The External Postmortem Examination

2

Case Study

A schoolboy found the lifeless body of an elderly woman lying on the pavement beside a busy main road in a built-up area in the early hours of the morning. The emergency physician who was summoned by mobile phone pronounced the victim dead but was forced to leave immediately thereafter to attend another emergency. Having arrived at the scene, the police requested an internist, whose medical practice was located in the immediate vicinity, to undertake the external postmortem examination and issue a death certificate. The internist stated that the woman was not known to him, that he was unable to undress and examine the body in public, and that it would be preferable to locate the deceased's family practitioner and allow him or her to perform the external postmortem examination. When asked, the internist also declined to perform the examination in his practice with the argument that his patients were waiting for him. Meanwhile, the police officers were able to identify the woman from an identity card they found in her coat pocket; however, they were forced to conclude that she was visiting an unknown person. They suggested to the internist that the body be transported to an undertaker's where it could then be examined. Mindful of his waiting patients, the internist proposed performing the external postmortem examination in the early evening—that being the earliest opportunity he would have for the examination.

Legislation governing the performance of external postmortem examinations varies from country to country. However, in many countries, an external postmortem examination may only be carried out by a physician, subsequent to which a death certificate should be issued. The structure of death certificates has changed somewhat over the years (Fig. 2.1). The purpose of the (medical) external postmortem examination includes the following:

Important: **It is mandatory for all bodies to be (medically) examined in order to pronounce death and establish time of death, mode of death, and cause of death. Findings, including medical findings, should be recorded on the death certificate. Depending on the legal framework, on-duty emergency physicians can limit their tasks to pronouncing death and filling out a provisional death certificate. The World Health Organization (WHO) already proposed an international death certificate form many years ago (Fig. 2.2) as a complement to national death certificates.**

In the absence of clear signs of death, resuscitation efforts need to be undertaken. Failure to achieve cardiac resuscitation is considered the criterion for unsuccessful resuscitation. In

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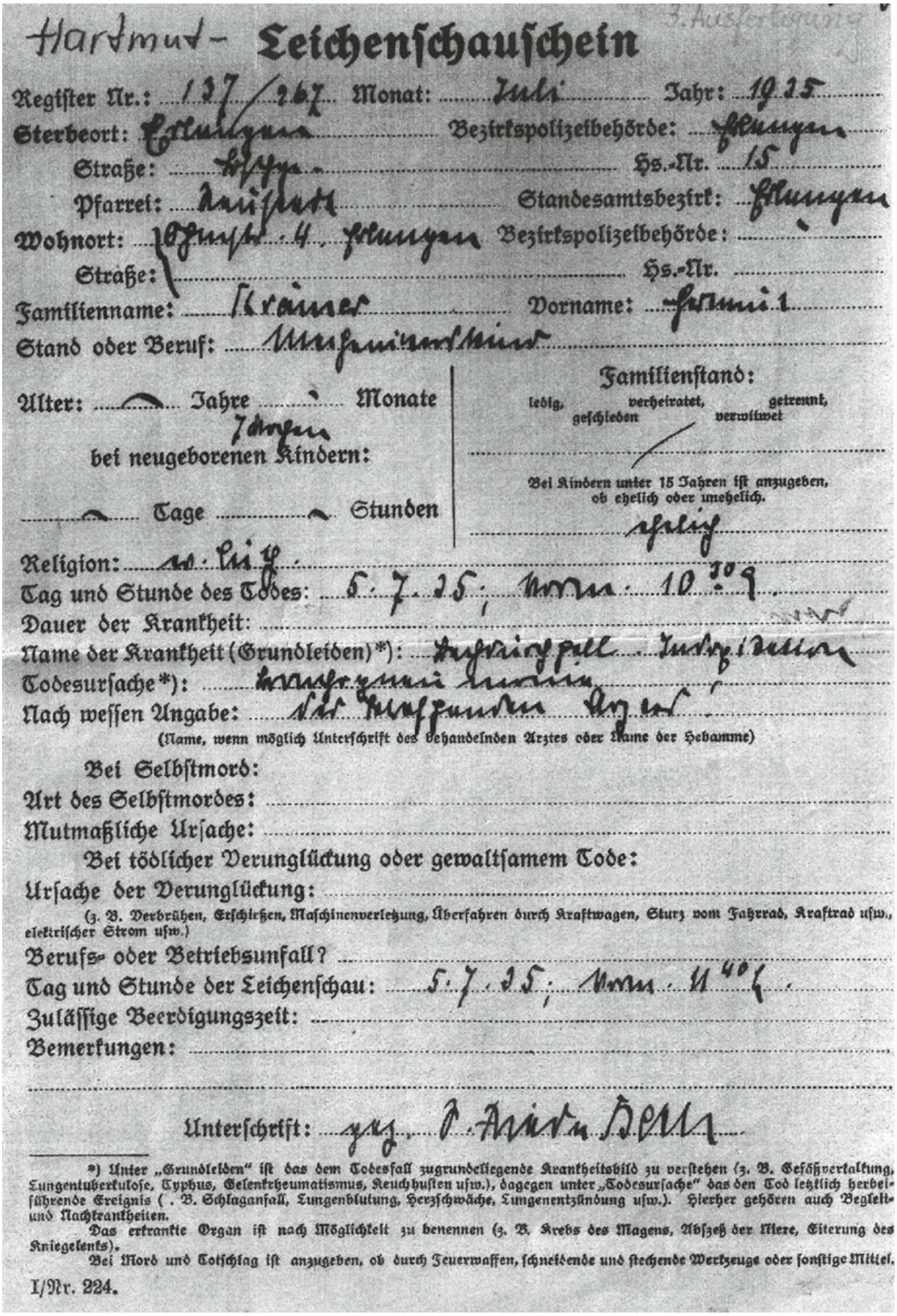

Hartmut – **Leichenschauschein**

Register Nr.: 137/267 Monat: Juli Jahr: 1935
Sterbeort: Bezirkspolizeibehörde:
Straße: Hs.-Nr. 15
Pfarrei: Standesamtsbezirk:
Wohnort: Bezirkspolizeibehörde:
Straße: Hs.-Nr.
Familienname: Vorname:
Stand oder Beruf:

Alter: Jahre Monate
bei neugeborenen Kindern:
Tage Stunden

Familienstand:
ledig, verheiratet, getrennt, geschieden verwitwet

Bei Kindern unter 15 Jahren ist anzugeben, ob ehelich oder unehelich.

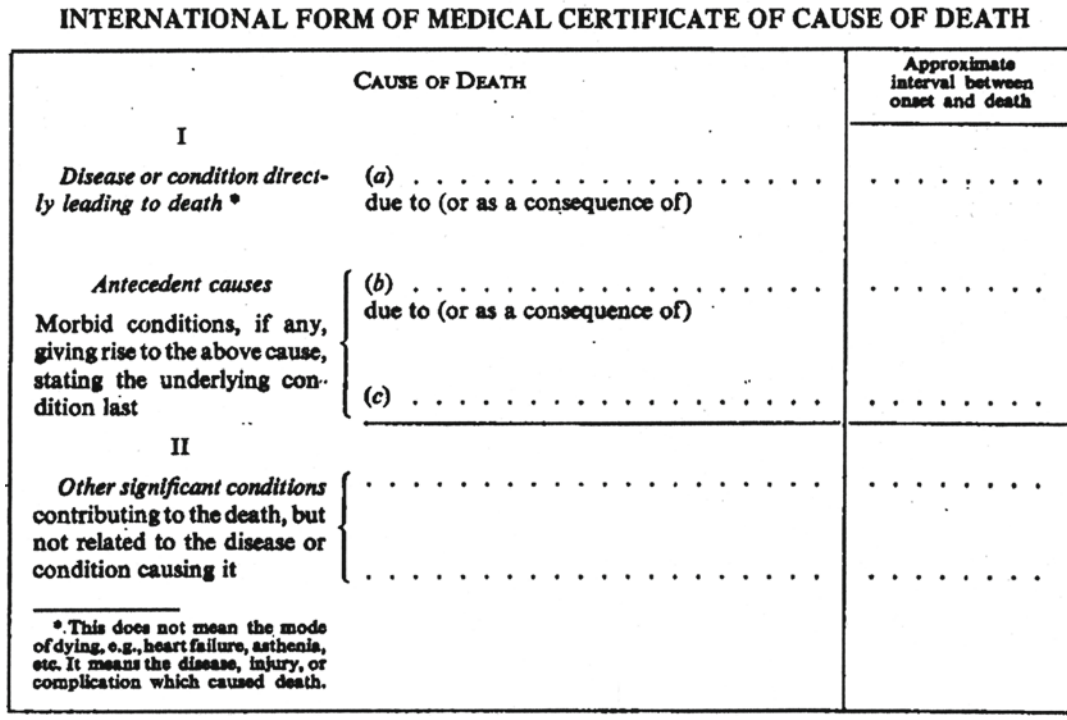
Religion:
Tag und Stunde des Todes: 5. 7. 35.
Dauer der Krankheit:
Name der Krankheit (Grundleiden)*):
Todesursache*):
Nach wessen Angabe:
(Name, wenn möglich Unterschrift des behandelnden Arztes oder Name der Hebamme)

Bei Selbstmord:
Art des Selbstmordes:
Mutmaßliche Ursache:
Bei tödlicher Verunglückung oder gewaltsamem Tode:
Ursache der Verunglückung:
(z. B. Verbrühen, Erschießen, Maschinenverletzung, Überfahren durch Kraftwagen, Sturz vom Fahrrad, Kraftrad usw., elektrischer Strom usw.)
Berufs- oder Betriebsunfall?
Tag und Stunde der Leichenschau: 5. 7. 35.
Zulässige Beerdigungszeit:
Bemerkungen:

Unterschrift:

*) Unter „Grundleiden" ist das dem Todesfall zugrundeliegende Krankheitsbild zu verstehen (z. B. Gefäßverkalkung, Lungentuberkulose, Typhus, Gelenkrheumatismus, Keuchhusten usw.), dagegen unter „Todesursache" das den Tod letztlich herbeiführende Ereignis (. B. Schlaganfall, Lungenblutung, Herzschwäche, Lungenentzündung usw.). Hierher gehören auch Begleit- und Nachkrankheiten.
Das erkrankte Organ ist nach Möglichkeit zu benennen (z. B. Krebs des Magens, Abszeß der Niere, Eiterung des Kniegelenks).
Bei Mord und Totschlag ist anzugeben, ob durch Feuerwaffen, schneidende und stechende Werkzeuge oder sonstige Mittel.
I/Nr. 224.

Fig. 2.1 German death certificate dating back to 1935



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

	Cause of Death	Approximate interval between onset and death
I		
Disease or condition directly leading to death *	(*a*) . . . . . due to (or as a consequence of)	. . . . .
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(*b*) . . . . . due to (or as a consequence of)	. . . . .
	(*c*)	. . . . .
II		
Other significant conditions contributing to the death, but not related to the disease or condition causing it	. . . . .	. . . . .
	. . . . .	. . . . .

*This does not mean the mode of dying, e.g., heart failure, asthenia, etc. It means the disease, injury, or complication which caused death.

Fig. 2.2 World Health Organization (WHO) international death certificate

the resuscitation setting, death is pronounced if no spontaneous respiration or spontaneous cardiac activity is seen after 20 min of uninterrupted resuscitation and if irreversible cardiac arrest is proven on the basis of asystole in ECG for a prolonged period of time. This does not apply in cases of general hypothermia, intoxication, and near drowning, where longer resuscitation times are required. Recent studies show, however, that survival chances can be improved by longer resuscitation times; the median resuscitation time in a large study was 35 min, with significant variations. Older (>70 years) long-term survivors who had undergone resuscitation for longer than 60 min were also seen in the study.

Resuscitation Injuries. Alongside chest compression as part of resuscitation efforts, other measures may include aspiration, intubation, the placing of a gastric probe, possibly also a thoracic drain, and coniotomy, among others. Prolonged and intensive resuscitation can cause injury, including:

- Rib fractures, most notably the second to seventh ribs, generally with a left-sided preponderance.
- Bilateral rib fractures are seen in approximately 50 % of cases.
- The 8th–12th ribs are usually spared from fracture in the course of resuscitation attempts.
- Transverse fractures of the sternum are caused more commonly by resuscitation than by any other trauma.
- Peristernal bleeding in the absence of fractures is seen in the resuscitation setting.
- Rarer resuscitation-related injuries: Ruptured aorta (more commonly the descending aorta) and hematothorax.
- Subpericardial and intramyocardial hemorrhage can occur due to resuscitation.
- Injury to the liver and spleen is possible.
- Very rare: Ruptured diaphragm or gastric wall (resuscitation-related rupture of the gastric wall due to high-pressure ventilation usually affects the lesser curvature).

Resuscitation-related injuries are rarely so severe that they need to be considered as a possible competing cause of death.

The Certifying Physician. Where possible, a deceased's general practitioner is the physician most suited to performing an external postmortem examination, not least since he or she is aware of the patient's history, underlying diseases, and clinical symptoms, as well as the circumstances of death in many cases. However, unnatural deaths occasionally go unrecognized as such at external postmortem examinations performed in particular by community-based physicians. Insufficient thoroughness during the examination is the main reason for this failing. On the other hand, many unnatural deaths or homicides cannot be detected at external examination alone. An autopsy, as well as possible forensic toxicological analyses, is needed to establish an unnatural death. Thus, the low autopsy rate goes a long way to explain unrecognized homicides and unnatural deaths. Where an emergency physician has been called, he or she is essentially authorized to perform an external examination following unsuccessful resuscitation. However, there are a number of (legal) regulations, whereby emergency physicians are not obliged to carry out an external examination if they are called to another emergency. The family practitioner who is then often called upon is able to decide whether performing the external examination would constitute a conflict of interests. In such cases, it is advisable for the next of kin to seek a neutral physician to perform the external examination. Only in rare cases do the next of kin actually have a legal entitlement to decline the deceased's treating physician as the certifying physician.

2.1 Tasks and Duties of Care at Medical External Examination

The requirements given in Table 2.1 highlight the need for care and diligence at external postmortem examination.

A distinction is made between early postmortem changes (livor mortis, rigor mortis, and algor mortis), late postmortem changes (autolysis, putrefaction, and insect and animal predation), and conserving processes (mummification and adipocere formation) for the purposes of estimating time of death. In specific cases, checking supravital functions (see Chap. 3) may be helpful, alongside other information or indications, e.g., witness statements, newspapers in the mailbox, last telephone call, last time seen alive, or the condition of food remains.

Caution is advised when entering the time of death; restricting oneself to giving approximate

Table 2.1 The tasks of the certifying physician at external postmortem examination

Task	Relevance
Pronouncing death	In the interests of the individual In the interests of society in terms of a reliable pronouncement of death and its legal consequences (e.g., inheritance issues, insurance policy deadlines) Legal certification of death by the authorities
Determining identity	At the same time, the examining physician certifies the identity of the deceased
Determining cause of death	Information on the medical cause of death can be included in cause-of-death statistics (malignancies, cardiovascular disease, etc.) Epidemiological data on causes of death can be obtained Information on the cause of death can influence health policy decision-making on, for example, the distribution of healthcare resources The spectrum of detected medical causes of death can improve quality assurance of patient treatment
Determining time of death	Relevant for official records, possibly also for inheritance issues if the order of death is relevant to multiple legal heirs
Determining mode of death	Natural Unnatural Unknown With the relative consequences in terms of how to proceed (burial, cremation, notifying the police authorities, etc.)
Detecting contagious diseases	Infectious diseases need to be detected and reported in the interests of the public

Table 2.1 (continued)

Task	Relevance
Obligation to notify the authorities	An unknown mode of death, unknown identity of the deceased, and signs of an unnatural death should prompt notification of the police (possibly by the emergency physician or later by the pathologist) Although rare, an occupational disease may be suspected at external examination; this suspicion needs to be communicated to the authorities depending on the legal framework. (Caution: a road traffic accident may need to be reported as a commuting accident according to insurance law!) Some countries have special lists of recognized occupational diseases!

Table 2.2 Orienting data for time of death estimations (hpm, hours post-mortem)

Livor mortis	
Confluent livor mortis	ca. 1–2 hpm
Fully developed livor mortis	ca. 6–8 hpm
Livor mortis blanches under (thumb) pressure	up to ca. 20 hpm
Partial blanching on sharp-edged pressure	up to ca. 36 hpm
Livor mortis may be completely displaced	up to ca. 6 hpm
Livor mortis may be partially displaced	ca. 6–12 hpm
Rigor mortis[a]	
Rigor mortis begins (jaw)	2–4 hpm
Fully developed rigor mortis	ca. 6–8 hpm
Renewed-onset rigor mortis after breaking	up to ca. 8 hpm
Rigor mortis resolution	after 2–4 days (strongly temperature- dependent)

[a]The extent of rigor mortis is always estimated by inspecting the large and small joints

times is recommended. In some cases, a time period of death can be given. The data shown in Table 2.2 apply to the estimation of time of death.

Livor mortis needs to be inspected for intensity, extent, color, localization (consistent with the position of the body?), contour marks, and capacity to shift or blanch. Other criteria used to estimate time of death include the Zsako muscle phenomenon (idiomuscular contraction) and measuring core body temperature (deep rectal temperature) (see Chap. 3).

2.2 Legal Considerations Relating to External Examinations

As a rule, it is the duty of the next of kin to arrange for an external postmortem examination to be performed; depending on national legislation, the examination should be carried out promptly by any doctor. A thorough external examination—preferably at the scene of death if possible—includes determining death, time of death, cause of death, mode of death, and the identity of the deceased; a final death certificate is issued only once the examination has been completed. The flowchart in Fig. 2.3 shows the complex tasks involved in a medical external examination and their chronological sequence.

In addition to the mandatory external examination, some legal systems make provision in all cases of death for the option to perform an inquest when explicitly ordered by a court or, in urgent cases, by the public prosecutor's office or police.

2.2.1 The Concept of the "Dead Body" and Ordering an External Postmortem Examination

The legislator sometimes provides definitions of the concept of the "dead body," including the following:

- The body of a deceased individual on condition that tissue integrity has not been compromised by decomposition (skeletons and skeletal fragments are not dead bodies!)
- A body part without which continued life is unviable
- A stillborn child weighing >500 g (in Germany; different weights are specified in other countries)

From a conceptual point of view, a distinction is made between a spontaneous abortion, a stillbirth, and a neonate/live birth when, for example, body weight is taken into account and depending on the legal framework:

Spontaneous abortion: A dead fetus weighing <500 g and showing no signs of having lived outside the uterus

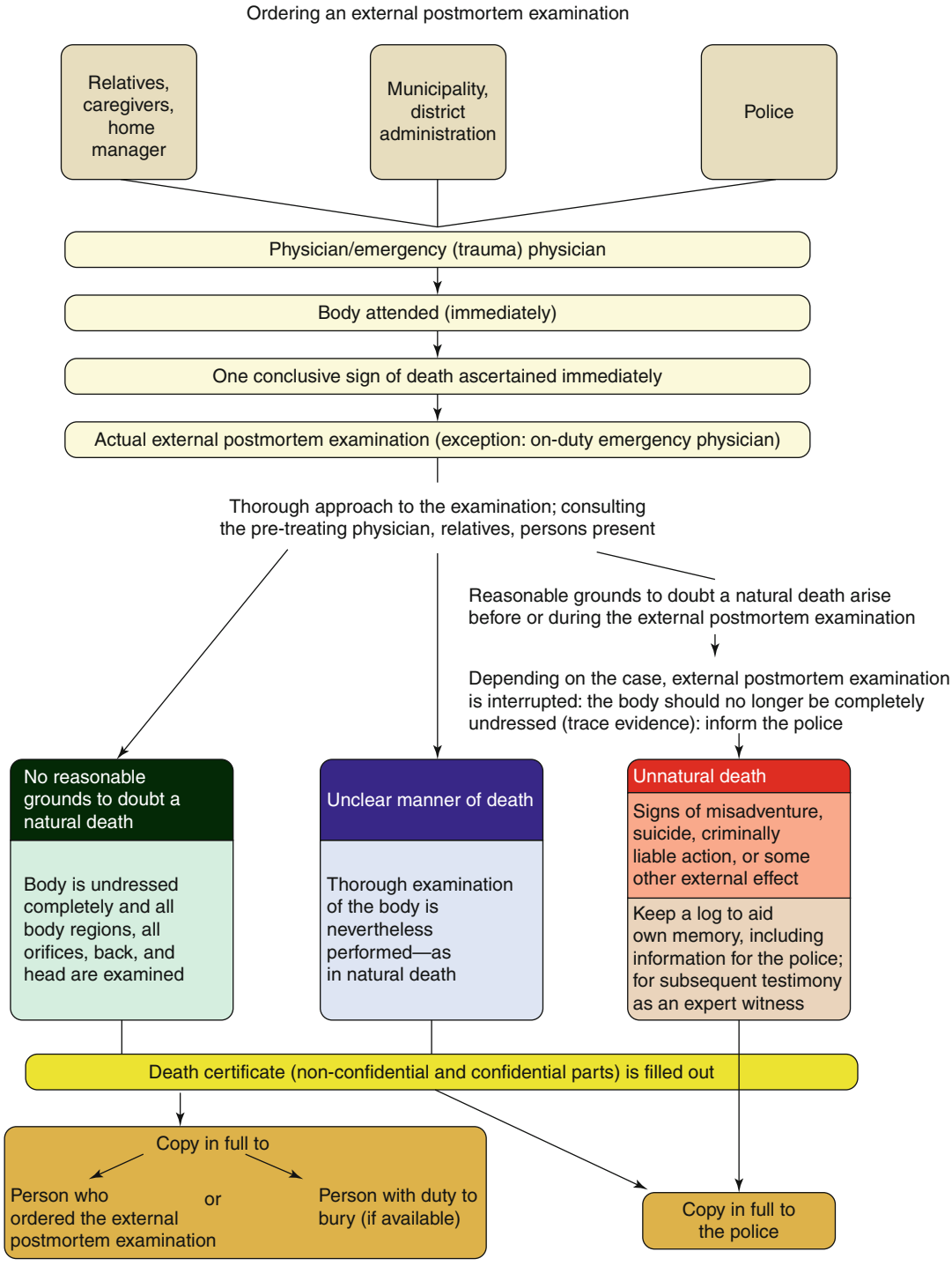


Fig. 2.3 Flowchart for performing a medical external examination (Modified from Hof (2001))

Table 2.3 Place of death and duty to instigate an external postmortem examination (depending on the legal situation)

Place of death or circumstances of death	Party obliged to instigate a postmortem external examination
Private home or private land	Relatives (spouse, partner, children, parents, other persons belonging to the domestic household) Owner or proprietor of the home or land Persons incidentally present
Hospital or clinic	Hospital or clinic management/ head physician
Homes, institutions, schools, etc.	Management of the institution
Ships, aircraft	Ship's or aircraft's captain
Live births irrespective of weight and stillbirths >500 g	Midwife or physician present at the birth or any other person present at the birth or who learnt of the birth through own findings
Discovery of a dead body	Anyone discovering a dead body has a duty to instigate a postmortem external examination; however, once informed, the police instigate the medical external examination

Stillbirth: Dead fetus weighing >500 g and showing no signs of having lived outside the uterus

Live birth: Fetus showing the following signs of having lived outside the uterus (irrespective of umbilical cord transection, placental expulsion, and birth weight)—heartbeat, pulsation of the umbilical cord, and natural pulmonary respiration

Depending on the legal situation, the place of death determines who is obliged to instigate an external postmortem examination (Table 2.3).

Important: **The place of death should also serve as the place at which the external postmortem examination is carried out**. **Where this is not possible**, **such as in a public place or a location that poses a possible hazard to the examiner**, **the examination can be continued at a more suitable location once death has been determined and documented**.

2.2.2 Timing of the External Postmortem Examination

Some countries make legal requirements relating to the time of the postmortem examination. In Germany, it should be carried out either "immediately," "promptly," or within a legally specified time period (8–12 h). Where death is unequivocal, the physician with a duty to perform the postmortem external examination should not interrupt the treatment of other patients or a surgical procedure on the basis of the examination.

Rights and Duties of the Certifying Physician. Depending on the legal framework, emergency or certifying physicians have the right to:

- Gain access to the place of death or scene at which a body was discovered (= permissible breach of the basic right of inviolability of the home)
- Request information from any persons with knowledge relating to the circumstances of death, including physicians who previously treated the deceased (= permissible breach of medical confidentiality)

If an emergency or certifying physician is refused access to the relevant site, access should be forcibly gained by the attending police officers. When filling out the death certificate, any information obtained should be noted in the fields relating in particular to underlying disease and cause of death, taking the specific circumstances of death into consideration. Physicians can refuse to provide information in the case of, for example, possible treatment errors associated with the death in question.

Undressing a Dead Body. The dead body should be examined in an undressed state under good lighting conditions (ideally in daylight); moreover, the examination should include inspection of the anterior and posterior sides of the body as well as all orifices. Any plasters or dressings should be removed unless a forensic autopsy is envisaged due to suspected unnatural death or unknown cause of death. Naturally, determining death always takes priority and making alterations at the scene of discovery, to clothing, and to the body is permitted to this end.

Table 2.4 Determining death: definite and inconclusive signs of death

Definite signs of death	Inconclusive signs of death
Livor mortis	Lack of consciousness or coma
Rigor mortis	Absence of spontaneous pulmonary respiration
Putrefaction	No pulse, no heartbeat
Mutilation of the body incompatible with life (e.g., internal organ evisceration)	Dilated, unresponsive pupils
Brain death identified under clinical conditions and in the setting of assisted ventilation (= state of irreversible loss of all cerebral, cerebellar, and brainstem functions). Depending on the legal framework, a distinction is made between complete and partial brain death!	Absence of reflexes (areflexia), loss of muscle tone

Determining Death. Death is determined on the basis of identifying reliable signs of death. In the absence of these signs during the early phase or in the case of an apparent state of death, attempts at resuscitation should be initiated. Under no circumstances should the determination of death be based on inconclusive signs of death (Table 2.4).

Death can only be conclusively determined once at least one definite sign of death has been identified or following 30 min of unsuccessful resuscitation and around 30-min asystole on ECG despite adequate resuscitation efforts in the proven absence of hypothermia or intoxication.

Important: **Marked cooling of the body and skin pallor should not be interpreted as definite signs of death**. **Incorrect determination of death is seen most notably in cases of intoxication and hypothermia**.

Determining the Time of Death. Information on time of death according to year, day, and time of day are required. Providing this information is straightforward assuming:

- Death occurred under medical supervision
- Reliable witnesses are able to report the time life expired
- An ultrashort agonal period in the case of an accident/disaster (e.g., an explosion) can be assumed
- The time of the accident/disaster corresponds to the time of death

In other cases, a period of death should be given; where applicable, an additional note stating "time of death according to information from…" is recommended. Inexperienced certifying physicians should restrict their time of death determinations to approximate time estimations based on the extent of rigor mortis, livor mortis, and body temperature (the body is still warm or has already cooled). A specialist forensic examination should be called for in cases where the time of death is of particular relevance.

Performing an External Postmortem Examination. The regulations governing how to perform external postmortem examinations and autopsies (see Chap. 4) in Germany can be found in the German Association of the Scientific Medical Societies (AWMF) Guidelines Register (Guidelines of the German Society of Forensic Medicine, DGRM), No. 054/002 (http://www.uni-duesseldorf.de/WWW/AWMF/11/054-002.htm).

Important: **An external postmortem examination should be carried out on a fully unclothed body and should include inspection of all body orifices under good light conditions**.

2.3 Collecting Evidence at the Scene of Discovery

Issues relating to the collection of evidence may be relevant to the emergency or certifying physician if indications point to an unnatural death or if the mode of death is unknown. The following applies in such cases:

- The external examination should be discontinued.
- The police should be notified immediately.
- No further alterations should be made at the scene of discovery.
- Make a record of all alterations already undertaken: Changes in position, partial undressing of the body, cutting open of clothes, aspiration,

other medical steps taken on the body, and unusual findings on the body.
- Ensure that no alterations are made to the scene of discovery by third persons present at the scene.
- As a memory aid, the certifying physician should compile a short record for himself or herself in the event questions arise possibly days or weeks later. Particularly relevant details may include those persons present and their behavior; apparent injury to persons present; indications of alcohol, drug, or medication use; indications of a physical confrontation; and whether doors and windows are locked.

When it is apparent, or later comes to light, that a crime has been committed, the emergency physician and/or certifying physician may be summoned by the investigating authorities to give evidence as an expert witness at court.

Fig. 2.4 Rectal prolapse seen at external postmortem examination

2.4 Abnormal Findings and Information at External Postmortem Examination

In the course of the mandatory external postmortem examination of a dead body, findings requiring closer inspection may be made on clothing on the body, in the immediate vicinity of the body, or in the form of information provided by relatives or witnesses. Suspicious findings can include those identified on the body (e.g., abnormal findings that in fact occurred post-mortem, findings resulting from the body being in an unusual position following death, or findings due to autolysis or putrefaction), or those found in the vicinity of the body. The following examples are taken from the broad spectrum of conceivable abnormal findings:
- Petechiae in the conjunctivae and scalp in a head-down position are interpreted as possibly the result of compression trauma to the neck.
- Vibices in areas of livor mortis in a head-down position are often misinterpreted as antemortem hemorrhage due to trauma to the neck.
- Putrefactive changes may lead to incorrect assessments [e.g., rectal prolapse (Fig. 2.4) or coffin birth due to putrefaction].
- Light-brown/ocher-colored areas of dry skin due to postmortem pressure points may be misinterpreted as antemortem injuries (Fig. 2.5).
- Skin discoloration and corresponding marks consistent with medical intervention, e.g., defibrillator marks (Fig. 2.6) or the imprint of a bite block, may be misinterpreted as due to antemortem blunt force trauma (Fig. 2.7).
- Tears in the seams of clothing, e.g., armpit seams of a shirt, may be interpreted as due to physical conflict when in reality they occurred during transportation of the body post-mortem.
- Indications of a break-in, a physical conflict in the home, or entertaining guests shortly prior to death are not considered as possible indications of an unnatural death.
- No possible causal link is made between information relating to accidents in the deceased's history and their death.
- Serious discrepancies between information on past history and previous disease fail to prompt further investigations (e.g., reporting sudden death where the cause of death has been given as hepatic coma and the body shows marked jaundice).

Fig. 2.5 Parallel marks above the occipital frontal circumference misinterpreted as a fatal blow to the head. In reality, the head had lain against the sections of a radiator post-mortem. No regional hemorrhage was seen at autopsy (image kindly provided by the competent police authorities)

Fig. 2.6 Defibrillator marks in a typical localization, misinterpreted as blunt force trauma inflicted by a third party (image kindly provided by the competent police authorities)

There are numerous other examples seen in forensic practice that necessarily lead to uncertainty and thus, quite reasonably, result in the police being notified. It should be noted, however, that further investigation frequently yields no indication of third-party responsibility and that already overstretched police officers often urge the certifying physician to record a natural death in the death certificate.

Fig. 2.7 A bite block left on the body following death in an epileptic state led in this case to postmortem pressure-related skin discoloration; the certifying physician expressed suspicion of asphyxia with a soft cover and notified the police

A systematic approach to examining the unclothed body is recommended in order to avoid overlooking important findings at external postmortem examination. Thus, a thorough examination involves careful attention to or inspection of the following:

General findings: Sex, age, type of physique, height, weight, nutritional and personal-care status, skin color, areas of swelling, asymmetries, scars, tattoos, amputations, degree of rigor mortis, extent of livor mortis, signs of putrefaction, injuries, impurities, and signs of mummification.

Head: Deformities, bony reaming, swelling, hematomas, and fluid effusion from natural orifices. Hairy scalp: hair color, hair length, swelling, transections, abnormal discoloration, and deposits on the scalp or hair. Non-hairy forehead: eyebrows, eyelids, conjunctivae, eyeball consistency, pupil width and anisocoria, facial skin, palpable fractures of the skull and facial bones, outer nostrils, upper and lower lips, corners of the mouth, (saliva) contact traces, oral vestibule and oral cavity (foam cone?), oral mucosa, dental characteristics, tongue position, checking for oral

odor (aromatic, acetonemic, uremic, or of bitter almonds/garlic) by pressing the edge of the left costal arch at the medioclavicular line, outer ear, and external auditory canals.

Neck: Mobility, findings on and in neck skin (strangulation marks, including manual and ligature strangulation marks), puncture sites, swelling, hematomas, scratches, and areas of drying due to abrasion.

Chest: Shape of the chest, symmetry, stability, and mobility, scars, defibrillation marks, injuries and discoloration, and assessment of the nipples; is skin emphysema palpable?

Abdominal walls: Above, at, or beneath chest level, curvatures, abdominal tension (gas congestion), scars, striae, puncture marks (e.g., heparin injections), pattern of hair growth, and pelvic ring mobility.

Anogenital region: Penis, scrotum, position of the testes, the major and minor labia and the hymen, deposits/trace evidence (blood, foreign bodies, secretions, feces), injuries, as well as the anal ring.

Extremities: Shape; form; mobility; edema; atrophy; lateral and circumferential differences (deep vein thrombosis!), evaluated separately according to upper and lower leg; shortening of extremities; amputations; scars; needle tracks, particularly on the flexor side of the elbow in i.v. drug abuse; and scars due to tentative wounds (previous suicide attempt?). Assessing the palms of the hands and soles of the feet: color of finger- and toenail beds, possibly collecting evidence found below fingernails by clipping the nails (take evidence separately for each finger!); applying adhesive tape to the palms of the hands (Frei's fiber test) in cases of fatal strangulation; palms and flexor side of the fingers (electrical burns?); washerwoman's skin on the palms of the hands and soles of the feet; and skin wounds on the palms of the hands and skin between the thumb and index finger (active defense wounds, seen most notably in sharp force trauma such as knife stabs, etc.).

Back: Pressure marks, swelling, discoloration, scars, injuries, and decubitus ulcers (in the buttock region, over the tips of the shoulder blades, over spinous processes, and on the heels!).

In specific cases, photodocumentation should be compiled at the time of external postmortem examination irrespective of whether or not an autopsy is foreseen. Making sketches can also be helpful, using, for example, a printed body diagram. In rare cases, it is necessary for an expert appraisal to be based purely on postmortem radiological findings; occasionally, an external postmortem examination consists solely of taking a blood sample from a femoral vein for blood alcohol determination.

2.5 Duty of Due Diligence at External Postmortem Examination

Failure to exercise due diligence at external postmortem examination can lead to unnatural deaths, including homicides, remaining undetected. Thus, misplaced consideration for the relatives of the deceased is ill-advised. Relatives should be made aware of the certifying physician's legal obligation to perform an external postmortem examination with due diligence.

Depending on the legal framework, a breach of the established rules relating to medical diligence at external postmortem examination can represent an offense punishable with a fine. Some cases may even result in criminal sanctions, such as manslaughter charges (see "Case Study" below).

Case Study

The physician facing prosecution had failed to undress the body of a 70-year-old woman found lifeless in a bathroom, thereby overlooking bright red livor mortis. Shortly thereafter, the deceased's daughter was also found dead in the same bathroom. It was subsequently revealed that both women had died of CO poisoning. Due to his failure to undress the body of the 70-year-old woman, the physician had not observed the characteristic bright red livor mortis.

Had he performed the external postmortem examination of the first victim according to regulations, the daughter's death may have been avoided. Criminal proceedings were taken against the physician and he was found guilty of manslaughter.

An official death certificate is completed once an external postmortem examination has been performed. One portion of the death certificate is intended for the official register of births, deaths, and marriages and includes the deceased's personal details, form of identification, determination of death, as well as additional information in the case of stillbirths or possible infectious diseases.

Another portion of the death certificate comprises information on the type of disease that caused death. A plausible chain of causality in terms of pathological changes that could lead to death should be given here (the medical determination of the cause of death).

Determining the Cause of Death. Information relating to cause of death is structured in the death certificate according to the WHO sample certificate, the International Form of Medical Certification of Cause of Death (Fig. 2.2). Each line is numbered as follows:

Ia = immediate cause of death
Ib = antecedent cause, i.e., morbid conditions giving rise to the immediate cause of death mentioned in 1a
Ic = underlying cause, i.e., the primary cause or underlying morbid condition
II = other significant morbid conditions contributing to death but unrelated to the underlying morbid condition mentioned in 1c

A scientifically and medically recognized pathophysiological mechanism should exist between the underlying morbid condition given and the immediate cause of death. Each field should additionally include information on the duration of the morbid condition prior to death, thus enabling its time course to be checked for plausibility. A number of sample cases are provided below by way of illustration:

Example 1:
Ia: Myocardial infarction (hours)—due to
Ib: Fresh coronary thrombosis (hours)—due to
Ic: Stenosing coronary sclerosis (years)
II: Hypertension, diabetes mellitus

Example 2:
Ia: Right ventricular decompensation (1 h)—due to
Ib: Recurrent pulmonary thromboembolism (2 h)—due to
Ic: Deep vein thrombosis (days)
II: Left-sided hypertensive intracerebral hemorrhage with right hemiparesis (6 months)

Example 3:
Ia: Cardiac tamponade (minutes)—due to
Ib: Dissecting aortic aneurysm (hours)—due to
Ic: Idiopathic medial necrosis of the aortic wall (years)
II: Hypertension, liver cirrhosis, and pyelonephritis

Example 4:
Ia: Polytrauma involving numerous body parts
Ib: Struck by a rail vehicle
Ic: Known depression
II: Diabetes mellitus

It is not always essential to complete all lines. If the cause of death (a mandatory field) is not the result of an underlying morbid condition, no further information is required, e.g., if the entry in field Ia is "narcotic poisoning," the other fields (Ib, Ic, and II) remain empty.

It is not uncommon, even after additional information has been gathered, for the medical cause of death to remain unexplained; this should be noted accordingly in the death certificate. Entering a speculative immediate cause of death, a pathophysiologically unfounded end state, or a meaningless diagnosis is not acceptable either in terms of cause of death statistics or as a basis for classifying the mode of death.

Important: **Inconclusive diagnoses**, **as well as entering the end states of any process of dying**, **should be avoided**, **e.g.**, "**old age**," "**heart failure**," "**respiratory arrest**," "**circulatory collapse**," **or** "**loss of the will to live**."

Findings are evaluated in terms of their relevance to the cause of death and weighted accord-

ingly, resulting in their differentiated classification into three groups:

Group I. Findings on the immediate cause of death and the underlying morbid condition/trauma may provide a highly plausible explanation in terms of causality and time course, as seen in "hard" causes of death: the underlying morbid condition and immediate cause of death are closely linked on a pathophysiological level, both occurring at a short time interval from one another (e.g., extensive subarachnoid hemorrhage due to a ruptured basilar artery aneurysm).

The mode of death can be clearly classified.

Group II. In contrast, a known disease can cause death by several different pathomechanisms, or several concomitant underlying diseases can converge in a final stage to cause death, so-called "soft" causes of death (e.g., stenosing coronary sclerosis and right lower lobe pneumonia in the setting of chronic lymphocytic leukemia). It is sometimes possible to identify the principal immediate cause of death from the deceased's medical history.

Classifying the mode of death may be problematic and needs to be performed on a case-by-case basis.

Group III. Lastly, there are cases of death in which, due to insufficient information on the deceased's medical history and lack of background knowledge relating to the circumstances of death, an immediate cause of death or relevant underlying disease cannot be recorded. In such cases, if the cause of death is recorded as unclear, the mode of death should likewise be recorded as unclear.

The mode of death can be classified as "unclear" or "unexplained."

Nevertheless, there are numerous medically accepted direct or indirect causes of death that are either organ-specific or non-organ-specific. Organ-specific causes of death include, for example, hepatic coma following decompensated liver cirrhosis in chronic alcohol abuse or central regulatory failure due to an epileptic state, intracerebral hemorrhage, subdural hematoma, or leptomeningitis. Non-organ-specific causes of death include embolisms or death due to sepsis.

Important: **Before filling out a death certificate**, **the certifying physician should always check whether the deceased's medical history and the circumstances of death plausibly explain final morbidity**, **in addition to whether the acuity of death can be accounted for**. **Where no plausible cause of death is found**, **this should be recorded on the form**.

Numerous studies have shown that the correspondence rate between causes of death recorded on death certificates and actual causes of death established at autopsy is 50–60 % at best. This is by no means due to a lack of diligence among certifying physicians, but rather to the unpredictability of the biological organism and its susceptibility to a multitude of possible diseases. Improving the data on actual causes of death could only be achieved by significantly increasing the number of autopsies performed.

Classifying the Manner of Death. Information on the manner of death should be recorded separately from information on the cause of death. Whereas the cause of death relates to the medical and scientific cause of death, information on the manner of death relates to the circumstances of death in terms of their criminological relevance: natural, unnatural, or unexplained. Thus, classifying the manner of death is in some cases of crucial importance in terms of the further measures taken by the authorities. In this context, the following applies:

Natural death: Death as a consequence of pathological internal causes that are in no way attributable to legally relevant external factors.

Unnatural death: Death as a consequence of an event that was caused, triggered, or influenced externally (including self-inflicted and third-party effects).

Unexplained manner of death: In the absence of evidence of a natural death, it is not possible to conclusively determine the manner of death solely on the basis of a medical external postmortem examination.

Determining whether or not a death was natural is paramount, i.e., identifying a defined internal disease for which the deceased received medical treatment ante-mortem and which, according to the given time course, could have

Table 2.5 Information or findings pointing to an unnatural cause of death

Patient history	Findings on the body
Sudden death	Congestive hemorrhage
No detectable preexisting disease	Color of livor mortis
Occupational, traffic, or other sort of accident	Odor of air from the lungs
Situation in which the body was discovered (e.g., drug paraphernalia at the scene of discovery)	Tablet remnants in the oral vestibule or mouth
Unexpected death in particularly young individuals (<40 years)	Injuries on the body

plausibly caused death, while at the same time there are no identifiable indications of an unnatural death. It is important to bear in mind here that even an individual suffering from a serious disease that could plausibly cause imminent death may be the victim of an unnatural death (poisoning, homicide to accelerate an inheritance process). Therefore, it is important to be aware of all findings that could point to an unnatural death. While legal definitions of unnatural death provide orientation, they are of only limited help in practice. One particular definition reads:

Any death resulting from suicide, an accident, an error in medical treatment, or any other external effect caused by the conduct of a third-party (death by a third party) is considered an unnatural death.

In practice, it is crucial to be able to recognize the signs of an unnatural death precisely as such. These signs may be apparent in the patient history or in findings made on the body (Table 2.5). It is sometimes necessary to verify findings in terms of whether processes associated with a natural death could be considered as the cause of death.

Since homicide can leave little or no trace, an absence of injuries is not sufficient grounds to assume a natural death. Finally, even if no indications of third-party involvement are found at the scene of discovery, this should not be taken as confirmation of a natural death. Particular attention should be paid to sequelae following (initially) survived trauma, i.e., delayed death following trauma. The following applies in this context:

Important: **Causality between the primary effect at the beginning of the causal chain resulting in death and death itself is not diminished with time—the interval may be many years**.

Incorrect death certification is seen most notably in cases with longer time intervals between the primary trauma/effect and the time of death, despite the fact that causality can be proven scientifically and medically and is recognized legally. The following examples illustrate this well:

Example 1: As a result of a road traffic accident, a cyclist suffered a lower leg fracture that could be treated successfully. The cyclist developed deep vein thrombosis in the lower leg followed by fatal pulmonary embolism 1 year later (= unnatural death).

Example 2: A female patient was left bedridden in a comatose state following hypoxic brain damage due to a mistake in anesthesia. The patient died of pneumonia after 6 years (= unnatural death).

Example 3: A patient suffered acute allergic shock following the application of a medically indicated medication (= unnatural death).

Example 4: A former metal worker died of malignant pleural mesothelioma 20 years after his final massive exposure to asbestos in an occupational capacity (= suspected unnatural death; the competent insurance institution was notified of this suspicion for the purposes of further verification and, where necessary, to call for an autopsy) (= suspected unnatural death)

The above examples also serve to clearly illustrate that classifying the mode of death is in no way linked to the question of guilt. Death due to allergic shock occurred despite correct administration of medical treatment, but the adverse drug reaction (ADR) caused distinctly premature death. However, there are specific borderline cases involving therapeutically acceptable causation of premature death. This is true, for example, of cancer patients in whom morphine-based pain medication possibly leads to a premature death, as well as in cancer patients who die as a result of

the effects of medically indicated and correctly administered chemotherapy, although without this therapy their malignancy may have caused death at an earlier—or later—point in time.

Case Study
Diagnostic coronary angiography was performed on a 56-year-old man with an abnormal stress ECG. The patient suffered circulatory collapse and asystole 2 h following the hitherto complication-free intervention. Resuscitation attempts were unsuccessful. The man had felt perfectly well that morning as he walked by foot to the examination. Due to the short time interval between the intervention and death, the man's relatives expressed suspicion that an error in medical treatment had occurred. At autopsy, cardiac tamponade due to coronary wall rupture was identified, an extremely rare yet typical complication of coronary angiography that patients need to be informed of prior to the intervention, as was the case in this particular instance.

It is not intraoperative deaths in severely ill or polytraumatized patients who succumb to their underlying disease or injuries despite interventions performed according to correct medical practice that are seen as problematic, but rather those deaths involving either patients whose quoad vitam prognosis up to the time of death was not particularly alarming or indeed patients who were largely in good health.

The question of whether a death should be certified as unnatural in cases where the unavoidable risk of a medical intervention becomes a harsh reality is a controversial one. There are those who demand at least a remote indication of a breach of the recognized rules of medical diligence (treatment error) in order for death to be suspected as unnatural. However, with regard to the case study described above, one can assume—in contrast to advanced-stage cancer patients who die as a result of their malignancy—that coronary angiography was responsible for causing the patient's death, possibly many years prematurely.

Case Study
A 77-year-old woman was treated for a femoral neck fracture with a total endoprosthesis. The patient developed postoperative right ventricular heart failure in the recovery room and died. Autopsy confirmed the surgeons' suspected diagnosis of partially fracture-related and partially unavoidable surgery-related fatal bone marrow and fat embolism. It was not possible to establish beyond a doubt whether the woman would have lived longer had she not undergone the operation. Meanwhile, police inquiries revealed that the patient had suffered a fall while walking to the toilet at the nursing home for the elderly where she was a resident. In contravention of explicit instructions that the overweight woman should always have two caregivers to support her when walking, she had been accompanied on the occasion in question by only one caregiver, who was not strong enough to prevent the fall. The patient would not have died at that point in time had instructions been followed.

Bone marrow and fat embolism during (in particular the bone cement phase) and following endoprosthetic surgery for femoral head fractures is a known yet rarely fatal complication that the patient needs to be informed about. In the event of this type of embolism, death usually occurs as the result of a fall in the home (an accident) and is therefore classified as an unnatural death. Accidents, like the one described above, which could be avoided through due care and diligence can result in legal prosecution for negligent manslaughter.

Death on the Operating Table. The death of a patient directly during a medical intervention, notably on the operating table, is a particularly challenging situation. In such cases, classifying the death as "unexplained" and notifying the

relevant authorities, even if the treating physician temporarily makes himself or herself the subject of a criminal investigation, is advised. The death certificate should be filled out by an impartial physician in order to avoid any suspicion of concealment by the operating physician. This could be regulated either by law or, for example, by hospital regulations. Most particularly in cases of death on the operating table, the underlying disease and cause of death need to be established at autopsy before any comment can be made on the question of a possible treatment error. A review of medical malpractice claims reveals that autopsies almost always result in exoneration of the accused physician.

Important: **Classifying death as "natural" is not recommended in cases of death on the operating table since**, **at any subsequent official inquiry**, **the treating physician may be suspected of attempting to conceal a medical error**. **The death certificate should be filled out by an impartial physician uninvolved in either the diagnosis or treatment of the patient**.

The death certificate must be filled out once the external postmortem examination has been completed and all available information has been collected. In a departure from specifications in the WHO's international death certificate (Fig. 2.2), some death certificates require more differentiated information, such as the US Standard Certificate of Death (Fig. 2.8), which includes a special section requiring information on the cause of death (Fig. 2.9) and the approximate time between disease onset and death.

2.6 Second External Postmortem Examination at the Crematorium

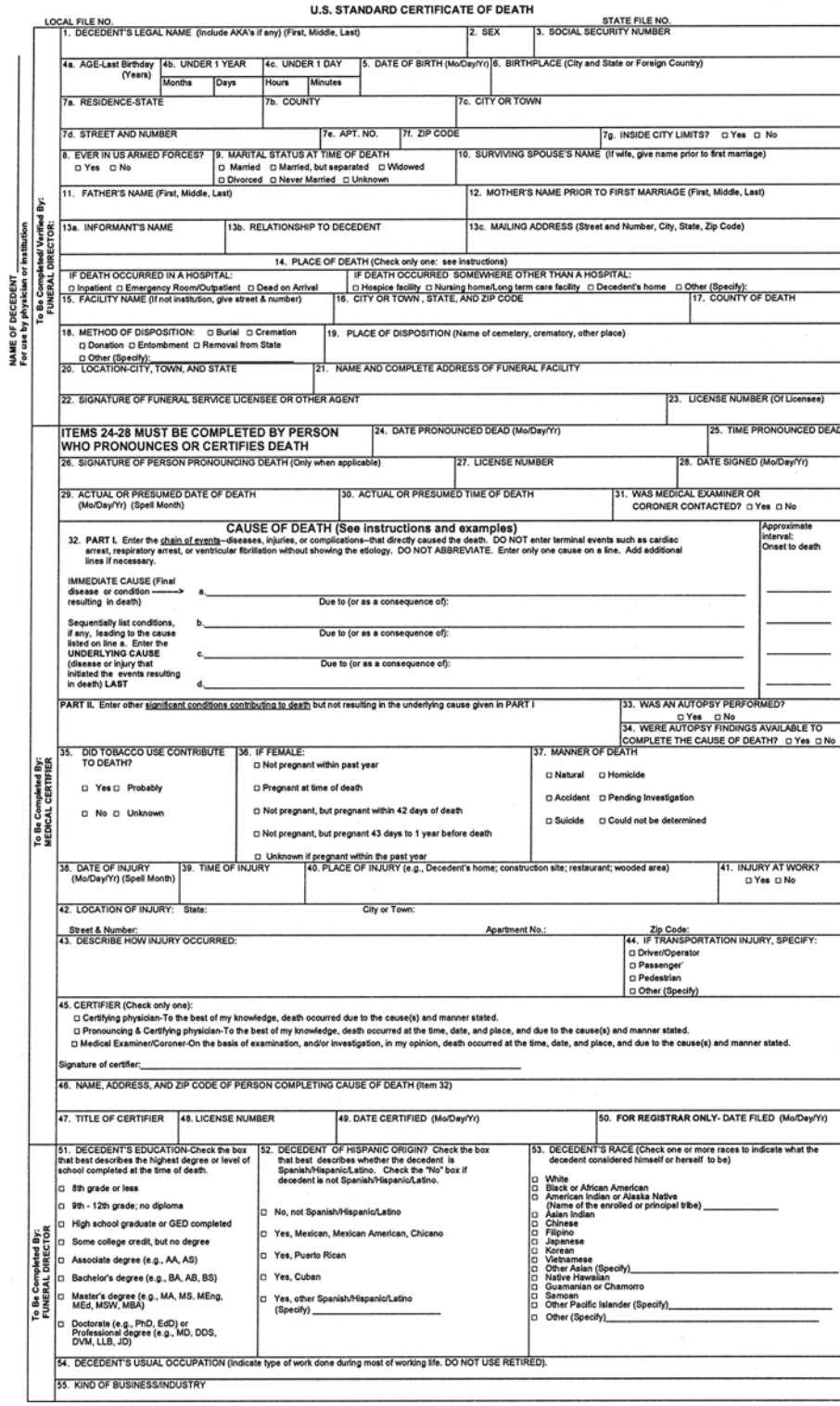
In countries where inhumation is predominantly practiced, a second external postmortem examination is sometimes required by law if cremation or burial at sea is planned. Since the body is irretrievably disposed of in both these cases, a second examination is designed to carefully reexamine the body and compare any findings with information given in the death certificate. Further information may be requested from the first certifying physician, as well as from other physicians involved in the previous treatment of the deceased, in order to clarify any conflicting information. If doubts persist as to whether death was natural, the body is not released for cremation. Any indication of an unnatural death should prompt the second certifying physician to notify the authorities. The public prosecutor's office will then decide whether a forensic autopsy is required. However, depending of the results of police inquiries, the public prosecutor's office can also release a body for cremation without calling for an autopsy.

Previously overlooked indications of homicide (small gunshot wounds or ligature marks missed by the first certifying physician), as well as reasonable suspicion of a treatment error or error in care, can give rise to an autopsy following the (second) external postmortem examination. Furthermore, a second external examination is intended to identify and further clarify deaths with long intervals since the harmful event (road traffic accident, occupational accident) that have been incorrectly classified as natural, as well as cases of suspected fatal occupational disease, prior to cremation.

2.7 The External Postmortem Examination and Recording Causes of Death/Fatal Injury

External postmortem examinations and death certification form the basis of statistical information on death due to natural causes or fatal external trauma. According to WHO World Health Statistics (WHO 2008), the following represent the most frequent causes of death:

1. Ischemic heart disease
2. Cerebrovascular disease
3. Lower respiratory infections
4. Chronic obstructive pulmonary disease
5. Diarrheal diseases
6. HIV/AIDS
7. Tuberculosis
8. Trachea, bronchus, and lung cancers
9. Road traffic accidents



U.S. STANDARD CERTIFICATE OF DEATH

LOCAL FILE NO. STATE FILE NO.

NAME OF DECEDENT
For use by physician or institution
To Be Completed/Verified By: FUNERAL DIRECTOR:

1. DECEDENT'S LEGAL NAME (Include AKA's if any) (First, Middle, Last) | 2. SEX | 3. SOCIAL SECURITY NUMBER

4a. AGE-Last Birthday (Years) | 4b. UNDER 1 YEAR Months Days | 4c. UNDER 1 DAY Hours Minutes | 5. DATE OF BIRTH (Mo/Day/Yr) | 6. BIRTHPLACE (City and State or Foreign Country)

7a. RESIDENCE-STATE | 7b. COUNTY | 7c. CITY OR TOWN

7d. STREET AND NUMBER | 7e. APT. NO. | 7f. ZIP CODE | 7g. INSIDE CITY LIMITS? ☐ Yes ☐ No

8. EVER IN US ARMED FORCES? ☐ Yes ☐ No | 9. MARITAL STATUS AT TIME OF DEATH ☐ Married ☐ Married, but separated ☐ Widowed ☐ Divorced ☐ Never Married ☐ Unknown | 10. SURVIVING SPOUSE'S NAME (If wife, give name prior to first marriage)

11. FATHER'S NAME (First, Middle, Last) | 12. MOTHER'S NAME PRIOR TO FIRST MARRIAGE (First, Middle, Last)

13a. INFORMANT'S NAME | 13b. RELATIONSHIP TO DECEDENT | 13c. MAILING ADDRESS (Street and Number, City, State, Zip Code)

14. PLACE OF DEATH (Check only one: see instructions)

IF DEATH OCCURRED IN A HOSPITAL: ☐ Inpatient ☐ Emergency Room/Outpatient ☐ Dead on Arrival

IF DEATH OCCURRED SOMEWHERE OTHER THAN A HOSPITAL: ☐ Hospice facility ☐ Nursing home/Long term care facility ☐ Decedent's home ☐ Other (Specify):

15. FACILITY NAME (If not institution, give street & number) | 16. CITY OR TOWN, STATE, AND ZIP CODE | 17. COUNTY OF DEATH

18. METHOD OF DISPOSITION: ☐ Burial ☐ Cremation ☐ Donation ☐ Entombment ☐ Removal from State ☐ Other (Specify): | 19. PLACE OF DISPOSITION (Name of cemetery, crematory, other place)

20. LOCATION-CITY, TOWN, AND STATE | 21. NAME AND COMPLETE ADDRESS OF FUNERAL FACILITY

22. SIGNATURE OF FUNERAL SERVICE LICENSEE OR OTHER AGENT | 23. LICENSE NUMBER (Of Licensee)

To Be Completed By: MEDICAL CERTIFIER

ITEMS 24-28 MUST BE COMPLETED BY PERSON WHO PRONOUNCES OR CERTIFIES DEATH

24. DATE PRONOUNCED DEAD (Mo/Day/Yr) | 25. TIME PRONOUNCED DEAD

26. SIGNATURE OF PERSON PRONOUNCING DEATH (Only when applicable) | 27. LICENSE NUMBER | 28. DATE SIGNED (Mo/Day/Yr)

29. ACTUAL OR PRESUMED DATE OF DEATH (Mo/Day/Yr) (Spell Month) | 30. ACTUAL OR PRESUMED TIME OF DEATH | 31. WAS MEDICAL EXAMINER OR CORONER CONTACTED? ☐ Yes ☐ No

CAUSE OF DEATH (See instructions and examples)

Approximate interval: Onset to death

32. **PART I.** Enter the chain of events--diseases, injuries, or complications--that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.

IMMEDIATE CAUSE (Final disease or condition ------> resulting in death) a. _____ Due to (or as a consequence of):

Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST
b. _____ Due to (or as a consequence of):
c. _____ Due to (or as a consequence of):
d. _____

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I

33. WAS AN AUTOPSY PERFORMED? ☐ Yes ☐ No

34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? ☐ Yes ☐ No

35. DID TOBACCO USE CONTRIBUTE TO DEATH? ☐ Yes ☐ Probably ☐ No ☐ Unknown

36. IF FEMALE: ☐ Not pregnant within past year ☐ Pregnant at time of death ☐ Not pregnant, but pregnant within 42 days of death ☐ Not pregnant, but pregnant 43 days to 1 year before death ☐ Unknown if pregnant within the past year

37. MANNER OF DEATH ☐ Natural ☐ Homicide ☐ Accident ☐ Pending Investigation ☐ Suicide ☐ Could not be determined

38. DATE OF INJURY (Mo/Day/Yr) (Spell Month) | 39. TIME OF INJURY | 40. PLACE OF INJURY (e.g., Decedent's home; construction site; restaurant; wooded area) | 41. INJURY AT WORK? ☐ Yes ☐ No

42. LOCATION OF INJURY: State: City or Town: Street & Number: Apartment No.: Zip Code:

43. DESCRIBE HOW INJURY OCCURRED:

44. IF TRANSPORTATION INJURY, SPECIFY: ☐ Driver/Operator ☐ Passenger ☐ Pedestrian ☐ Other (Specify)

45. CERTIFIER (Check only one):
☐ Certifying physician-To the best of my knowledge, death occurred due to the cause(s) and manner stated.
☐ Pronouncing & Certifying physician-To the best of my knowledge, death occurred at the time, date, and place, and due to the cause(s) and manner stated.
☐ Medical Examiner/Coroner-On the basis of examination, and/or investigation, in my opinion, death occurred at the time, date, and place, and due to the cause(s) and manner stated.

Signature of certifier: _____

46. NAME, ADDRESS, AND ZIP CODE OF PERSON COMPLETING CAUSE OF DEATH (Item 32)

47. TITLE OF CERTIFIER | 48. LICENSE NUMBER | 49. DATE CERTIFIED (Mo/Day/Yr) | 50. **FOR REGISTRAR ONLY**- DATE FILED (Mo/Day/Yr)

To Be Completed By: FUNERAL DIRECTOR

51. DECEDENT'S EDUCATION-Check the box that best describes the highest degree or level of school completed at the time of death.
☐ 8th grade or less
☐ 9th - 12th grade; no diploma
☐ High school graduate or GED completed
☐ Some college credit, but no degree
☐ Associate degree (e.g., AA, AS)
☐ Bachelor's degree (e.g., BA, AB, BS)
☐ Master's degree (e.g., MA, MS, MEng, MEd, MSW, MBA)
☐ Doctorate (e.g., PhD, EdD) or Professional degree (e.g., MD, DDS, DVM, LLB, JD)

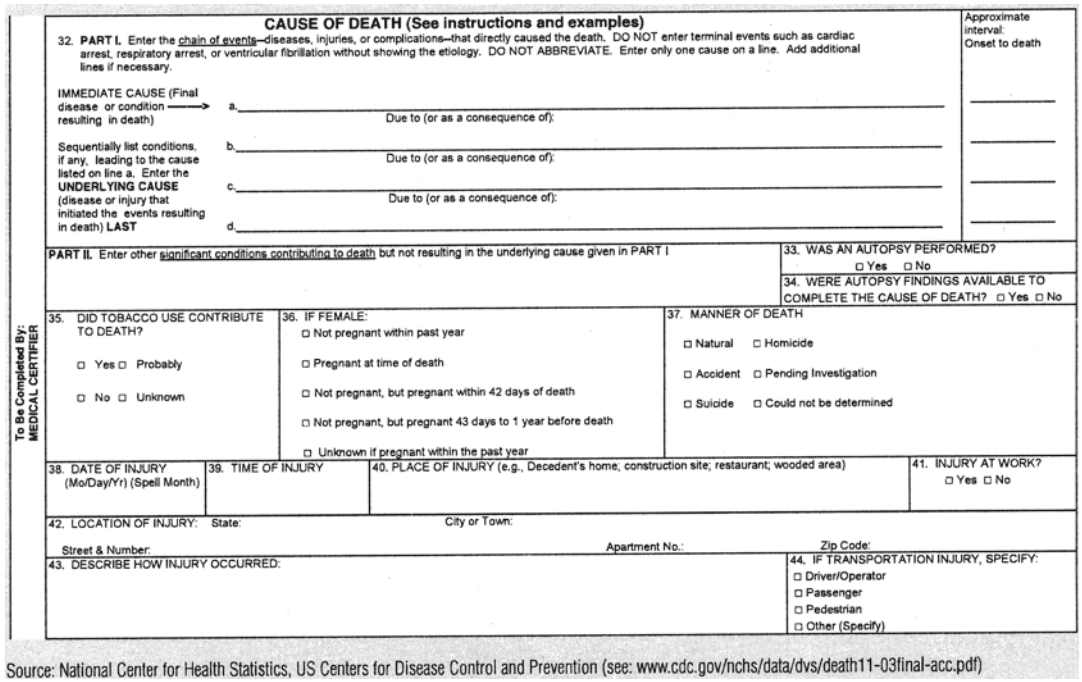
52. DECEDENT OF HISPANIC ORIGIN? Check the box that best describes whether the decedent is Spanish/Hispanic/Latino. Check the "No" box if decedent is not Spanish/Hispanic/Latino.
☐ No, not Spanish/Hispanic/Latino
☐ Yes, Mexican, Mexican American, Chicano
☐ Yes, Puerto Rican
☐ Yes, Cuban
☐ Yes, other Spanish/Hispanic/Latino (Specify) _____

53. DECEDENT'S RACE (Check one or more races to indicate what the decedent considered himself or herself to be)
☐ White
☐ Black or African American
☐ American Indian or Alaska Native (Name of the enrolled or principal tribe) _____
☐ Asian Indian
☐ Chinese
☐ Filipino
☐ Japanese
☐ Korean
☐ Vietnamese
☐ Other Asian (Specify) _____
☐ Native Hawaiian
☐ Guamanian or Chamorro
☐ Samoan
☐ Other Pacific Islander (Specify) _____
☐ Other (Specify) _____

54. DECEDENT'S USUAL OCCUPATION (Indicate type of work done during most of working life. DO NOT USE RETIRED).

55. KIND OF BUSINESS/INDUSTRY

Fig. 2.8 The US Standard Certificate of Death



CAUSE OF DEATH (See instructions and examples)

32. PART I. Enter the chain of events—diseases, injuries, or complications—that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.

Approximate interval: Onset to death

IMMEDIATE CAUSE (Final disease or condition → resulting in death) a. Due to (or as a consequence of):

Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST
b. Due to (or as a consequence of):
c. Due to (or as a consequence of):
d.

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I

33. WAS AN AUTOPSY PERFORMED? ☐ Yes ☐ No

34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? ☐ Yes ☐ No

To Be Completed By: MEDICAL CERTIFIER

35. DID TOBACCO USE CONTRIBUTE TO DEATH? ☐ Yes ☐ Probably ☐ No ☐ Unknown

36. IF FEMALE: ☐ Not pregnant within past year ☐ Pregnant at time of death ☐ Not pregnant, but pregnant within 42 days of death ☐ Not pregnant, but pregnant 43 days to 1 year before death ☐ Unknown if pregnant within the past year

37. MANNER OF DEATH ☐ Natural ☐ Homicide ☐ Accident ☐ Pending Investigation ☐ Suicide ☐ Could not be determined

38. DATE OF INJURY (Mo/Day/Yr) (Spell Month)

39. TIME OF INJURY

40. PLACE OF INJURY (e.g., Decedent's home; construction site; restaurant; wooded area)

41. INJURY AT WORK? ☐ Yes ☐ No

42. LOCATION OF INJURY: State: City or Town: Street & Number: Apartment No.: Zip Code:

43. DESCRIBE HOW INJURY OCCURRED:

44. IF TRANSPORTATION INJURY, SPECIFY: ☐ Driver/Operator ☐ Passenger ☐ Pedestrian ☐ Other (Specify)

Source: National Center for Health Statistics, US Centers for Disease Control and Prevention (see: www.cdc.gov/nchs/data/dvs/death11-03final-acc.pdf)

Fig. 2.9 Extract from the US Standard Certificate of Death: cause of death

10. Prematurity and low birth weight
11. Neonatal infections[1]
12. Diabetes mellitus
13. Malaria
14. Hypertensive heart disease
15. Birth asphyxia and birth trauma
16. Suicide
17. Stomach cancer
18. Cirrhosis of the liver
19. Nephritis and nephrosis
20. Colon and rectum cancer

"Homicide" comes 22nd on the list. However, in most countries around the world, there is no reliable or structured system for recording fatal trauma. The WHO proposed a system for recording deaths which could be used as a supplement to current death certificates and which classifies fatal trauma according to type: road traffic incident, other transport incident, blunt force (struck/hit by a person, animal, or object), fall, stab/cut, animal bite, drowning/submersion, burn (smoke/fire/flames), burn (contact with heat/scald), poisoning, suffocation, choking, hanging, electrocution, firearm discharge/gunshot, explosive blast, and envenomation, among others. In 2012, both a short version and a long version of a fatal injury surveillance data collection form were proposed with the aim of improving the worldwide lack of data. Naturally, there are significant discrepancies in the rates of death due to trauma between different areas of the world, with South Africa, for example, demonstrating particularly high rates. However, cases of fatal trauma can also be recorded to a certain extent by applying the coding system used in the International Classification of Diseases (ICD 10; see Table 2.6).

2.8 Duty to Bury

The duty to organize and pay for the burial of a deceased person usually falls to relatives. Many countries specify a fixed hierarchy of relatives upon whom the duty to bury falls (e.g., spouse, biological or adopted children, parents, siblings, grandparents). If the wishes of the deceased are unknown, the type of burial (inhumation,

[1]Comprises severe neonatal infections and other noninfectious causes arising during the perinatal period

Table 2.6 External causes of injury and their corresponding ICD codes (Bartolomeos et al. 2012)

External cause of injury	ICD-10 Code
All injuries	Vo1-Y98
Unintentional injuries	V01-X59, Y40-Y86, Y88, Y89
1. Road traffic injuries	V01-V89, V99, Y850
2. Poisoning	X40-X49
3. Falls	W00-W19
4. Fires	X00-X09
5. Drowning	W65-W74
6. Other unintentional injuries	V90-V98, W20-W64, W75-W99, X10-X39, X50-X59, Y40-Y86, Y88, Y89
Intentional injuries	
1. Self-inflicted	X60-Y84, Y870
2. Interpersonal violence	X85-Y09, Y871
3. War	Y36
4. Other intentional injuries	Y35

cremation, or burial at sea) is also chosen by the relatives within the boundaries of national law. In many countries, regulations determine the point at which a duty to bury becomes relevant in the case of stillbirths or spontaneous abortions (e.g., from a body weight of 500 g) and/or whether relatives are entitled to bury low-body-weight embryos and fetuses. Time limits within which burial should take place, starting from the time of determination of death, are often specified (e.g., 5 days) unless there are legally recognized grounds to delay burial. In addition, there are regulations and laws limiting the period of time a body can remain buried in a cemetery (e.g., to 30 years), while others permit urn burials only in designated places and either permit or forbid urns to be taken home. Finally, there are also regulations relating to the scattering of a person's ashes at sea, in a specially designated woodland area, or on private land.

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