ORIGINAL ARTICLE

Twenty-five years of unidentified bodies: an account from Milano, Italy

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Abstract

The identification of decedents has always been a central issue in forensic pathology, for ethical, criminal, and administrative reasons, but today, it needs more attention due to issues related not only to migration but also to the weakening of family ties. This article presents a descriptive study discussing the Italian regulatory situation developed in the last decade to face the many identification issues, with all its improvements and flaws. Hence, data gathered in 25 years of at the Institute of Legal Medicine of Milan and the epidemiology of unidentified decedents are illustrated. Briefly, from 1995 to 2019, the number of unidentified human remains with no identity or requesting verification of identity amounts to 726, i.e., 3% circa of all autopsies performed at the Institute, with an average of 29 individuals per year. In total, 528 (72.7%) individuals were successfully identified, 100 (13.8%) remained without an identity, and 98 (13.5%) individuals remained with suspected yet unconfirmed identities. Percentages for each identification technique are displayed, with insight into the role of forensic anthropology and odontology compared to genetics, and into the misuse of non-scientific methods allowed by Public Prosecutors. All the data is compared, as much as possible, with the very few recent studies concerning the problem worldwide. Finally, the article aims to show the Italian experience in dealing with unidentified bodies, in order to provide food for thought for other countries toward a discussion regarding a global issue which is sometimes taken for granted and underestimated.

Keywords Human identification · Missing person · Forensic pathology · Forensic genetics · Forensic anthropology

Introduction

Identification of the dead is fundamental for many reasons: criminal, civil, administrative, ethical, and most importantly for the mental health of the loved ones who "are behind" an unidentified body (who in turn was a missing person) and who may end up in the psychologically impairing limbo of ambiguous loss if the dead are not identified [1]. Despite all this and the evident advances in forensic techniques and technology, from genetics to computer sciences, this issue is frequently mismanaged and still presents several unsolved crucial points even though identification of unknown decedents [2] has taken some steps forward in the last decade in terms of political strategies. It is generally taken for granted

that the presence of national databases, particularly for DNA profiles, and the existence of agencies such as Interpol who can exchange data between countries will solve all or most issues in this sense, but this is not the case. The Italian situation is a clear example of the incapacity of national and regional systems to adequately deal with this issue, due to mismanagement of several variables, ranging from scientific to administrative and legal ones. This is why some light may be shed on an international problem from data gathered from a single country, in our case Italy.

In Italy, the situation has improved since the establishment of a special Commissioner of the Government for missing persons (Commissario straordinario del Governo per le persone scomparse) in 2007 and the law of November 14th 2012, n. 203 [3] on missing persons, whose aims are to collaborate with local, national, and international authorities for comparative studies on the subject of missing persons and unidentified corpses. The year 2007 also saw the creation of the national informative system named Ri.Sc (Ricerca scomparsi). The system aims to gather all the information on missing persons thanks to the compilation of

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Ante Mortem (AM) forms carried out by officers of judiciary police which are then crossed with the biological profile of unidentified bodies and other relevant information on the deceased obtained during autopsy and in theory destined to be inserted into postmortem (PM) forms by the pathologist, and then into the "general registry of unidentified cadavers" [4].

The collaboration among the special Commissioner, local authorities, and universities produced several protocols to manage both standard domestic situations and migration disasters [5, 6] although in the latter case, the situation is still far from being satisfactory. In 2009, Italy adhered to the Prum treaty (established in 2005 between Belgium, Germany, Luxemburg, Spain, France, Holland, and Austria, with the intent to oppose crime, terrorism, and illegal immigration) and established the DNA Data Bank, which collects DNA samples also from relatives of missing persons and from all unidentified bodies obtained during autopsies [7]. Regardless, as mentioned previously, the simple existence of a DNA database is not sufficient as sometimes the lack of AM and/or PM adequate genetic profiles calls for anthropological or odontological methods to be implemented [8], which is why the RISC system was conceived—in order to accommodate medico legal data also. Regardless, the last report drafted by the special Commissioner [9], which reviewed cases from 1974 to June 30, 2019, counts 236,656 missing persons, of which 59,044 still missing, and over 1000 unidentified bodies.

Furthermore, it should be kept in mind that in Italy as in most countries routinely, on well-preserved cadavers, scientific identification is not even performed since visual recognition on behalf of the relative is considered an adequate measure for identifying the decedent. Forensic scientists know only too well how dangerous recognition may be in certain situations; nonetheless, if the body is well preserved, if the individuals who recognize the body (usually relatives) have seen the decedent recently, and the situation is not psychologically challenging, then recognition can be considered satisfactory. If the body is compromised or if nobody can reliably recognize it, then it is mandatory to proceed to a scientific method of identification which can be fingerprint analysis, forensic odontology or anthropology, soft tissue/personal descriptors, etc. [8]. Identification through personal belongings and documents should be discouraged. Nonetheless, as will be discussed further on, this unfortunately may still happen, with tragic consequences.

The aim of this article is to present an epidemiological study on unidentified decedents that underwent autopsies at the Institute of Legal Medicine of Milan. Particular attention will be given to identification techniques and their frequency of use. The study discusses 25 years (from 1995 to 2019) of the experience in Milan in dealing with human unidentified decedents, highlighting how things have

changed in the last 10 years due to political sensibilization toward the phenomenon and the subsequent establishment of the "Commissario Straordinario per le Persone Scomparse" in 2007 while also discussing the many problems that still need to be solved.

This analysis will be preceded by a brief overview of the worldwide scenario over the past decade.

Worldwide scenario

Very few articles discussing the entity of the problem have been published in the last 10 years: publications and sources discussing the epidemiology of unidentified bodies were searched with the terms "unidentified bodies," "identification of cadavers/bodies," and "epidemiology of unidentified bodies" in Pubmed and Google Scholar (Table 1). Although the literature might not provide much data, it should be kept in mind that many countries have national protocols in place to face the problem. In the USA, the National Missing and Unidentified Persons System (NamUs) was created in 2005 to improve access to information that would help solve missing and unidentified person cases. In 2009, the system was implemented thanks to the linking of the Missing Persons database with the Unidentified database for automatic case comparisons. Later, the storage of DNA samples of unidentified deceased and missing persons' family members was added. 2012 saw the creation of the NamUs AFIS/Fingerprint unit. More recently, the system underwent a complete revision, which was concluded in 2018 with the release of NamUs 2.0. The American database reports over 600,000 missing individuals and about 4400 unidentified bodies each year. Of these approximately a thousand remain unidentified after 1 year of research (22.7%) [10]. Mulawka et al. pointed out how a uniform protocol to address unidentified human remains and missing persons, consisting of several points listed in their article published in 2010 [11], is crucial in decreasing the number of cold cases concerning identification; regardless, 22 people out of 144 unidentified decedents were, indeed, identified through a period of 10 years. Despite the progresses made in the USA, Kimmerle has highlighted how the assumption that people are always reported missing and entered into the system is faulty because a lot of people who went missing prior to the 1990s, or who come from marginalized groups, may not have been filed as missing persons cases [12].

This entire issue has obviously been exacerbated by migration. The tremendous number of undocumented deaths of immigrants at borders demonstrates the extent of this tragedy; the identification of these bodies represents in fact a huge challenge for forensic pathologists. Baker et al. [13] stated that there were 16 deaths every 10,000 migrants crossing the US-Mexico border in 2012, with an

Table 1 Publications discussing the epidemiology of unidentified bodies in the last decade and online National Database

Source's name	Authors	Journal	Year	Type of source	Nation/area
[2] Unidentified bodies and human remains: An Italian glimpse through a European problem	Cattaneo et al	*Forensic Science International*	2010	Original article	Italy (Milan)
[5] Challenges in the identification of dead migrants in the Mediterranean: The case study of the Lampedusa shipwreck of October 3rd 2013	Olivieri et al	*Forensic Science International*	2018	Original article	Mediterranean area
[6] Italy's battle to identify dead migrants	Piscitelli et al	*The Lancet*	2016	Original article	Italy (Milan)
[10] NamUs	---	---	2005	National Database	USA
[11] A uniform protocol to address unidentified human remains and missing persons	Mulawka et al	*Journal of Forensic Identification*	2010	Original article	USA (California)
[12] Practicing Forensic Anthropology: a human rights approach to the global problem of missing and unidentified persons	Kimmerle	*Annals of Anthropological Practice*	2014	Original article	USA (South Florida)
[13] Biological Affinity in Forensic Identification of Human Skeletal Remains	Edited by Berg and Ta'ala	Chapter 14: Identification of deceased unauthorized border crosser in the United States	2014	Book	USA
[14] Deaths at the borders database: evidence of deceased migrants 'bodies found along the southern external borders of the European Union	Last et al	*Journal of Ethnic And Migration Studies*	2017	Original article	Mediterranean area
[16] The past, present and future state of missing persons investigations in Australia	Ward	*Australian Journal of Forensic Sciences*	2018	Original article	Australia
[17] Unidentified bodies in forensic pathology practice in South Africa: demographic and medico-legal perspectives	Evert	Dissertation	2011	Thesis	South Africa (Pretoria)
[18] Unidentified bodies in autopsy – A disaster in disguise	Chattopadhyay et al	*Egyptian Journal of Forensic Sciences*	2013	Original article	India (Calcutta)
[19] Forensic and police identification of "X" bodies. A 6-years French experience	Cavarda et al	*Forensic Science International*	2011	Original article	France (Garches)
[23] Registro Nazionale Cadaveri Non Identificati	---	---	2007	National Database	Italy

increase in deaths in the last decade of about 600%. The Mediterranean Sea is also a scenario of many unidentified migrants' dying making it another critical area for proper identification. Although the real death toll is difficult to estimate with precision, Italy, Malta, Greece, and Spain have buried in their cemeteries over 20,000 men, women, and children who died during sea crossings, and about 60% of these victims remain unidentified [6].

To truly show the magnitude of the Mediterranean tragedy, in 2015, the Human Costs of Border Control project

published the Deaths at the Borders Database for Southern EU, an open-source "evidence based" group of individualized information on people who have died border deaths between 1990 and 2013. It is the first database on border deaths in the EU based on official international sources as opposed to the news outlets that provide official centralized data. Centralization of data grants a quick and precise consultation, which is a great help when it comes to identification and family notification [14].

Besides the USA, other countries have taken notice of the situation that has been described by Ritter in 2007 [15] as a "Nation Silent Mass Disaster." In Australia, Jodie Ward [16] stated that between 2008 and 2015, an average of 38,000 Australians was reported missing each year and approximately 2% of those reported missing has not yet been located. Moreover, it was estimated that there were more than 500 cases of unidentified human remains [16].

South Africa has established the Bureau of Missing Persons that cooperates with South African Police Service (SAPS) responsible, among other services, for the search for missing persons. The Victim Identification Center (VIC), a part of SAPS, is in charge of giving an identity to all the unidentified bodies. In this country, about 3000–4000 people are declared missing every year. The Medico-Legal Laboratory in Pretoria handles almost 3000 bodies of the approximately 116,000 people that die in Gauteng each year; about 10% of these cadavers remains unidentified [17].

In India, Saurabh Chattopadhyay et al. stated that out of a total of 2,515 autopsies conducted during a 2-year period study involving the deceased in the Calcutta area, nearly one-fourth (24.5%, 614) of the above cases were unidentified at the time of postmortem examination. Subsequently, 109 (17.8%, $n = 614$) were identified within 1 week of autopsy and the remaining 505 (82.2%, $n = 614$) remained unidentified [18].

Very little is known about the epidemiology of unidentified bodies in Europe, because of the limited publications discussing the problem. In a retrospective analysis of all methods of identification and characteristics of unidentified bodies which arrived in the Department of Forensic Medicine and Pathology of the University Hospital R. Poincaré, Garches, France, during a 6-year period (2003–2009) [19], a total of 9.1% of all autopsies involved unidentified bodies (217 cases out of 2384). However, only 134 of them were included in the study; many of the cases were excluded due to a lack of data or because the remains consisted in archaeological and animal samples. Out of the selected 134 cases, 10.2% remained without identity, 0.8% of all autopsies performed in the department. No further reports treating unidentified decedents in European countries could be found in our survey although we know how the problem is

stagnant for example also in Paris [20] and in other major European cities.

Materials and method

The following method of data collection was followed by the institute of legal medicine and in particular by LABANOF (Laboratorio di Antropologia e Odontologia Forense), its forensic anthropology lab, on all bodies or human remains arriving at the Institute for judicial autopsy either with no identity (unknown) or with dubious identity (DI). This last category is composed of those remains too badly maimed to be identified or who may have ID with them but no one will show up for formal recognition and therefore they have to be identified through a scientific AM-PM comparison, as well as a more complex DI category, that of individuals who have no ID and who, in life, had been identified by the criminal system (with fingerprints for example) with false or dubious generalities.

The data gathered from postmortem examinations performed from 1995 to 2019 were closely analyzed. The information was collected as previously described in another study from our Laboratory [3] and in accordance with Interpol Guide for DVI system [21] as well as by implementing with techniques described below.

For each unidentified cadaver the following data was collected:

– sex, age, ancestry, stature, and personal identifiers/ descriptors (e.g., tattoos, scars) collected by forensic pathologists and anthropologists through external examination/autopsy/lab analyses;
– information concerning date and place of retrieval, circumstantial data, and state of decomposition;
– cause of death, obtained at necropsy;
– detailed photographs of the face and a 3D scan of the face (when a CT scan or MRI was not possible) in order to create a 3D model of facial traits to be compared with photographic or video antemortem material. This makes it possible to superimpose the PM face, for example, on the AM one regardless of whichever orientation the AM photograph was taken in;
– dental profile and chart as well as dental casts for possible superimposition with AM data (8);
– fingerprints;
– biological samples for DNA analysis (bone, tooth, muscle);
– total body x-rays and when possible a total body CT scan;
– for all identified bodies, the method that led to identification was selected among the following: genetic, anthro-

pological (from bone morphology to soft tissue personal descriptors and facial shape), odontological, fingerprinting, personal belongings, documents, recognition.

This information is then transferred into the RiSC form and sent to the Police Forensic Services and the Commissioner's Office.

Obtained data were then recorded and entered also in a digital data set and subsequently analyzed with descriptive statistics using Excel® software. Analyzed results were then grouped into frequency tables, expressed as percentages.

Results

The total number of autopsies carried out at the University Institute of Milan from 1995 to 2019 was 22,434. Among them, the number of unidentified bodies and human remains analyzed by LABANOF in 25 years amounts to 726, i.e., 3% circa of all autopsies performed, with an average of 29 individuals who underwent judicial investigations. From the analysis, it was possible to observe that 496 (68.3%) cadavers were in a good state of preservation, whereas 230 (31.7%) were poorly preserved (which includes advanced putrefaction, carbonization, saponification, mummification, facial trauma). In 528 (72.7%) unidentified individuals, the identification process was successful, in 100 (13.8%) cases, no identity was achieved, and in 98 (13.5%) individuals were classified as DI.

Regarding cadavers in a good state of preservation, 367 (73%) individuals were identified, 60 (12.1%) remained

unidentified, and 69 (13.9%) were classified as of DI (Fig. 1).

Among cadavers and human remains in a bad state of preservation, 161 (70%) individuals were identified, 40 (17.4%) remained unidentified, and 29 (12.6%) individuals were classified as DI (Fig. 2).

Briefly, during the period from 1995 to 2008, an average of 32 unidentified decedents underwent autopsy every year. Among these, 62% was identified, 17% remained unknown, and 21% was classified as DI [2]. Furthermore, analyzing the data from 2009 to 2019, the number of unidentified subjects was 239, with a mean of 21.7 individuals per year; 187 (78.2%) persons were identified, 22 (9.2%) remained unknown, and 30 (12.6%) were DI.

For well-preserved bodies, identification methods were as follows: visual identification in 286 cases (70.8%), dactyloscopy in 48 cases (11.9%), documents in 46 cases (11.4%), soft tissue characteristics in 11 cases (2.7%), personal belongings in 7 cases (1.7%), forensic odontology in 3 cases (0.7%), forensic anthropology in 2 cases (0.5%), forensic genetics in one case (0.2%) (Fig. 3).

Badly preserved bodies showed the following percentages: visual identification in 48 cases (22.4%), forensic odontology in 47 cases (22%), forensic anthropology in 31 cases (14.5%), soft tissue characteristics in 22 cases (10.3%), personal belongings in 21 cases (9.8%), dactyloscopy in 21 cases (9.8%), forensic genetics in 15 cases (7%), documents in 9 cases (4.2%) (Fig. 4).
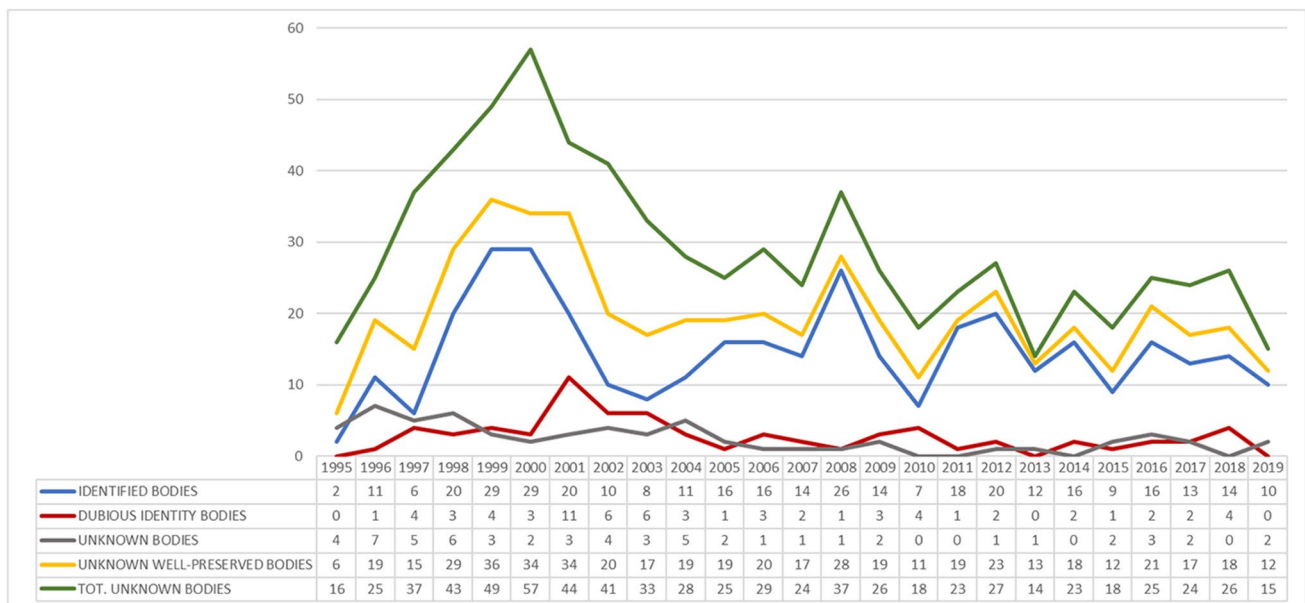

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
IDENTIFIED BODIES	2	11	6	20	29	29	20	10	8	11	16	16	14	26	14	7	18	20	12	16	9	16	13	14	10
DUBIOUS IDENTITY BODIES	0	1	4	3	4	3	11	6	6	3	1	3	2	1	3	4	1	2	0	2	1	2	2	4	0
UNKNOWN BODIES	4	7	5	6	3	2	3	4	3	5	2	1	1	1	2	0	0	1	1	0	2	3	2	0	2
UNKNOWN WELL-PRESERVED BODIES	6	19	15	29	36	34	34	20	17	19	19	20	17	28	19	11	19	23	13	18	12	21	17	18	12
TOT. UNKNOWN BODIES	16	25	37	43	49	57	44	41	33	28	25	29	24	37	26	18	23	27	14	23	18	25	24	26	15

Fig. 1 Total number of unknown bodies per year (from 1995 to 2019) and subgroup of well-preserved bodies divided into identified bodies, dubious identity bodies, and unknown bodies
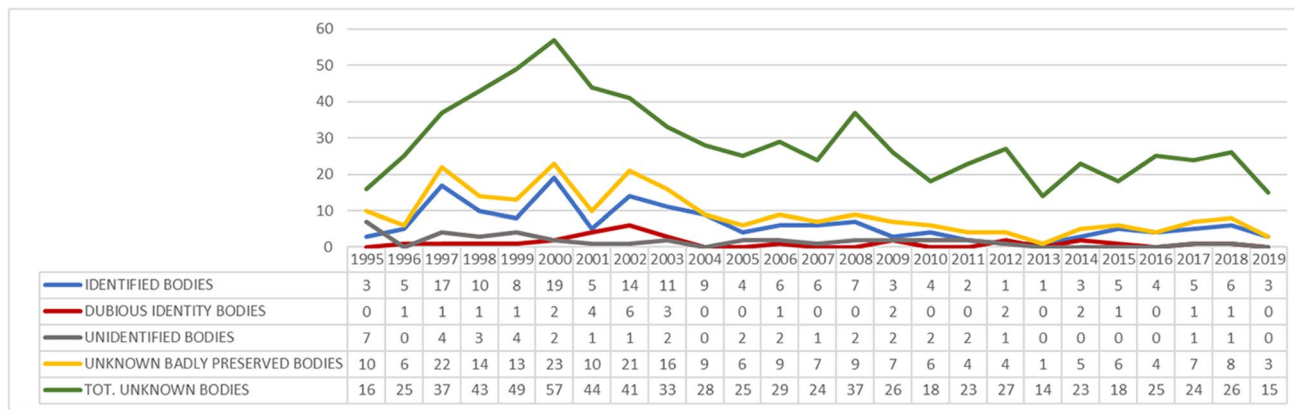
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
IDENTIFIED BODIES	3	5	17	10	8	19	5	14	11	9	4	6	6	7	3	4	2	1	1	3	5	4	5	6	3
DUBIOUS IDENTITY BODIES	0	1	1	1	1	2	4	6	3	0	0	1	0	0	2	0	0	2	0	2	1	0	1	1	0
UNIDENTIFIED BODIES	7	0	4	3	4	2	1	1	2	0	2	2	1	2	2	2	1	0	0	0	0	1	1	0	
UNKNOWN BADLY PRESERVED BODIES	10	6	22	14	13	23	10	21	16	9	6	9	7	9	7	6	4	4	1	5	6	4	7	8	3
TOT. UNKNOWN BODIES	16	25	37	43	49	57	44	41	33	28	25	29	24	37	26	18	23	27	14	23	18	25	24	26	15

Fig. 2 Total number of unknown bodies per year (from 1995 to 2019) and subgroup of badly preserved bodies divided into identified bodies, dubious identity bodies, and unknown bodies

Discussion

Identification of the deceased represents a pillar in every legal proceeding involving the death of a person [8]. In large mass disasters, the use of classical DVI "primary" methods can be inapplicable because specific AM data for comparison may not be available and/or PM data collection may not provide adequate information [22]. Furthermore, in routine single domestic cases, the scenario can be very similar since AM biological data for comparison may not be available (in case of the homeless, migrants, and all those who can be counted among the categories of missing persons such as victims

of psychiatric disease, minors, victims of crime). Consequently, in both disasters and "everyday cases," the use of as many identification methods, or even better, a thorough and varied collection of data from PM and AM sources, is mandatory to maximize chances of identification [8–22].

The present study helped gather insight on Italian unidentified decedent epidemiology. Comparing data with other countries' epidemiology is difficult due to the poor number of studies discussing the problem and to the dishomogeneity of the information found. The National Database for missing and unidentified persons "NamUs" allows Americans to evaluate the dimension of the problem at a national level. They state that out of all the autopsies

Fig. 3 Percentage of each identification technique used to identify well-preserved bodies during the period 1995–2019

IDENTIFICATION TECHNIQUES IN WELL-PRESERVED BODIES

- VISUAL ID. (n=286) — 70,8%
- DACTILOSCOPY (n=48) — 11,9%
- ANTHROPOLOGY (n=2) — 0,5%
- SOFT TISSUE (n=11) — 2,7%
- ODONTOLOGY (n=3) — 0,7%
- PERSONAL BELONGINGS (n=7) — 1,7%
- DOCUMENTS (n=46) — 11,4%
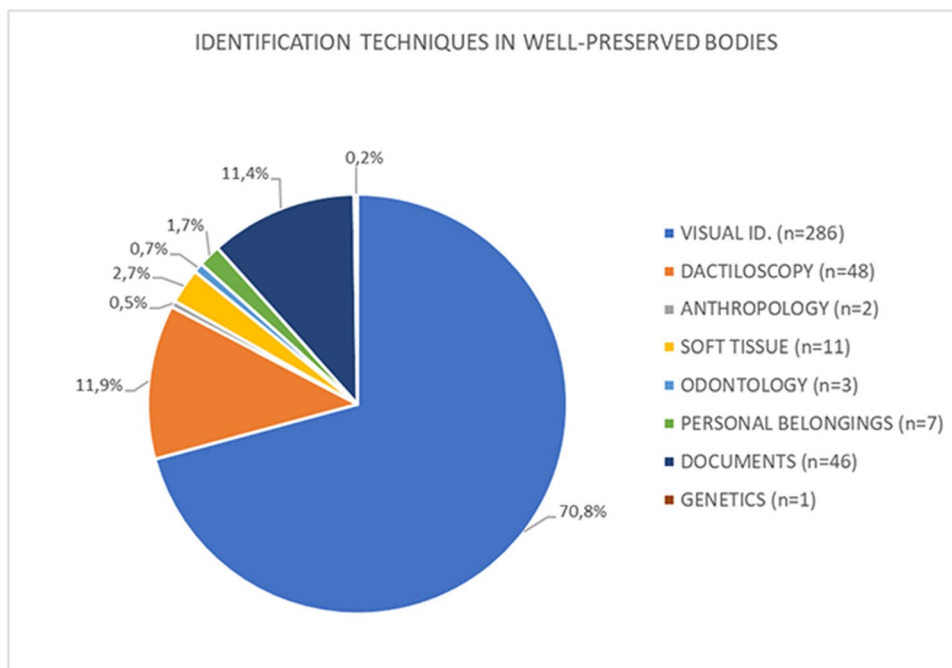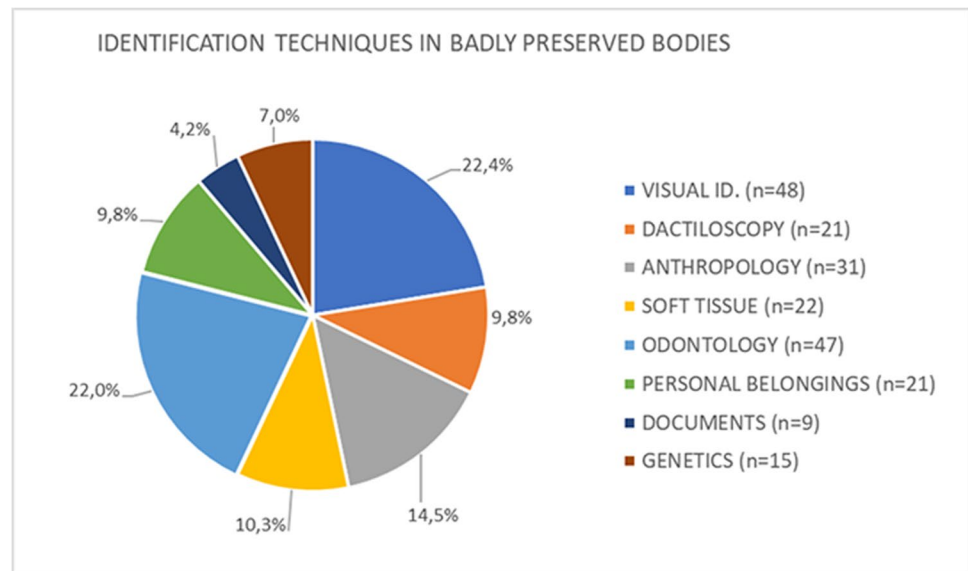- GENETICS (n=1) — 0,2%

Fig. 4 Percentage of each identification technique used to identify badly preserved bodies during the period 1995–2019

performed on unidentified bodies every year, about 22.7% remain unidentified. Despite the presence of a similar database in Italy, regardless of the national registry, a thorough system such as NamUs did not exist until few months ago when an operative research system was created, but unlike Namus, images of the dead and their personal belongings cannot be consulted by the public [23]. As pointed out by Mulawka [11] and confirmed by the Italian Commissioner of the Government in his last report [9], this could be due to the misuse of the RiSc informative system; it seems, indeed, that the AM and PM forms are not always correctly and readily implemented, and even if they are, there is a lack of comparison between missing persons and the unidentified bodies.

The Italian data show better results if compared to countries such as South Africa, where, as stated in a report [17], unidentified persons constitute 10% of all autopsies, a number 10 times larger than the Italian (northern) one. In India, almost one-fourth of all autopsies are conducted on unknown individuals, and about 80% of them remain unidentified.

On the other hand, French colleagues show better statistics in a study [19] that estimated a percentage of 10.2% of people who remained unidentified (vs Milano's 13.8%), only 0.8% of all autopsies performed in their department.

It is interesting to discuss how Milano's data has changed in the last decade if compared with the data of the 1995–2008 period, before the creation of the Commissioner's office. First of all, the mean of unidentified subjects has decreased from 32 to 21.7, with an overall 29 over the whole 25-year period. These data show a decrease of about 32.2% of people arriving at autopsy with identity issues which might be due to an increase of national sensibility and organization toward the search for missing persons. The percentage of identification success went from 62 to 78.2%,

whereas the percent of unknown individuals dropped from 17 to 9.2%, and the percentage of DIs decreased from 21 to 12.6%.

Another interesting consideration can be evaluated from the analysis of the identification methods; visual recognition seems to be the preferred method for well-preserved bodies, but it is used also for badly preserved ones, respectively with scores of 70.8% and 22.4%. This should be strongly discouraged because of its proven unreliability with a success rate of around 70–80% [24–27]. Thus, the decision of a Public Prosecutor to rely on visual recognition for the identity of individuals in those 48 cases (22.4%) in which facial features were strongly modified by postmortem processes must be not only discouraged but also condemned.

Moreover, adding the percentages of all non-biological methods, which include personal belongings and documents, a score of at least 12% for both well and badly preserved bodies can be reached; this means that 11.4% (83 cases) of all 726 unidentified bodies examined reaches a preoccupying "positive identification" with non-scientific techniques, only based on the assumption of identity that the Public Prosecutor erroneously considers enough.

The same struggle seems to be present in France since 46.4% of all unidentified bodies are identified only through police investigations, using physical recognition (direct or with photographs), personal belongings, or identity documents in close relationship with the body [19].

Forensic genetics has been considered, for its reliability and well-documented percentages of success, the gold standard; however, it would be erroneous to completely rely on this technique, since there are many cases where genetic analysis cannot be performed because of the absence of adequate antemortem biological material (or close relatives) to compare with the sample taken during

autopsy (or vice versa). Moreover, genetic analyses are far more expensive than anthropology, dactyloscopy (fingerprinting), and odontology examinations, so that the Public Prosecutor has requested them in very few cases, only 1 case (less than 1%) for well-preserved bodies and 15 cases (7%) for badly preserved ones.

Although forensic anthropology and odontology have been used few times for well-preserved bodies (respectively 2 and 3 cases), when it comes to badly preserved bodies, their contribution is indispensable, with respectively 31 cases (14.5%) and 47 cases (22%) solved.

Different percentages are shown by Cavarda et al. which state in their study [19] a higher rate of genetics (28%), at the expense of anthropology (radiology and autopsy data) which covers 6.7% of the cases. Similar percentages regarding odontology (23%) and fingerprint analysis (7.5%) are shown.

Conclusion

The study shows how the synergism between the policies introduced by the "Commissario straordinario del Governo per le persone scomparse" and all the stakeholders that have a role in the identification process (from the judicial authorities to the university departments) can grant an increase in identification success. However, there is still a consistent percentage of individuals identified with non-scientific methods. This percentage needs to be lowered by avoiding visual recognition for badly preserved bodies and by granting the freedom to pathologists to choose the identification technique that will most likely lead to a positive identification. Forensic anthropology and odontology are nowadays frequently used techniques due to their reliability and low cost, especially when forensic genetics cannot be applied.

Finally, this article aims to show the Italian management of unidentified deceased in order to internationally share the problem and initiate a discussion that might lead to an increased awareness of this worldwide phenomenon.

Declarations

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