

Experience of DVI teams with identification work in light of Interpol standards: report of the 31st Interpol International DVI Conference in Lyon.

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Abstract

Standardised identification procedures that are accepted by DVI teams from different countries enable efficient and effective exchange of information at the international level and form the basis for effective identification of victims of disasters especially those that may result in the deaths of hundreds and sometimes thousands of victims of different nationalities. The purpose of this article is to present the latest global reports on the identification of disaster victims, the organisation of identification work at the scene of a mass casualty incident, and the study of primary and secondary identification methods in the Interpol standard, based on information gathered at the 31st Interpol International DVI Conference, which took place from July 21 to 23, 2022 at the headquarters of the Interpol General Secretariat in Lyon, France.

Keywords: disaster victims identification, DVI teams, Interpol DVI standards, 31st Interpol International DVI Conference

Introduction

The process of identifying the victims of a mass casualty event is very complex, especially in situations where the number of unidentified human remains is very large and the victims are citizens of different nationalities. In the aftermath of such incidents, cooperation at the level of jointly developed algorithms for action involving standardized methods of identification at the international level is very important. A set of such uniform policies that can be used by DVI teams around the world is contained in the Disaster Victim Identification Guide issued in 1984 by Interpol (Interpol DVI Guide, 2018), which is also a unique, globally accepted standard for DVI protocols. The cyclical meetings of Interpol's DVI Working Group provide an excellent opportunity for the exchange of experiences between forensic and police experts on the identification of disaster victims from around the world and provide a basis for the development of good practices for the organisation of DVI activities. This year's 31st Interpol International DVI Conference, held from July 21 to 23, 2022 at the headquarters of the Interpol General Secretariat in Lyon, France, was mainly devoted to the latest reports on lessons learned from recent DVI incidents from different areas of the world, such as floods, aircraft crashes,

water traffic disasters and warfare. The post-conference conclusions provide a good basis for improving the process of identifying victims and using them in operations for practical use during DVI incidents.

International experience from recent DVI incidents

As practice shows, even experienced, trained DVI teams face a number of difficulties when a disaster resulting in mass casualties occurs. In this regard, conclusions formulated on the basis of summaries carried out after completed identification activities are extremely valuable, as they enable practical modifications to existing procedures and models of operation. During the 31st Interpol International DVI Conference, conclusions were presented from lessons learned after the completed identification efforts during the July 2021 floods in Germany and the water traffic disaster – the sinking of a cruise ship with Korean tourists on the Danube River in Budapest in 2018. With regard to both incidents, the main points emphasised were the great need to coordinate the activities of the various DVI teams at the level of management of individual operations, the maintenance of good communication between members of the DVI teams, the correct cyclical updating of lists of missing persons, the need to

provide psychological support both for the relatives of the victims but also for the DVI team members involved in the operations.

Based on the experience gained after the July 13–15, 2021 flood in Germany, the following conclusions are presented regarding the difficulties encountered during the body identification process:

- difficulties in coordinating activities: the mixing of the competencies of the Regional Police of Germany and the DVI group in the segregation of bodies and the impossibility, therefore, of keeping a reliable list of the missing, which should be frequently updated,
- lack of preparation for identification activities from the personnel side as a result of the occurrence of the incident during the holiday season (very low staffing of people to work as a result of vacations),
- lack of coordination in combining post-mortem (PM) and ante mortem (AM) data, as a result of which the forensic laboratory, which had DNA, odontological and dactyloscopic test results, did not have ante mortem data for comparative testing,
- large gaps in AM data due to flooding – loss of reference material as a result of the destruction of homes and the disappearance of entire families.

The scale of the flooding, which covered areas of Rhineland-Palatinate and North Rhine-Westphalia, was enormous: hundreds of deaths and injuries, collapsed homes and public places. Any difficulties in the identification process in the case of an open disaster, which includes flooding, were primarily due to the large number of people reported missing. Events over a large geographic area, caused by a natural cause such as, in this case, flooding due to heavy rains, generally involve the difficulty of accurately identifying its participants and quickly compiling a named list of victims (Hogan D.E., Burstein J.L., 2007). An inaccurate estimate of the number of people reported as missing, which was the result of errors in coordination and communication, can have negative consequences in the form of erroneous hypothesis formulation and incorrect assumption of a priori probabilities which in turn affects the final stage of combining data from different identification studies (Prieto L., et al., 2022, Vullo C.M., et al., 2021). During the floods in Germany, two innovations were introduced that had not previously been used in the process of identifying disaster victims. A new line of work was applied – fast-ID research („Fast-ID Research”). Used for the first time as AM data for comparative studies – biometric data (fingerprints) from electronic ID cards – „eID” (Tautenhahn J., 2022). The meeting of Interpol’s DVI Working Group on Forensic Genetics

also discussed aspects of identifying flood victims in Germany based on DNA testing (Carsten P., 2022). For genetic testing, identification material included muscle swabs, fingernails and ribbone fragments. DNA quality was good in most samples. Many experiments confirm the effectiveness of DNA testing performed on bone material as a source of good quality and quantity of DNA (Mundroff A.Z., et al. 2013, Hines D.Z., 2014, Antinick T.C., Foran D.R., 2019, Edson S.M., 2019). As for the reporting of genetic testing results, within the first day of operations 51% of positively completed DNA tests were reported out of all biological samples submitted for testing, the second day 21% and the third day 28%. The study’s methodology relied on conducting two PCR cycles for each sample, which was summarized as flawed because it generated a great deal of effort and time, as well as the potential for confusion due to the increased number of samples. It was requested that in the future one PCR reaction be performed for each sample. According to the recommendations of the ISFG (International Society of Forensic Genetics), the strategy of duplicating tests should take into account aspects related to the logistics of such arrangements and the circumstances of the mass event itself (Prinz M., et al., 2007). On the one hand, repeating the testing of a sample that is degraded offers the possibility of acquiring more information and the potential of assembling a complete DNA profile after several amplifications (provided that the existing rules written in the test methodology and interpretation of the results are followed). On the other hand, duplication of test results can lead to confusion in case of error at the laboratory level – when samples are swapped or samples are mislabelled.

In the case of flood victims in Germany, DNA testing identified 58% of cases, with odontology identifying 23%, based on combined testing: DNA and odontological – 10% and by means of fingerprint examinations – 9%. According to Interpol guidelines, DNA testing is, in addition to fingerprint and odontological tests (as well as serial numbers of medical implants), the primary and most reliable means of identification. Identification methods used in disasters should be scientifically sound, reliable and applicable to field conditions as well as implementable in a realistic time frame (Interpol DVI Guide, 2018). Any information that supports proper identification is invaluable and should be considered. If possible, some of these identification methods may eliminate the need for more labour-intensive and costly DNA analysis or reduce the need to reanalyse some remains (Budowle et al., 2005). In addition to the conclusions regarding the methodology for performing DNA testing, the need to keep an updated list

with DVI team members (including laboratory staff) on standby was also emphasised. This would have prevented for the future the situation that occurred in this case, namely the high absenteeism of laboratory employees resulting from the vacation break. The most important part of successfully preparing a laboratory for identification studies of victims of mass disasters is to identify specific individuals and team members who will be responsible for the various segments of DVI activities. These people must be trained, and the list with their names must be regularly updated by the relevant local or national structures. Laboratories should have a pre-developed plan in place in case they take steps toward mass identification of disaster victims that takes into account DNA extraction procedures, alternative analytical methods for the most challenging samples, automation of processes for high-throughput samples and appropriate software for analyzing test results. (National Institute of Justice, 2006). Experience from mass disasters occurring in the past two decades has shown that a predetermined strategy for handling human remains, which is a preparedness plan rather than a reaction plan, ensures relative order in a mass casualty situation (Boer H., et al., 2020).

Another conclusion after the completed DVI activities was presented by a Hungarian team of forensic scientists, who presented their experience in identification work after a water traffic disaster – the sinking of a walking ship with Korean tourists that was rammed by a larger tourist ship on the Danube River in Budapest in 2019 (Farid A., Petretei D., 2022). As a result of the collision, 26 Korean tourists and two of the ship's crew drowned. Seven people managed to survive the disaster. The identification effort involved two international DVI teams – the host country, Hungary, where the incident occurred, and a South Korean DVI team identifying citizens of their country – Korean tourists from a walking ship. The Hungarian DVI team, the vision for which was created in 2017, was to be periodically trained in DVI activities. In 2018, the first such training was conducted, and not long after, in 2019, Hungarian DVI specialists were challenged to act under real conditions that occurred on the Danube River – a cruise ship disaster. As a result of the incident, the bodies of Korean tourists were identified through fingerprint examinations. Only in two cases, where friction ridge analysis weren't possible, identification was made by odontological examination. All the bodies were found within three weeks. The bodies found last posed quite a challenge for identification due to the large decomposition of the bodies and the lack of hands. In such cases, the bodies were identified by means of dental examinations. In the case of the last victim found, identification

was applied using a combination of odontological examination and secondary methods: comparing personal effects (jewellery, clothing items) and distinctive scars on the victim's body found on the corpse with photographs of the person taken on the day of boarding the ship. In the absence of photographic documentation that corresponds to the actual image of the missing person, it is becoming increasingly common for teams from AM teams (collecting vital records) to rely on material in the form of photos and videos posted on social networks and online media (Ferguson I., Soave V., 2021, Weeber S.C., 2012). Active cooperation with the mass media provides additional opportunities to obtain information in the search for missing persons in terms of determining the appearance characteristics of the missing person and any other relevant information useful in the identification process (Solodov D., Soltyszewski I., 2022). Identification activities were divided into three phases: 1 – criminal investigation 2 – rescue operations 3 – identification operations. The numbering of human remains and personal items found on the bodies was tested in accordance with Interpol standards, unfortunately, three types of numbering were introduced during the course of operations, which hindered the identification process and was treated as a request for the future with a recommendation to correct and stick to the guidelines from Interpol's DVI guide. Proper numbering, properly maintained records and pre-established chain of custody and test results are key to a properly executed identification process (Montelius K., Lindblom B., 2012).

The Korean-Hungarian international DVI team had psychological assistance provided by four volunteer psychologists. The authors of the speech shared their impressions in the context of psychological experiences – working under political pressure and high emotions and stress. Often, those involved in disaster victim identification activities are subject to the major stressors of working under difficult physical conditions (long working hours, lack of adequate communication and data flow) and mentally and emotionally taxing (experiencing the trauma of dealing with families and relatives of disaster victims, working in a *post mortem* team) (Schuliar Y., Knudsen J.T., 2012). The aforementioned stressors can be exacerbated by the pressure felt due to expectations of completing identification as soon as possible as well as widespread media attention (Black S. et al., 2009, Muller D., 2010). On the other hand, uncertainty about the fate of the missing from those closest to them is a highly traumatizing factor and the grieving process for family members may not be complete until final identification (International Committee Red Cross, 2009, International Committee Red

Cross, 2007). The experience of many DVI teams indicates the need for psychological support and medical assistance (Byard R.W., Winskog C., 2010, Beauchier J.P., et al., 2009, Thormar SB, et al., 2010). Debriefing, a method that has been used frequently as group support for teams working on traumatic events is discussed in the literature as not necessarily effective in some cases (Deville D.J., Gist R., 2006). As of 2012 World Health Organisation has not recommended the use of debriefing (WHO recommendations, 2012), and as of 2017 American Psychological Association classifies debriefing as a potentially harmful method that has no basis in scientific findings (Society of Clinical Psychology, American Psychological Association position statement, 2017).

Following the experience presented by the Hungarian DVI team, a representative of the National Police in South Korea presented identification activities carried out in cooperation by his team. The Korean DVI team was formed in 2018 and consists of 86 specialists. It is divided into four components: 1 - forensic examination 2 - crime scene 3 - PM team (*post mortem*) 4 - AM team (*ante mortem*). Following the passenger ship disaster on the Danube River in Budapest in 2019, described above, specialists from Korea's DVI group participated in identification activities in cooperation with the Hungarian DVI team. The presentation presents fingerprint methods of identifying the victims of this disaster: 1 - use of boiling water (70-90°C) - 2-3 sec, 2 - injection of air/hot water with a syringe (with modification - taping the wrist to prevent air from escaping), 3 - the „degloving” method (which involves cutting the skin from the palm of the body and applying it to the hand/fingers of the expert for fingerprinting). In the case of using black powder - it was first applied to the finger, to which a tape was then glued, which was finally reflected on a white sheet (Kang H., 2022). In order for analysis by fingerprint to be possible, it is good practice for the PM team to secure the hands as soon as possible and then determine the best fingerprint method depending on the degree of decomposition of the corpse (Souza M. A., et al. 2022). Friction ridge analysis is considered the fastest method of identifying a corpse among the main methods recommended by Interpol (Johnson B.T., Riemen J.A.J.M., 2019).

At this year's edition of Interpol's DVI conference, in addition to reports on issues related to the identification of victims of natural or communications disasters, also raised the question of assistance in the identification of victims of warfare (Gouet A., 2022). A representative of the French Institute of Forensic Science presented activities in assisting in the identification of unknown human remains from mass graves in Bucha near

Kyiv - victims of warfare in Ukraine. In cases where a large number of deaths occur in areas of less economically developed countries, specialists from countries where the forensic investigation infrastructure is more developed often provide intervention support. The intensity and nature of the fighting conducted in the populated areas of Ukraine resulted in significant civilian and military casualties, which inevitably led to the conduct of temporary burials during the fighting or during the breaks in the attacks (Ashbridge S. I., 2022). A team of specialists from France took part in bilateral efforts with Ukraine to identify unidentified human remains exhumed from mass graves in April 2022, one month after the Bucha massacre. In the absence of developed identification standards in accordance with Interpol procedures in Ukraine (in particular, the lack of Interpol DVI identification forms), it was decided that the French and Ukrainian parties should work together at each stage and in each individual identification case. France has a Gendarmerie Unit for the Identification of Disaster Victims (UGIVC), consisting of units for odontology, fingerprints, DNA (mobile DNA laboratory), and forensic medicine, which has participated in 130 identification missions during its 30 years of operation. The unit was established by the Institute of Forensic Research of the National Gendarmerie (IRCGN). The DVI unit is available 24/7 and is called in on an ad hoc basis in case of the need for mass identifications after a disaster event (both domestically and internationally when the victims are French citizens). The group from France that was sent to Ukraine to support identification activities in Bucha, Ukraine, consisted of 26 specialists equipped with personal protective equipment (helmets, bulletproof vests), weapons, medical first aid kits supplied with tourniquets, diplomatic passports. Most identifications were made by DNA testing due to the fact that the bodies were heavily decomposed and fingerprint identification was not possible. The samples for the study were mainly long bone fragments, which enabled a throughput of 100 DNA profiles within 12 hours. During the autopsy, radiological examinations played a key role. Bullets were discovered in many of the bodies, as well as various types of shrapnel that had become lodged in the victims' bodies as a result of the hostilities. Investigations of post-explosion residues on the victims' clothing were also undertaken. The need to protect the DVI team working in very difficult conditions in a situation of open armed conflict was emphasised, not only in terms of equipping them with helmets and bulletproof vests but also with detectors for measuring radioactivity.

In addition to reports related to the experience of DVI teams in identifying victims from recent mass

incidents with large numbers of victims, the conference also addressed aspects of revisiting victim identification from many years ago. The speaker from the Finnish Medical University in Helsinki presented in his presentation the issues related to identifications carried out on the basis of DNA testing of archival material of victims of the 1939–1940 and 1941–1944 armed conflict between Finland and Russia. The war effort claimed a total of 90,000 casualties – dead soldiers. In 1992, identification work was launched to restore the memory of those killed and to honour the affected families who lost their loved ones. Operations began with a search for potential sites where the remains of those killed would be located. After finding suitable locations and exhumations, it was assessed whether the remains found could have belonged to soldiers killed during the conflict. The next step was to search for families, people related to the victims, and then take samples from them for genetic testing. The process was completed by comparing AM and PM data (DNA profiles from families and body remains were determined using aSTR, mtDNA and YSTR systems). The identification was successful with 75% positive identifications (95% of the samples were testable showing good DNA quality), thus contributing to restoring the memory of those killed and respecting the affected families who lost their loved ones (Palo J., 2022). Identifying victims from years ago is a major challenge. The development of new identification techniques makes it possible to undertake reanalysis in archival cases or opens up new perspectives for identification where it was not possible before (Daniel V., 2020, Ossowski A. et al., 2017, Ossowski A., et al. 2013, Davoren J. et al, 2007).

New tools useful in the identification of disaster victims

The cyclical meetings of Interpol's DVI Working Group are an excellent opportunity to present the latest developments in the field of identification research as well as various tools to improve the identification process of disaster victims. This edition of the conference presented the functionalities and organisation of the operation of international databases: DNA and biometric facial images. The first of the databases cited is an international DNA database centralized in Lyon, France, called „I-Familia”, which was launched in May 2021. It makes it possible to compare the DNA profiles of relatives searching for their loved ones reported as missing in one country with the DNA profiles of unidentified human remains from another country on a 24/7 basis. DNA profiles of relatives may be sent to the I-Familia central database only in cases when it is not possible to determine or obtain the DNA profile of the missing

person (e.g., from everyday items or medical samples) and when all other means of finding the person undertaken at the level of the country have been exhausted and proved unsuccessful. To increase the chances of identification using kinship determination, it is advisable to determine at least two DNA profiles from relatives in the ascending or descending parent-child line. Interpol does not accept biological samples for testing, its role is only to enter DNA profiles determined by country, search the I-Familia database, and interpret the profile matches in the database. The „Bonaparte” software is used to establish kinship. The results obtained in the form of LR – likelihood ratio are interpreted by experts from the Interpol DNA Division. Three aspects are taken into account when interpreting DNA profile matches: 1 – the likelihood ratio (LR) value, 2 – the number of relatives included in the family tree, 3 – the number of the same common DNA loci for all related DNA profiles. To determine the value of the LR threshold that determines potential relatedness between individuals, a guide was created with interpretations developed from multiple simulations on known family trees (Laurent F. et al., 2022). An Interpol-reported occurrence of a potential match between families searching for their loved ones from one country and an unidentified human remains from another country is not tantamount to identification. It is up to the member states that have sent DNA profiles to be searched in the I-Familia database to make further arrangements and exchange information leading to final identification. When a hit is recorded in the I-Familia database – information about a potential match between an unidentified human remains and a family is sent to the countries that sent DNA profiles on the case. The exchange of information is carried out by international contact points. If the identification is confirmed, the countries involved in the case are obliged to send such information to the General Secretariat of Interpol to delete the data from I-Familia. If no confirmation is sent, DNA data is stored in the I-Familia database for 5 years. Based on statistics for the past first year of the database's operation, countries that have already joined the international exchange of DNA data through I – Familia were presented. As of the time of the presentation, 8,237 potential biological matches of the family – unidentified human remains had been recorded in the database (including two hits: one between Italy and Croatia, and another within a single country). Typings are rejected when *ante mortem* and *post mortem* data are inconsistent in terms of dates, as well as when the LR value for kinship is below the designated threshold, and when there are inconsistencies in the expanded DNA profiles in additional markers submitted by countries. There is no designated minimum number of markers for

a DNA profile to qualify for a search. The need to spread information about the assumptions of the functioning and effectiveness of the I-Familia database in the aspect of searching for families and unidentified human remains in identification and missing persons cases among the new accession countries was emphasised. In order for the exchange of data through the I-Familia database to be possible and effective, the countries that would like to join such an exchange must have legislative solutions that would make such an exchange possible (Laurent F., 2022). This is because the scope of data exchange is governed by the national authority in charge of the system and by individual national laws, which determine the type of information that can be shared. Legal and ethical considerations, including issues of data privacy and confidentiality, can limit the full potential of DNA data exchange systems (Amankwaa A.O., 2020).

Interpol member countries have access to the I-Familia database. One way to enter DNA profiles is for the country to send in special colour-coded forms. These are black-coloured notes for information on the unidentified human remains and yellow-coloured notes for missing persons, which include, among other things, information on the DNA profiles of relatives. In the case of genetic data (relevant to searches of the I-Familia database), 919 DNA profiles were recorded from black notes and 454 DNA profiles from yellow notes. In comparison, the number of registered fingerprints is higher, at 1,035 (for black notes) and 1,965 (for yellow notes), respectively. As for biometric data in the form of facial images, a large disparity between the 78 images for the unidentified human remains (black notes) and the 4,580 images of missing persons (yellow notes) becomes apparent. Interpol's 160 member countries participate in the international exchange of information through yellow notes and 91 countries for black notes (Hitchin S, 2022).

In addition to the „I-Familia” international DNA database administered by INTERPOL in Lyon, described above, the conference also presented the basics of the facial recognition database. The system was launched in 2016 to complement existing DNA and fingerprint databases. There were 95,940 images stored in the facial image database at the time of the presentation and 1990 potential candidates have been detected so far. The functionalities of this database are the ability to store and search facial images. The whole system is based on two stages. The first is to automatically search the database for the best match. Special computer software algorithms operating on the basis of so-called „deep learning”, create neural networks to refine searches. There is no minimum number of

facial morphological features that sets the threshold for matches. The activities of the first stage result in a list of potential image matches. In the second stage, which is based on the work of a facial image analysis expert, an evaluation of the morphological features of the faces of potential candidates, determined by a computer program, is carried out. However, the final decision always rests with the expert, who sends the matching information through the international contact office to the country that is handling the case. Experts in the country of interest only give an opinion on the case. Although facial image analysis is not among the main identification methods recommended by Interpol, it has the advantage of high efficiency in terms of cost-effectiveness – it carries a low cost, however, subject to a number of conditions, which include the good condition of the human remains (i.e., when the body is preserved in such a condition that facial features can be recognized and the photo of the corpse's face is of sufficient quality) and when AM (*ante mortem*) material in the form of relevant photos taken while the person was alive is available. In order for a facial image photo to be used for searches, it must meet quality criteria consistent with passport-type photos. The website of the Working Group on Facial Image Identification includes recommendations relating to how to take *post mortem* facial photographs. The website address is: www.fiswg.org (Garcia L., 2022).

According to Interpol standards, three of all identification methods are among the main, priority methods – these are DNA, fingerprint and odontological tests. During the conference, a representative from Saudi Arabia presented the objectives of two projects on dental examinations: the UDent project (on unifying the diverse documentation of AM-life data) and the project for age estimation based on dental examinations. Analysis of the world's major disasters in terms of identifying victims by major identification methods covering the years: 2004-2011 showed the high efficiency of identifications carried out with odontological tests compared to costly DNA tests, in which contamination of biological material is often a hindrance to interpretation. It has also been emphasised that in the case of fingerprint examinations, often due to the large decomposition of the body, it is not possible to conduct such examinations and then the most durable material such as teeth can contribute to a successful identification (Al-Salamah S., 2022). When the odontological AM data is of very good quality, then the value of identification by classical odontological methods reaches 60% and, together with a combination with other identification methods, can result in an additional 30% (Prajapati G, et al., 2018). As AM (*ante mortem*) odontological records data vary widely from one medical center to another

in the world or even within a single country, the Udent project proposed a model for unifying *ante mortem* dental data by creating a specialized homogeneous record through an appropriate code system representing treatment and clinical records (AlSalamah S., 2022). Such an electronic system would more effectively secure data stored in the form of paper forms, which can be lost or destroyed, and could be used in online exchanges. Challenges to setting up such an electronic system include gaps in patients' vital records of dental treatment, poor quality of AM data, and wide variation in the markings used for dental records. Especially in economically less developed countries, dental data may be unavailable and of questionable quality (Acharya J., et al., 2017), and to a large extent the success of identification by odontological methods depends on the availability of good quality dental records (Forrest A., 2019). The electronic system would allow automatic conversion of dental codes and storage of odontological data. This would be a very helpful device to facilitate the work of forensic odontologists who, when identifying mass victims, often have to face different recording systems and their respective interpretation (Manica S., 2014). The second aspect that was discussed in the context of ongoing projects was the creation of a platform to calculate age based on dental examinations. As different centers use different methods of age estimation, such an electronic tool would enable comparison of these data with the intention of achieving uniformity in the results obtained (AlSalamah S., 2022).

Training of DVI teams in the Interpol standard

Regardless of the level of sophistication in DVI operations, teams with many years of practical experience as well as teams that have been in operation for a short time should undergo periodic training in the performance of their activities in the event of a mass casualty disaster and in the aspect of maintaining the readiness of all services involved in mass casualty activities, taking into account the size of the event, its consequences and the number of tasks carried out in connection with it. Of particular importance are training courses of an international nature, where participants can test cooperation with teams from other countries, sharing their experiences as well as gaining skills for joint activities in the future. One of the basic elements of training should be improvement in both personnel and technical aspects, as well as continuous implementation of organisational solutions proven in other countries (Gruza E., Sołtyszewski I., 2022, Frankowski A., Łukomska A., 2017). Research conducted on a representative group of DVI teams that are members of Interpol as well as teams from countries participating in the 29th

Interpol International Conference on the Identification of Disaster Victims in Lyon showed that the frequency of training with practical exercises of DVI teams varies greatly, most often from one or several times a year, but in extreme cases from several to more than two hundred since the formation of the team (Frankowski A., Ossowski A., 2021).

Of all the DVI team trainings presented at the Interpol conference, this exercise conducted in Kiruna (Sweden) in 2019 was the largest with 161 representatives from the following countries participating: Sweden, Norway, Finland, Germany, and Iceland (Johansson U., Bröms L., 2022). The training was planned for two years and cost 500,000 euros. The premise was to practice mixed-nationality DVI teams after a mass event in all five phases of operations recommended by Interpol. The innovation was the involvement of real actors, whose task was to play the victims, the injured and wounded, and the families searching for their loved ones. It is worth mentioning that also in 2019, in large simulated activities related to the occurrence of a mass event and the practical application of DVI procedures, conducted for about 120 people by the Central Forensic Laboratory of the Police in Mińsk Mazowiecki, soldiers of the Military Police were used as actors (CFLP website, <https://clkp.policja.pl/clk/aktualnosci>, 2019)

The entire course of training conducted in Sweden was to reflect all the activities that were to take place in real time. A bomb explosion was arranged at a hotel on the island, to which DVI teams were transported by plane. A PM (*post mortem*) team was launched at the scene during which another call took place - this time for rescue and identification activities in the cave. All bodies from the crime scenes were taken to the morgue, where identifications continued. During the PM team's activities, activities related to the collection *of ante mortem* data on AM team activities (*ante mortem*) were carried out in parallel. At the end of the activity, the data linking team used computer software to compare the collected AM data with the PM data. The conclusions summarizing this DVI training, the largest in Interpol's history, were as follows: 1. A very important aspect in the DVI process is good management of the activities of the various DVI teams, often carrying out their tasks in parallel. In this regard, the need for training for the division that manages activities both in terms of international cooperation and in terms of the country has been reported. 2. Critical to the smooth operation of all links in the DVI process is logistics, which must be considered at all levels of operational planning. 3. In joint international operations, getting help in the territory of the particular country in the area where the mass event occurred is crucial.

Conclusions

The DVI team is a team of specialists who, if necessary – the occurrence of a mass casualty event – are able to immediately go to the site with the appropriate equipment and begin operations to identify victims, which is why it is so important to test diverse scenarios by teams of different types of specialists from different countries who will work together during such events. Exercises of local as well as international scope, involving various services, provide an opportunity to learn the principles and procedures for handling human remains and cadavers at the scene of a mass casualty event, in accordance with international guidelines developed by Interpol, as well as the actions taken by the DVI team in documenting *ante mortem* information (data before death, obtained from families and relatives of victims), *post mortem* (data after the death of the victim), and the stage of combining these data, leading to the decision on identification. A predetermined and tested strategy for dealing with a DVI incident that is a preparedness plan rather than a post plan ensures greater efficiency and relative order resulting from knowledge of handling procedures, individual roles and responsibilities, and the ability to respond quickly. It is also very important to establish a chain of responsibility for specific tasks and coordinate the activities of individual DVI teams at the management level, to periodically update the lists of laboratory personnel involved in identification studies, and to prepare on the side of psychological support for the relatives of victims and DVI team members. In addition to practical exercises and action plans, the DVI team should implement a continuing education system that takes into account current knowledge and international standards in this area. Of particular note in recent times has been the development of databases providing new opportunities for identification and information sharing at the international level especially in cases where activities leading to the identification of disaster victims or missing persons within a country have not been effective. Launched in May 2021 in Lyon, France, Interpol's „I-Familia” database enables comparisons of DNA profiles of relatives looking for their loved ones with those of unidentified human remains, and mediates through international contact points searches and identifications between countries for which potential matches have been recorded. Interpol's second database, complementing the DNA and fingerprint database, is the facial image database, where special computer software algorithms running on a „deep learning” system – create neural networks to refine searches. Potential matches of facial images selected by the system are verified by experts, who then send

the matching information through the international contact office of the country that is handling the case. Continuous development of research techniques and methods increases the identification potential when confirming the identity of victims of current disasters as well as when exhuming human remains from mass graves for archival matters. Modern molecular biology methods confirm the effectiveness of taking such measures. An example is the identification of the victims of the 1939–1940 and 1941–1944 armed conflict between Finland and Russia, carried out by a team from the Medical University of Helsinki, which succeeded in identifying 75% of the fallen soldiers, thus contributing to restoring the memory of those killed and respecting the affected families who lost their loved ones. DVI teams identifying victims of mass incidents face many challenges, those related to research capabilities as well as the difficulties caused by identification in situations where victims are from different countries of the world, and comparing hundreds, sometimes thousands, of post-mortem (PM) and ante-mortem (AM) data with each other is a very complex and time-consuming process. Often, the international nature of mass events – natural disasters, disasters, in land traffic, construction disasters, terrorist attacks or armed conflicts necessitates the carrying out of coordinated actions by teams from different countries, where the common platform for action can be unified standards, which are, among others, the procedures used during mass events in the Interpol standard. In cases where mass deaths occur in areas of countries with less developed forensic investigation infrastructure, specialists from more developed countries often provide intervention support. An example of this is the recent events inside Ukraine related to the armed conflict with Russia. The intensity and nature of the fighting carried out in populated areas of Ukraine has resulted in significant civilian and military casualties and the carrying out of temporary burials during the fighting or during breaks in the attacks. The mass graves in Bucha near Kyiv posed a challenge due to the lack of developed identification standards that Interpol recommends. In this regard, the DVI team from France, as part of bilateral identification efforts with Ukraine, conducted identification of war victims mainly based on genetic testing due to the fact that the bodies were highly decomposed. Regardless of the level of sophistication in DVI operations, teams with many years of practical experience as well as teams that have been operating for a short time face a number of difficulties when a disaster occurs that results in a massive number of casualties. In this regard, planning a strategy for future action on the basis of one's own identification experience, periodic local and

international training, constant updating of DVI knowledge, is crucial in terms of maintaining readiness to participate in activities related to the occurrence of a mass casualty event.

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