Free State, and the Western Cape), 61 postgraduate forensic science students from five South African universities and 16 forensic scientists from South Africa, Nigeria, and Canada. Previous workshop presenters include African forensic specialists and international forensic specialists who present on their contexts in Canada, the United Kingdom, and France. This provides attendees with current and international standards and has facilitated international collaborations on active forensic cases who are unidentified.

Conclusion

The ID Unit is a unique supplementary service, which acts as a humanitarian collaborative effort between police, forensic pathology services, university and humanitarian aid organizations who all have a mandate and role in the identification of the deceased. The ID Unit provides a unique nexus between these organizations which facilitates the sharing of vital information that assists in the identification of the deceased in Johannesburg. The ID Unit also provides invaluable practical experience for postgraduate forensic science students and training for forensic practitioners in South Africa. The ID Unit has facilitated the identification of 87 individuals who would have otherwise remained unidentified and buried by the municipality. Collecting as much postmortem data, to aid in an eventual identification, ensures that unidentified decedents are treated with dignity and respect. Through the collaborative efforts of all the agencies involved, the impact of the work of this unit is vast—not only for South African authorities but most importantly for the decedents and their families. This is a vital service and pilot program that aims to expand to and be adapted by other FPS facilities in South Africa in the future.

Declarations

Conflict of interest The authors declare no competing interests.

Research involving human participants and/or animals The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed consent Not applicable.

Ethics approval The study was approved by the University of the Witwatersrand Human Research Ethics Committee (Medical) (clearance number: M210235).

Disclaimers The authors conceived this study, and performed the data collection, analysis and interpretation, and the writing of this article. The manuscript, data, figures, and tables have not been previously published and are not under consideration elsewhere.

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