

RESEARCH ARTICLE

Significance of on-site forensic anthropological studies in post-disaster and emergency contexts: the case of Turkey

Nehir Varol^a, Cansel Çeken^b, Tarık Gülcü^c, Timur Gültekin^d

^a Department of Emergency and Disaster Management, Ankara University

^b Institute of Health Sciences, Ankara University

^c TÖMER, Ankara University

^d Department of Anthropology, Ankara University

ABSTRACT

Responding to a scene after a disaster or emergency requires a multi-disciplinary approach. For this reason, studies conducted on site need to proceed systematically. Forensic anthropologists should make determinations, especially in mass casualties that occur after disasters and emergencies. Forensic science is the application of scientific methods and techniques for legal purposes, and forensic anthropology is a branch of forensic science. Turkey is a country experiencing many kinds of natural and man-made disasters due to its geomorphological, geopolitical, meteorological, and demographical structure. Some recent disasters such as the Marmara Earthquake in 1999, Van Earthquake in 2011, and explosions have mandated studies be conducted on victim identification. Forensic science has gained significance in Turkey in terms of crime studies, crime prevention, and gathering and presenting evidence to judicial authorities since 2000 and has become more important to the authorities. Due to not being able to identify victims after disasters, experts need to conduct an identification process using appropriate techniques. The importance of the forensic anthropological approach needs to be understood for on-site investigations after natural disasters and emergencies.

ARTICLE HISTORY

Received 29 August 2021

Revised 13 October 2021

Accepted 2 January 2022

KEYWORDS

Disaster • Emergency • On-Site
• Forensic Anthropology

Disasters are natural or man-made events that occur suddenly and affect a society or environment negatively (Varol & Gültekin, 2016). Natural events do not actually harm humanity. Whether they have the ability to become a disaster depends on human activities. A multidisciplinary approach is vital at this point for disaster and emergency risk management studies. Besides other approaches, social anthropology is important in the pre-disaster context, whereas physical and forensic anthropology is significant in the post-disaster context. Determining and reporting on casualties in disasters and the cause-effect relationship are important.

Forensic anthropologists in particular play a major role in the aftermath of disasters leading to mass casualties. Examining and identifying human skeletal remains have been established as the basic purposes of forensic anthropology.

When viewing human history in relation to mass casualties deriving from disasters, researchers have associated mass child casualties from 600 years ago to flash-flooding and the mud-flows experienced alongside the flood in that timeline. Moreover, Jews being burned alive due to their alleged responsibility for the breakout of the plague known as the Black Death in the Medieval Age comes to mind (Akay, 2019). Much early research concerning mass casualties and the ways societies react to them has been published by the Disaster Research Centre at Delaware University (Hershiser & Quarantelli, 1976). Recently, the literature on disaster and emergency management has investigated the kinds of diseases and deaths expected after a breakout of disasters (Bourque et al., 2007).

CORRESPONDENCE TO: Nehir Varol (Assist. Prof.), Department of Emergency and Disaster Management, Ankara University, Ankara 06100 Turkey.

Email: nehir.varol@gmail.com ORCID: 0000-0003-4876-9313

To cite this article: Varol, N., Çeken, C., Gülcü, T., & Gültekin, T. (2022). Significance of on-site forensic anthropological studies in post-disaster and emergency contexts: The case of Turkey. *TRC Journal of Humanitarian Action*, 1(1), 49–57. <https://doi.org/10.55280/trcjha.2022.1.1.0007>

Victim identification in natural disasters such as earthquakes, tsunamis, floods, avalanches, and landslides as well as technological and man-made disasters like aircraft and train accidents, terror events, and fires is crucial in the legal sense.

Early studies in forensic anthropology appear as research concerning murder cases rather than as scientific research and studies. In the murder case known as the Parkman Murder, John Webster, a professor of chemistry at Harvard University, was alleged to have murdered Dr. George Parkman in order not to pay his debt to him for the construction of the Faculty of Medicine building. He had dismembered the corpse in the anatomy lab and burned it in a tank. The dental plates remaining from the burned head were understood to belong to Dr. Parkman, and this revealed Webster as the culprit. The earliest skeletal survey recorded in history was performed in the USA in 1878 by Thomas Dwight. Dwight is considered the pioneer of forensic anthropology as he used the information acquired from human skeletons to identify fossils. Though known as one of the founders of physical anthropology, he also contributed to forensic anthropology with his studies on identification regarding skeletons, trauma, and photographic superimposition. Another contributor to forensic anthropology was T. Wingate Todd. Having taken photos and made anthropometric measurements of cadavers, Todd's studies on mass casualties as a result of wars and the re-identification of victims mark the most significant contribution to the development of forensic anthropology as a scientific discipline. In the contemporary context, disaster victim identification (DVI) teams and forensic anthropologists have collaborated with each other for identifying victims in the post-disaster context in many countries in the world. Contrarily, the police force being the only unit authorized to identify victims in post-disaster settings and anthropologists having been excluded from this process are considered drawbacks for Turkey. Prior to the Marmara Earthquake in 1999, the disaster management system was primarily based on intervention. A proactive approach has been shown for disaster management since Disaster and Emergency Management Presidency (AFAD) was founded in 2009. Discussions on the sociological dimensions of disasters as well as their physical aspects have begun since them. Hence, the term "disaster anthropology" has emerged in recent years in studies about disaster management in Turkey.

Detecting casualties is at least as important as their identification regarding non-criminal mass casualties from natural catastrophes. However, conducting these studies often entails difficulties because most casualties can either be destroyed, scattered, severely decomposed, burned, or beyond recognition (see Figure 1). The need disaster victim identification (DVI) in past disasters has gained significance over time and become a systematic study.

The process of gathering these findings and taking them to lab are as critically important as detecting the physical and biological findings on site after disasters and emergencies. Findings need to be preserved so as to protect the structure and avoid any harm; they must be packaged properly, from the time they are collected until their arrival in the lab setting (Bayer, 2003).

Even though the term "disaster anthropology" has been mentioned in the international literature, it has yet to be widely used in the area of disaster risk management in Turkey. As one branch of physical anthropology, forensic anthropology is important for studies concerning post-disaster contexts. Forensic anthropologists need to be included in the on-site examination team in order to identify victims properly after disasters and emergencies (Varol & Gultekin, 2016). The major method forensic anthropologists apply on site in post-disaster contexts are known as the Snow Protocol. The protocol Snow (1982) suggested for evaluating gathered information is the most commonly approved method. The Snow Protocol aims to find answers to the following questions:

1) Do the detected remains belong to human beings? The main purpose of forensic anthropologists is to determine whether or not the remains belong to human beings. Skeletal examination determines if it is of human or animal origin. In case the remains are composed of multiple parts, microscopic examinations are made.

2) How many people do the detected remains belong to? Following the determinations on whether the skeletal remains are human, efforts are made to answer how many people the detected remains belong to. Expertise is required to determine remains that have been burned, smashed, and mixed due to mass casualties in mass disasters. The available parts are categorized as belonging to a baby, child or adult, and, the number of people in the detected remains is determined based on morphological examinations.

3) When did the person die? Determining the time of death from postmortem skeleton remains is difficult. Anthropologists try to clarify the time of death by considering microscopic changes in the bone. Carbon-14 dating analyses is the preferred method for this (Ubelaker 2014; Ubelaker et al. 2006).

4) How old was the deceased? A range of ages can be mentioned instead of determining the exact age. Degenerative changes, depreciation, and wear occur in bones following the completion of the growth process in adulthood. For this reason, different methods are used in age prediction for babies compared to children, as well as for youths compared to older adults. The epiphyseal fusion of bones and diaphysis length of long bones, particularly teeth, are taken into account in babies and children (Ubelaker 1989, 1991; Scheuer & Black, 2000).

5) What is the sex of the dead person? Gender is one of the major components in the process of identifying victims. Sex is determined more accurately if pelvis, skull, and long bones are available.

6) What is the race of the dead person? According to some scientists' classifications, three types of races exist: White (Caucasoid), yellow (Mongloid), and black (Negroid). These three types of legally determined races are differentiated according to their skull structures in legal cases (Pickering & Bachman, 1997).

7) What is the deceased's height, weight, and physical structure? The Fully method is the most reliable technique in height prediction. The approximate height of the skeleton is found by unifying parts of the remains from cartilages and joints in anatomical order using a glue. Almost all skeleton bones need to be available to apply this method appropriately.

8) Is there a significant anomaly in the skeleton? Are there visible signs of disease or injury? Many researches on trauma and injuries detected in the individual have been carried out by anthropologists. The biological profile of the person can be determined with these signs and they help to get access to findings for positive identification. Disease and trauma signs provide information about the lifestyle of the dead person.

9) How did the person die? Detecting trauma and surgical operations from skeletal remains provides information about the cause of the death. (Çeker, 2014; Stanojevich, 2012; Byers, 2005).

Whether due to climate change, greater population densities, pandemics, or migration, humankind will somehow be exposed to a wide variety of disasters in the future. Identifying the losses resulting from these disasters will become a more significant issue. As a general global tendency, forensic anthropologists are involved in site investigation teams, labs, and DVI teams. Contrary to this global trend, the police and gendarmerie carry out this investigation in Turkey. Hence, this study sets out to prove that forensic anthropologists also need to be involved in site investigation in Turkey.

When considering its geological structure, Turkey in particular is a country frequently exposed to natural disasters, especially earthquakes. Such events as the Marmara Earthquake in 1999, the Van Earthquake in 2011, and many terrorist attacks have mandated procedures for identification. Forensic sciences, criminal investigations, evidence collection and their presentation to judicial authorities by all competent authorities have become ever more important. The police and gendarmerie operate under the Ministry of Interior Affairs. Both forces have their peculiar criminal investigation labs and scene investigation teams. The Forensic Medicine Institute works under the Ministry of Justice and coordinates with universities' forensic medicine departments and institutes. Courts and prosecutors are able to request the expertise of these university departments (Polat, 2010). The major problematic issue for developing forensic sciences with regard to victim identification in Turkey is the lack of coordination between experts and departments or institutions.

The On-Site Forensic Anthropological Approach in Post-Disaster and Emergency Context

Forensic anthropologists working in the field of forensic sciences determine the biological profile of the skeletal findings under examination; the age, gender, and height of the individual; as well as the presence of any trauma, health problem, or pathology reflected there and the quality of life or work (Adams, 2009; White et al., 2011; Pickering & Bachman, 2009). In addition, the forensic anthropologist sometimes needs supporting information to figure out whether or not a death is a forensic case and sometimes to reach a definitive conclusion.

Regarding the losses incurred as a result of disasters, forensic anthropologists primarily conduct individual anthropological examinations on bone and bone fragments. Before that, however, they need to carefully create crime scene investigation reports. For example, detailed reports should be created regarding the sketches, photographs, and features of the place where the skeleton was unearthed, and a holistic analysis should be made by evaluating these reports and data altogether.

As a result of the forensic skeletal anthropological examinations carried out:

- Morphological comparison methods using the bone mass, spongiosa structure, cortex thickness, and comparative osteology method should be applied in order to reveal whether the skeletal material at the scene is of human origin.
- In collective deaths in disasters, the morphological and morphometric properties of bones are examined, and the number of individuals at the scene is determined.
- The age of the obtained skeletal material can be determined by calculating the maximum lengths of ossification centers; epiphyseal and dental development; degree of erosion; symphysis pubis; facies auricularis; sutural, clavicle, and complex aging of long bones in accordance with childhood, adolescence, adult, and adult age periods.
- Sex determination is made by calculating the osteological and morphological features of the pelvic skeleton and skull as well as the lengths of the long bones.
- Individuals' height can be predicted from long bone lengths.
- Detailed trauma analysis should be done on skeletal remains to determine whether a trauma is ante-mortem, peri-mortem, or post-mortem.

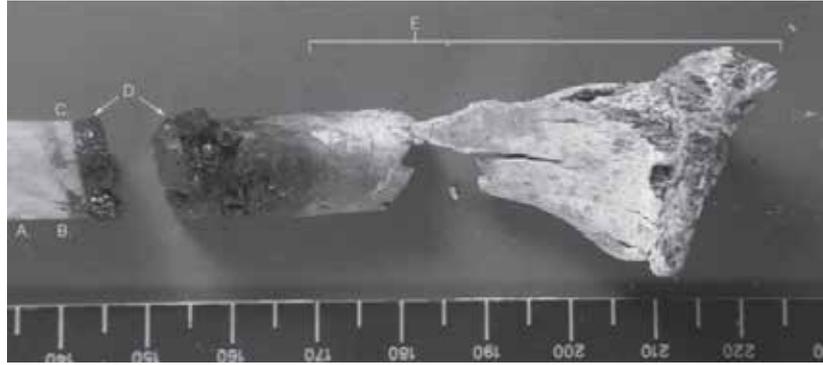
In addition to the identification techniques mentioned above, modifications in the body, surgical scars, other scars, prostheses, traumas, soft tissue diseases, and some cultural practices (e.g., tattooing, scarification, branding, cutting, subdermal implants, transdermal piercings) applied to the body can provide clues about the identity of individuals (Randolph-Quinney et al., 2009).

Due to the inability of identifying victims after disasters, an expert must conduct the mentioned identification process using the appropriate techniques. The involvement of non-experts in the identification process causes the remains to get scattered and lost. Another problem for the first on-site response team in Turkey is the lack of necessary experts on these teams as well as a lack of inter-team coordination. The most important solution to this problem is the preparation of protocols based on the DVI guidelines prepared by Interpol. Forensic anthropologists have an increasing role at this point in minimizing on-site errors and accelerating the identification process. The systematized form of this process is termed as DVI. Disaster in terms of DVI means unexpected circumstances causing mass casualties.

The International Criminal Police Organization (Interpol) has published a DVI handbook that contains forms on data gathering as well as counselling about the techniques to use in identifying human remains following cases of mass casualties (Interpol, 2018; National Institute of Justice(NIJ), 2006). This manual from Interpol is commonly used to simplify disaster victim identification in international areas. This document outlines all four steps in the victim identification process. The disaster site is the region that covers all aspects of an event and determines where the processes of an event occurred as well as the relationship between the victim and the criminal (Bayer 2003). Post-mortem data collection refers to the materials that provide ample information for identification. Information acquired from a victim such as personal belongings, scars, or pathological findings on the body can be considered as examples of post-mortem data. Ante-mortem data denote the personal belongings of the victim such as jewelry and clothing as well as dental and medical records.

Turkey is a country that experiences many kinds of natural and man-made disasters due to its geomorphological, geopolitical, meteorological, and demographical structure. Some recent disasters such as the Marmara Earthquake in 1999, the Van Earthquake in 2011, and explosions have mandated studies be conducted on victim identification. Forensic science in Turkey has gained significance in terms of crime studies, crime prevention, and gathering and presenting evidence to judicial authorities since 2000 and has become more important to authorities. Reconciliation signifies the accurate identification of a victim as a result of comparing post-mortem and ante-mortem data.

On-site investigation is performed by the police and gendarmerie. Both forces have their own crime examination labs and scene investigation teams. The Forensic Medical Institute works under the Ministry of Justice in collaboration with the departments and institutes of forensic sciences at universities. For some criminal cases, the courts are able to request counsel from these departments (Polat, 2015). To make these studies more effective, institutions need further and stronger collaboration and coordination with each other.



(a)



(b)

Figure 1. (a) Burn patterns on a single bone (Dirkmaat et.al 2012); (b) Heavily fragmented skeletal remains (Blau & Briggs 2011).

An appropriate on-site evaluation of skeletal findings is possible by involving forensic anthropologists in the on-site investigation team. As the first step, a forensic anthropologist determines whether skeleton findings belong to human beings or animals.

After determining the findings as belonging to human beings, forensic anthropologists also gain access to such information as whether skeletons are antique or current, the number of people to which the detected bones belong, the time of death, and the age of individual upon death (Konyar & İşcan, 2005, p. 89).

Traditionally, forensic anthropologists were asked to predict the biological profile of skeletal findings. These days, personal identification, trauma analyses, taphonomic analyses, and estimations concerning time elapsed since death, as well as determining the causes of mass casualties (i.e., either violation of international law/conflicts or disaster outbreaks) are common in addition to these traditional practices. For this reason, the importance of forensic anthropological studies lies in its contribution to providing information about the biological, bio-mechanical, evolutionary, and cultural bases of skeletal findings (Christensen, 2013).

Regarding events that occur due to disasters, every bone fragment found at a scene has great importance. For example, when researchers find a tooth, they can find answers to the following questions about this tooth: Does it belong to a human or some other animal? Which type of tooth is it (e.g., incisor, canine, premolar, or molar)? Is it a milk tooth or

a permanent tooth? Is it from the upper or the lower jaw? Which side is it from (right or left)? Was the individual suffering from any disease? What was the individual's age? What was the sex of the individual? Whose tooth could it be?

Discussion and Results

Forensic anthropologists have been included in on-site investigation teams, labs, and DVI teams in many parts of the world. In Turkey, scene investigation is carried out by the gendarmerie or police. However, forensic anthropologists have started to be included in these studies as a recent trend in Turkey. DVI teams are included within the Criminal Police Lab, the Forensic Science Institute, and the Gendarme Forensic Lab in Turkey. Each of Turkey's 81 cities has an on-site investigation unit, while only 10 of these cities have criminal labs. Only one forensic anthropology lab is found, and that is in the Ankara Criminal Police Lab. As such, forensic anthropologic findings from all cities are transferred to this lab in Ankara, but this situation may result in various issues. No protocol exists regarding the methods for coordinating the on-site investigation teams who respond to mass casualties, nor in terms of reporting or conducting examinations.

Forensic anthropological studies offer significant information concerning the possible cause of individual deaths on the basis of human remains after disasters that happened long ago (Ceker, 2018). When evaluating human remains detected during a scene investigation, an expert osteologist needs to be consulted regarding such cases as the necessity for experience in forensic excavation as well as for determining whether the remains belong to a human being.

When considering the possibility of conducting scientific studies in the light of new technological analyses in the future, skeletal remains obtained from mass burials need to be well-preserved in the appropriate labs under acceptable conditions.

This study reveals the necessity of the multidisciplinary approach in on-site investigation studies in the context of post-disasters and emergencies. Having forensic anthropological studies becomes more significant as the human remains obtained from a scene become more fractured. Starting the identification process without changing the placement of human skeletal remains is majorly important for shedding light on the disaster and identifying the findings. For this reason, particularly in regard to the first on-site evaluation at a disaster area, the experience of forensic anthropologists must be consulted. In Turkey, the approach to the scene post-disaster should be based on learning forensic anthropology methods and techniques, opening forensic anthropology departments in higher education institutions, training experts and the teams that will take part in crime scene investigations. Universities need to graduate more people specialized in forensic anthropology, and these experts must be involved in the on-site investigation teams in the aftermath of disasters and emergencies. In this way, human remains can be identified appropriately and misidentification prevented through the excavations conducted in accordance with forensic protocols.

Forensic anthropologists need to be included in the on-site investigation team following disasters and emergencies to eliminate mistakes at the scene and to accelerate the identification process accurately. In summary, disaster risk management is an interdisciplinary process that requires expert involvement in the different phases of disaster management, such as preparation, response, and recovery. In particular, forensic anthropologists play a vital role in the response phase in terms of disaster victim identification.

Two other ways exist for classifying a disaster, and being aware of these is important as they can have a direct effect on DVI process. The first classification relates to what caused the disaster. Thus, the origin of a disaster may be classified as:

- Natural (e.g., earthquake, hurricane, flood)
- Man-made (e.g., plane crash, explosion, terrorism)
- Hybrid (natural but initiated by human activities; (Horswell, 2015).

Knowing what type of disaster one is dealing with is important for being able to dictate the number and physical state of the victims to be processed. The fact that one may be dealing with victims recovered from different environments or whether there are whole bodies or body parts can dictate what identification methods may ultimately be used or not used.

All disasters produce victims of one sort or another. People or organizations may not be aware that there were even victims at the time of a disaster.

They may be identified as victims days, weeks, months or even years later, they can be identified as victims.

Below is a list of possible categories to which victims may belong; based on the particular disaster, some of these may not be relevant:

- Dead
- Injured
- Uninjured (but still affected)
- Witnesses/Onlookers
- Rescue workers
- The company employees, authorities, politicians
- Friends and relatives of all those listed above.

This study has only concentrated on identifying the deceased in a disaster, although understandably other victims may also need to be identified in order to receive appropriate support and treatment. Furthermore, the friends and relatives of the deceased who supply identifying information to the authorities should be treated as if the victims were still alive as the process they are asked to endure is beyond their normal sphere of experience.

As a result, forensic anthropologists are required to carry out identification studies over a wide range of perspectives, from soft tissue, teeth, trauma, modifications, variations, and DNA to cultural applications in addition to skeletal material. In order to perform these studies in a healthy manner, they must gain expertise by feeding off of different disciplines. Forensic anthropological studies provide the most significant data, especially in samples found in mass graves and in shedding light on situations claimed as war crimes. Learning forensic anthropological methods in post-disaster on-site approaches, increasing the number of forensic anthropology departments at universities, training experts in this field, and having forensic anthropological experts in on-site investigation should be prioritized. The employment of forensic anthropologists needs to be ensured in order to provide continuity to forensic anthropological studies and to appropriately apply the methods and techniques for on-site interventions. Excavations performed by teams containing forensic anthropologists in accordance with judicial procedures and detecting human-related remains appropriately lowers the loss of evidence. Ankara University has recently established MSc and PhD programs in forensic anthropology to ensure the employment of forensic anthropologists. Anthropology education takes four years to complete in Turkey. Those requesting to specialize in forensic sciences need to enroll in the MSc and PhD programs.

Ethical approval

Ethical approval is not applicable, because this article does not contain any studies with human or animal subjects

Authors' contribution

All authors contributed equally to this manuscript.

Peer-review

Externally peer-reviewed

Funding

This research received no external funding.

Disclosure statement

The authors report no conflict of interest.

Author's ORCID numbers

Nehir Varol	0000-0003-4876-9313
Cansel Çeken	0000-0002-1903-2075
Tark Gülcü	0000-0002-9141-3593
Timur Gültekin	0000-0003-3520-5308

References

- Adams, B. J. (2006). *Forensic anthropology (Inside forensic sciences)*. Chelsea House Publishers.
- Adams, J. B. (2009). *Forensic anthropology*. Infobase Publishing.
- Akay, A. (2019). İklim değişikliğinin neden olduğu afetlerin etkileri [Climate change-caused disaster impacts]. In *İklim değişikliği eğitim modülleri serisi 15. İklimin*.
- Bayer, M. (2003). *Olay yeri inceleme ve kriminal laboratuvar analizleri* [On-site investigation and criminal laboratory analyses]. Seçkin
- Byers, N. S. (2005). *Introduction to forensic anthropology A textbook* (2nd ed.). Pearson Education.
- Blau, S., & Briggs, C. A. (2011). The role of forensic anthropology in disaster victim identification (DVI). *Forensic Science International*, 205(1-3), 29–35.
- Bourque, L., Siegel, J. M., Kano, M., & Wood, M. M. (2009). Morbidity and mortality associated with disasters. In H. Rodríguez, E. L. Quarantelli, & R. R. Dynes (Eds.), *Handbook of disaster research* (pp. 97–112). Springer.
- Christensen, A. M., Passalacqua, N. V., & Bartelink, E. J. (2013). *Forensic anthropology: Current methods and practice*. Academic Press.
- Christensen, A. M., & Crowder, C. M. (2009). Evidentiary Standards for Forensic Anthropology. *Journal of Forensic Sciences*, 54(6), 1211–1216. <https://doi.org/10.1111/j.1556-4029.2009.01176.x>
- Çeker, D. (2014). Adli antropolojide perimortem ve postmortem kırıkların ayırımı ve travma analizlerindeki önemi [Differentiating perimortem and postmortem fractures in forensic anthropology and its importance in trauma analysis]. *Antropoloji*, 27, 47–64.
- Çeker, D. (2018). *Adli antropolojide yaş tahmini metodları* [Age estimation methods in forensic anthropology]. *Ankara Üniversitesi Dil Tarih Coğrafya Fakültesi Antropoloji Dergisi*, 35, 35–54.
- Dirkmaat, D. C., Olson, G. O., Klales, A. R., & Getz, S. (2012). The role of forensic anthropology in the recovery and interpretation of the fatal-fire victim. In D. C. Dirkmaat (Ed.), *A companion to forensic anthropology* (pp. 113–135). <https://dx.doi.org/10.1002/9781118255377>
- Hershiser, M. R., & Quarantelli E. L. (1976). The handling of the dead in a disaster. *Journal of Death and Dying*, 7(3), 195–208.
- Horswell, J. (2015). Accreditation: crime scene investigators. In J. Payne-James & R. W. Byard (Eds.), *Encyclopedia of forensic and legal medicine* (pp. 1–11). Elsevier.
- International Crime Police Organization. (2018). *Disaster victim identification guide*. <https://www.interpol.int/How-we-work/Forensics/Disaster-Victim-Identification-DVI>
- Interpol. (n.d.). *Disaster victim identification guide*. *disaster victim identification*. <https://www.interpol.int/How-we-work/Forensics/Disaster-Victim-Identification-DVI>
- İşcan, M. Y. (1988). Rise of forensic anthropology. *Yearbook of Physical Anthropology*, 31, 203–230.
- İşcan, M. Y. (2001). Global forensic anthropology in the 21st century. *Forensic Science International*, 117(1-2), 1–6.
- İşcan M. Y., & Konyar, E. (2005). Adli arkeoloji: Olay yerine arkeolojik yaklaşım [Forensic archaeology: On-site archaeological approaches]. *Arkeoloji ve Sanat*, 120, 89–100.
- İşcan, M. Y., & Steyn, M. (2013). *The human skeleton in forensic medicine* (3rd ed.). Charles C. Thomas.
- National Institute of Justice. (2006). Victim satisfaction with the criminal justice system national institute of justice. *Journal Science*, 253, 16–18.

- Oliver, S. A. (1996). Anthropological research on hazards and disasters. *Annual Review of Anthropology*, 25, 303–328.
- Pickering, R., & Bachman, D. (2009). *The use of forensic anthropology*. CRC Press.
- Polat, O. (2015). *Kriminoloji ve kriminalistik üzerine notlar*. Seçkin.
- Randolph-Quinney, P. S., Mallett, X., & Black, S. M. (2009). Forensic anthropology. In A. Jamieson & A. Moenssens (Eds.), *Wiley encyclopedia of forensic science* (pp. 1–27). John Wiley and Son.
- Scheuer, L., & Black, S. (2000). Development and ageing of the juvenile skeleton. In M. Cox & S. Mays (Eds.), *Human osteology in archaeology and forensic science* (pp. 9–22). Cambridge University Press.
- Snow, C. C. (1982). Forensic anthropology. *Annual Review of Anthropology*, 11, 97–131.
- Snow C. C., Tedeschi, L. G., Levine, L., Orrego, C., Lukash, L., & Stover, E. (1984). The investigation of the human remains of the “disappeared” in Argentina. *American Journal of Forensic Medical Pathology*, 5, 297–299.
- Ubelaker, D. H. (1989). *Human skeletal remains: Excavation, analysis, interpretation*. Taraxacum.
- Ubelaker, D. H. (1997). Taphonomic applications in forensic anthropology. In W. D. Haglund & M. H. Sorg (Eds.), *Forensic taphonomy: the postmortem fate of human remains* (pp. 77–90). CRC Press.
- Ubelaker, D. H. (2014). Commingling analysis: Historical and methodological perspectives. In *Commingled Human Remains* (pp. 1–6). Academic Press.
- Ubelaker, D. H., Buchholz, B. A., & Stewart, J. E. (2006). Analysis of artificial radiocarbon in different skeletal and dental tissue types to evaluate date of death. *Journal of Forensic Sciences*, 51(3), 484–488.
- Varol, N., & Gültekin, T. (2016). Afet antropolojisi. *Elektronik Sosyal Bilimler Dergisi*, 15(59), 1431–1436. <https://dx.doi.org/10.17755/esosder.89650>
- White, D. T., Black, T. M., & Folkens, A. P. (2011). *Human osteology*. Elsevier Academic Press.