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ILCOR Advisory Statement

Recommended guidelines for uniform reporting of data from drowning: the "Utstein style"

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1. Consensus conference on drowning

This document presents the consensus of a group of international investigators who met to establish guidelines for the uniform reporting of data from studies of drowning incidents. The consensus process consisted of formal discussions at three international meetings, as well as expert review, endorsements from multiple organizations, and invited recommendations from other interested parties. The concept of using consensus workshops to formulate guidelines is not new. Similar consensus guidelines for reporting surveillance and resuscitation research have been developed for both adult and pediatric cardiac arrest [1–3].

The principal purpose of the recommendations in this advisory statement is to establish consistency in the reporting of drowning-related studies, both in terms of nomenclature and guidelines for reporting data. These recommendations are intended to improve the clarity of scientific communication and the comparability of scientific investigations. Improved clarity and comparability of future scientific reports will advance the clinical and epidemiological knowledge base. In turn, such studies can help identify appropriate prevention strategies as well as the best treatment for victims of drowning and can ultimately save lives.

2. History of the Utstein style

Laboratory and clinical investigators from many different specialties contribute to the multidisciplinary knowledge base of injury prevention and resuscitation science. Although diversity can be a strength, it can also be an obstacle due to the lack of a common language and communication between investigators from different backgrounds.

In response to these problems, in June 1990 an international group of scientists concerned with research involving out-of-hospital cardiac arrest met at the Utstein Abbey in Stavanger, Norway. Participants discussed the lack of standardized nomenclature and definitions as a key problem in research reports. A second meeting, the Utstein Consensus Conference, was held in December 1990 in Brighton, England. Recommendations from this follow-up conference were published simultaneously in American and European journals [4,5]. The report included uniform definitions, terminology, and recommended data sets (the "Utstein style") to assist clinical investigators in reporting human resuscitation studies. With the benefit of 10 years of use and experience, the recommendations for out-of-hospital resuscitation were recently reviewed at a conference in Melbourne, Australia, revised, and simplified for update in a future publication.

The issues discussed at the first Utstein style consensus conferences are common to other disciplines concerned with resuscitation. Accordingly, since that time many other Utstein style meetings have been organized to discuss such issues [6–11]. Drowning is

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another important problem in resuscitation research that shares many of the same nomenclature and reporting problems. Drowning victims often require cardiopulmonary resuscitation (CPR) or other interventions by emergency medical systems. Drowning research is based on clinical events, time intervals and points, pathophysiological changes, autopsy findings, and other observations common to cardiac arrest and CPR research.

3. Introduction

Drowning accounts for more than one half million deaths annually worldwide. This number is probably a gross underestimate because of underreporting [12]. In highly developed countries the highest incidence of drowning is seen in children <5 years of age and in persons 15–24 years of age [13,14]. In some countries, drowning is the first or second leading cause of death in this age group [15]. Reports from many parts of the world have emphasized that drowning is a leading cause of cardiac arrest in children and adolescents [16–20].

Physicians and other healthcare workers across the world deal with the consequences of drowning on a daily basis, yet there are few population-based surveillance studies on drowning incidents or prospective clinical studies of prognostic factors and outcomes of drowning. A review of existing studies reveals a lack of standardized definitions [21]. Something as fundamental as the definition of drowning itself varies among reports, as do clinical characteristics of outcome measures. The lack of consistency makes assessment and analysis of studies difficult, both individually and as a whole.

Few studies have evaluated the results of attempted resuscitation from drowning starting at the scene of the drowning and continuing through hospital admission, hospital discharge, and long-term follow-up. In fact, most studies of drowning outcomes have been hospital based and have not evaluated events at the scene or care given the victim before admission to the hospital. Because most studies demonstrate that the victim's condition on arrival at the hospital is the best indicator of outcome, prehospital incident-related events such as duration of submersion, failure to receive bystander CPR, and prolonged resuscitation efforts are key factors [22–26]. Drowning inflicts a primary hypoxic insult. The drowning victim who is not breathing or is unconscious is at risk for additional hypoxic insult upon being removed from the water. Bystander and advanced life support interventions are critical for preventing secondary injury, prolonged hypoxia and additional organ damage and must be considered in outcome studies. Even when spontaneous ventilation is reestablished, hypoxemia may persist because of intrapulmonary shunting secondary to aspiration of water/foreign material, and organ injury continues to evolve even after hospital admission [27]. Thus, data from hospital course remain important in reports of drowning.

Table 1
Organizations with representatives on the Utstein Task Force on Drowning

American Heart Association
Maatschappij tot Redding van Drenkelingen
European Resuscitation Council
U.S. Centers for Disease Control and Prevention
Australia and New Zealand Resuscitation Council
InterAmerican Heart Foundation
Heart and Stroke Foundation of Canada
Resuscitation Council of Southern Africa

To solve these problems, an international Utstein style consensus conference convened in Amsterdam in June 2002 to develop guidelines for definitions and reporting of data related to drowning. The conference was part of a larger comprehensive meeting, the World Congress on Drowning, an initiative of the Maatschappij tot Redding van Drenkelingen (Dutch Society to Rescue People From Drowning) [28]. This society was founded in Amsterdam in 1767 and has remained active in the Netherlands since then. The Utstein Task Force on Drowning was composed of representatives from major organizations whose focus is resuscitation and epidemiology (Table 1), as well as other recognized experts from around the world. The guidelines that emerged from this conference were presented and approved in October 2002 at a meeting of the International Liaison Committee on Resuscitation (ILCOR), in Florence, Italy.

The following is a discussion of the results of this conference. A definition of drowning is provided, as are recommended core and supplemental data. As in previous Utstein style reports, the primary language for the consensus process was English.

4. History of drowning terminology

In an effort to align definitions more closely of drowning with the pathophysiological process of drowning and its clinical implications, in 1971 Modell proposed a variety of definitions. In *The Pathophysiology and Treatment of Drowning and Near-drowning* [29], he wrote

> The *Standard Nomenclature of Athletic Injuries* [30] lists "near-drowning" as "a critical aquatic predicament resolved by successful water rescue." This definition implies that recovery is certain once the victim is removed from the water. However, this is not always the case. Some patients who have regained consciousness after near-drowning, sub-

sequently have died. Countless others probably have met a similar fate, but have gone unreported. Ultimate survival should not be a consideration in the initial classification of these patients.

A number of other terms were proposed in an attempt to relate them to pathophysiological processes: delayed death subsequent to near-drowning, drown without aspiration, drown with aspiration, near-drowning without aspiration, near-drowning with aspiration, delayed death subsequent to near-drowning. Since that time, numerous other terms have appeared, such as "drowned," "near-drowning with a 24 h time limit," "wet drowning," "dry drowning," "active drowning," "passive drowning," "silent drowning" and "secondary drowning."

However, these terms have been confusing and imprecise. For example, a drowning victim without apparent clinical signs of aspiration may be found, after careful searching, to have pathologic signs of aspiration. It has also been reported that some of the terminology changes its meaning when translated into languages other than English.

Therefore, it became apparent that a new look at terminology was needed to improve understanding and reporting of these events. For this purpose, universal adoption of the following definitions and glossary is recommended.

5. Definitions

5.1. Drowning

Drowning is a process resulting in primary respiratory impairment from submersion/immersion in a liquid medium. Implicit in this definition is that a liquid/air interface is present at the entrance of the victim's airway, preventing the victim from breathing air. The victim may live or die after this process, but whatever the outcome, he or she has been involved in a drowning incident.

5.2. The drowning process

The drowning process is a continuum that begins when the victim's airway lies below the surface of the liquid, usually water, at which time the victim voluntarily holds his or her breath. Breathholding is usually followed by an involuntary period of laryngospasm secondary to the presence of liquid in the oropharynx or larynx [31]. During this period of breathholding and laryngospasm, the victim is unable to breathe gas. This results in oxygen being depleted and carbon dioxide not being eliminated. The victim then becomes hypercarbic, hypoxemic, and acidotic [27]. During this time the victim will frequently swallow large quantities of water [32]. The victim's respiratory movements may become very active, but there is no exchange of air because of the obstruction at the level of the larynx. As the victim's arterial oxygen tension drops further, laryngospasm abates, and the victim actively breathes liquid [33]. The amount of liquid inhaled varies considerably from victim to victim. Changes occur in the lungs, body fluids, blood–gas tensions, acid–base balance, and electrolyte concentrations, which are dependent on the composition and volume of the liquid aspirated and duration of submersion [27,33,34]. Surfactant washout, pulmonary hypertension, and shunting also contribute to development of hypoxemia [35,36]. Further physiologic derangements, such as the cold shock response, may occur in victims immersed in cold water. Water that is 10 °C or less has pronounced cardiovascular effects, including increased blood pressure and ectopic tachyarrhythmias. The response may also trigger a gasp reflex followed by hyperventilation, which may occur while the victim is underwater [37].

A victim can be rescued at any time during the drowning process and may not require an intervention or they may receive appropriate resuscitative measures, in which case the drowning process is interrupted. The victim may recover from the initial resuscitation efforts, with or without subsequent therapy to eliminate hypoxia, hypercarbia, and acidosis and restore normal organ function. If the victim is not ventilated soon enough or does not start to breathe on their own, circulatory arrest will ensue, and in the absence of effective resuscitative efforts, multiple organ dysfunction and death will result, primarily because of tissue hypoxia. It should be noted that the heart and brain are the two organs at greatest risk for permanent, detrimental changes from relatively brief periods of hypoxia. The development of posthypoxic encephalopathy with or without cerebral edema is the most common cause of death in hospitalized drowning victims [38,39].

Most resuscitations begin at the scene of the drowning and not at a hospital, making on-scene data extremely important. Furthermore, many, or possibly most, drowning victims have mild symptoms, recover at the scene, and may or may not be transported to a hospital [40]. Thus, to have a complete understanding of drowning and to capture the full scope of this problem, it is crucial that data at the scene be included in drowning reports.

The following terms should be abandoned.

5.3. Dry versus wet drowning

By definition, all drownings occur in liquid, and therefore, all drowning are wet. The terms "wet" and

"dry" have been used to classify drowning victims as those who aspirate liquid into the lungs (wet) and those who do not (dry). Frequently it is not possible to determine at the scene whether or not water was aspirated. This is particularly true when the amount of water is small. Furthermore, even if a victim has no evidence of fluid aspiration, the diagnosis of drowning must be suspect.

5.4. Active versus passive versus silent drowning

The term "active drowning" refers to a witnessed drowning event in which the victim is making some motion. The terms "passive drowning" and "silent drowning" have been used when the victim is found motionless in the water and no one saw the victim enter the water. Underwater cameras, however, have shown that even victims who are apparently motionless to observers at the surface usually make some movement. In addition, cloudy or murky water may preclude accurate observation. Thus, these terms should be abandoned in favor of the terms "witnessed," used when the episode is observed from the onset of submersion/immersion, or "unwitnessed," when the victim is found in the water and no one saw how he or she got there.

5.5. Secondary drowning

This term has been used to describe an unrelated event (e.g. seizures, cervical spine injury, and heart attack) that results in the victim's submersion and subsequent drowning. The term has also been used to describe development of adult respiratory distress syndrome in a victim who appears to be recovering from drowning. This is particularly confusing because the victim does not experience a second drowning episode. Therefore, use of the term "secondary drowning" should be abandoned. It is the belief of the writing group that descriptions of associated events and sequelae should be explicit and should recognize any drowning event as a primary process that occurs secondary to a variety of predisposing events, such as disease, injury, or unintentional submersion.

5.6. Drowned and near-drowned

The terms "drowned" and "near-drowned" have been used for decades to describe the outcomes dead or alive, respectively. The term "near-drowned", however, has also been used to describe patients who subsequently died from drowning. This usage has led to uncertainty about the meaning of the term [2,3]. Furthermore, when the term is translated from English into other languages, the meaning can be confusing and imprecise. Therefore, it was the consensus, but not the unanimous opinion, of the conference that the term "near-drowned" should no longer be used. The term "drowned" will continue to refer to a person who died from drowning.

6. Other important issues

6.1. Precipitating event

In each case of drowning, the precipitating event should be reported if known. Drowning is sometimes precipitated by an injury or a medical condition. Seizure is the most common initiating event in all age groups [41]. Loss of consciousness from any cause, however, such as hyperventilation before breathholding under water, concussion, stroke, or cardiac arrhythmia may result in drowning. Circulatory arrest from arrhythmias is probably underestimated as a major cause of loss of consciousness among older adults with ischemic heart disease; it is also a cause of loss of consciousness among children and young adults with unrecognized prolonged QT syndrome [41,42]. Other precipitating events are major trauma or cervical spine injury, which are usually associated with vehicular accidents or diving [43–46].

When assessing a drowning incident, it is important to recognize the role of intentional injury, suicide, homicide, and child abuse. Hypothermia, alcohol, and drugs may impair motor function and judgment. Moreover, alcohol may affect the cardiovascular response to submersion [47,48]. Of note, several precipitating events, such as seizures, alcohol use, and hypothermia, are associated with an increased risk of death from drowning [49,50]. Thus, these precipitating events should be noted, as they may be confounders in outcome. In some situations it may be difficult to identify the primary cause of death as drowning or another condition. For example, drowning in an older person may trigger a heart attack, whereas a heart attack may precipitate a drowning event.

Examples of precipitating events are:

- Syncope or seizure.
- Impairment of judgement, level of consciousness, and/or motor function by drugs, alcohol, or hypothermia.
- Unconsciousness from any other cause.
- Circulatory arrest (e.g. pulseless electrical activity, ventricular fibrillation).
- Hyperventilation before breathholding under water.
- Impairment of judgment, level of consciousness, and/or motor function by drugs or alcohol.
- Trauma.

6.2. Immersion

To be covered in water. For drowning to occur, usually at least the face and airway are immersed.

6.3. Submersion

The entire body, including the airway, is under water.

6.4. Time intervals and time points (events)

An *interval* is the period of time between two events [4,5]. There should be an explicit definition of the two anchor events, with a beginning and an end point in time. *Time point* refers to one point (event) in time. Therefore, "response times" should be reported as two "time points" on a clock that result in a defined "response interval" (e.g. in minutes).

The importance of time intervals in resuscitation science is exemplified by the duration of submersion. The number of minutes submersed is a measure of the period of hypoxic insult. Although this information is usually estimated by bystanders and is inaccurate, it has been correlated with survival [51–55].

6.5. Outcome

The primary outcome of a drowning episode should be categorized as either death or survival. *Survival* indicates that the victim remained alive after the acute event and any acute or subacute sequelae. For example, survival is defined as the outcome of drowning victims who were successfully resuscitated from cardiac and/or respiratory arrest and were then discharged from the hospital or survived initially and subsequently died of other causes. A drowning event in which the victim is successfully resuscitated at the scene but succumbs to a condition that is causally related to the drowning should be categorized as *death due to drowning*. Following are examples of common sequelae leading to death from drowning. Of note, the most common cause of death in hospitalized drowning victims is posthypoxic encephalopathy.

- Brain death due to severe hypoxic or ischemic brain injury.
- Acute respiratory distress syndrome.
- Multiorgan system dysfunction secondary to severe hypoxic or ischemic insult.
- Sepsis syndrome due to aspiration pneumonia or nosocomial infections.

Although differentiating *death* from *survival* is usually easy, judgment occasionally is required to determine whether death following illnesses such as aspiration pneumonia or septic shock is causally related to the drowning episode. A death from such causes in the first few days or weeks after a drowning episode would generally be judged to be due to the drowning because the chain of causation is clear. Death from drowning would also be the ruling for a drowning victim who develops and dies from aspiration pneumonia after being stable with severe hypoxic encephalopathy for weeks to months. However, if that same patient died of acute myocardial infarction, it most likely would be classified as a death not related to drowning. Thus, there is no time limit between the drowning event and death from drowning if there is a clear chain of causality.

The survival category can be subclassified in terms of severity and type of morbidities, such as neurological impairment and/or respiratory impairment (e.g. ventilator dependence).

Multiple outcome scales have been validated. For adults, commonly used assessment tools are the ABC (awake, blunted, comatose) score, the Glasgow Coma Scale (GCS), and the Glasgow–Pittsburgh Cerebral Performance Categories (CPC) and Overall Performance Categories (OPC) (Table 2) [23,38,56–58], and for children, the Pediatric Cerebral Performance Category Scale and Pediatric Overall Performance Category Scale [59]. Other important schemas measure nonfatal health outcomes applicable to drowning survivors, expanding the range of possible outcomes and describing better how survivors and families actually function after injury.

One of the major composite measures of life and health after injury is quality-adjusted life years (QALYS), which is calculated by multiplying the life expectancy after the injury by a weight of the health-related quality of life during each year of life [60]. Health-related quality of life measures describe individuals' opportunities, health perceptions, and impairments. Health status measures describe individuals' abilities. Pediatric health status measures include the Child Health Questionnaire and the Pediatric Quality of Life [61,62]. Adult health status measures include EuroQol [64], and SF-36 [65], among others. Preference-based measures of health-related quality of life such as the Health Utilities Index [66,67] are consistent with current standards for economic evaluation of health interventions [68].

Another functional outcome measurement tool, Disability-Adjusted Years of Life (DALY), was developed to incorporate judgments about the value of time spent in different states of health. Through surveys, six classes of disability severity were established for activities of daily living and other domains and then weighted. Thus, value choices have been standardized using an international population so that the classification system can be used internationally. The DALY is the sum of years of life lost and years lived with disability adjusted for severity of disability [69].

Table 2
Glasgow–Pittsburgh outcome categorization of brain injury [58]

CPC	OPC
1. Good cerebral performance: conscious, alert, and able to work and lead a normal life. Might have minor psychological or neurological deficits (mild dysphasia, noncapacitating hemiparesis, or minor cranial nerve abnormalities)	1. Good overall performance: healthy, alert, and capable of leading a normal life. Good cerebral performance (CPC 1) plus no functional disability from noncerebral organ system abnormalities
2. Moderate cerebral disability: conscious. Sufficient cerebral function for part-time work in a sheltered environment or independent activities of daily life (dress, travel by public transportation, food preparation). Such patients may have hemiplegia, seizures, ataxia, dysarthria, dysphasia, or permanent memory or mental changes	2. Moderate overall disability: conscious. Moderate cerebral disability alone (CPC 2) or moderate disability from noncerebral organ system dysfunction alone or both. Performs independent activities of daily life (dress, travel by public transportation, food preparation) or able to work part-time in sheltered environment, but disabled for competitive work
3. Severe cerebral disability: conscious; patient dependent on others for daily support (in an institution or at home with exceptional family effort) because of impaired brain function. Has at least limited cognition. This category includes a wide range of cerebral abnormalities, from patients who are ambulatory but have severe memory disturbance or dementia precluding independent existence, to those who are paralyzed and can communicate only with their eyes, as in the locked-in syndrome	3. Severe overall disability: conscious. Severe cerebral disability alone (CPC 3) or severe disability from noncerebral organ system dysfunction alone, or both. Dependent on others for daily support
4. Coma/vegetative state: not conscious, unaware of surroundings, no cognition. No verbal and/or psychological interaction with environment	4. Same as CPC 4
5. Brain death: certified brain dead or dead by traditional criteria	5. Same as CPC 5

Morbidity should be quantified using an outcome scale for a given point in time (e.g. at hospital discharge or 1 year after discharge). Ideally, long-term follow-up after discharge, especially for children, would best depict the outcome. In one study, one half of severely neurologically devastated victims died [70]. In addition, outcome may be elucidated better in less severely affected survivors with later follow-up. Scoring systems emphasizing functional outcome should be used because recent reports demonstrate that abnormalities may exist in so-called neurologically normal survivors [71].

Much of the clinical literature on drowning has focused on predictors of outcome. Victim-related factors associated with increased risk of death or poor outcome include being male, being nonwhite (in the United States), having a seizure disorder, and use of alcohol [22,49,50,72]. Incident-related factors associated with death or bad outcome include prolonged duration of submersion, failure to receive bystander CPR, and acute resuscitation efforts lasting >25 min [22,51–55]. Factors identifiable at hospital admission include level of consciousness, especially if unconsciousness is prolonged; elevated serum glucose; hypothermia; and signs of brainstem dysfunction, such as absent pupillary reflex, absent spontaneous respiration, and Pediatric Risk of Mortality (PRISM) scores [24,26,73,74]. Of note, age has no independent association with outcome [52,75,76].

7. Recommended data to report

The consensus conference developed a reporting template to help investigators report methods and results. A summary reporting template is shown in Fig. 1; specific items to be reported are listed in Tables 3–7. **Core** data (shown in **bold typeface**) should be reported in all studies; *supplementary* data (shown in *italic typeface*) are recommended but not essential. **Core** data were considered important and feasible to be reported in most systems worldwide. *Supplementary* data were considered important but nonessential information or important information that is difficult to capture reliably (e.g. time points and time intervals). **Core** data can be gathered reliably by almost any investigator so that a minimum universal data set worldwide is feasible.

8. Template

8.1. Victim information (Table 3)

A. **Core**

1) **Victim identifier:** A number, code, or other information for unique identification of each victim.
2) **Gender:** Male, female.

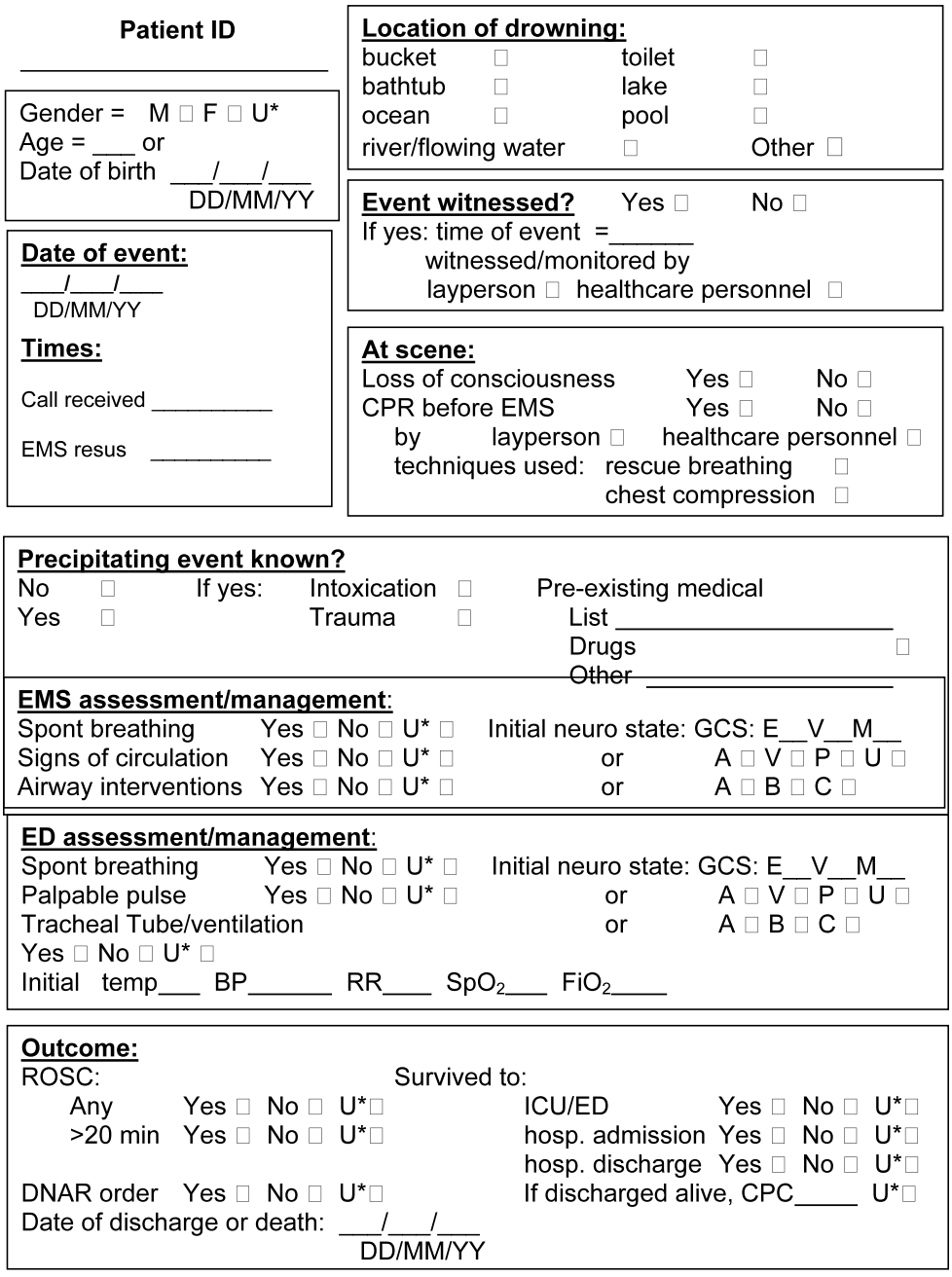

Fig. 1. Example of revised Utstein drowning data form.

Table 3
Victim information

A. **Victim identifier**	**Core**
B. **Gender**	**Core**
C. **Age (estimate, if necessary)**	**Core**
D. *Race or ethnic category*	*Supplemental*
E. **Date and time of day of incident**	**Core**
F. *Residence (city, county, state, country)*	*Supplemental*
G. **Precipitating event: known/unknown; (if precipitating event is known, then specify)**	**Core**
H. *Preexisting illness: yes/no; if yes, then specify*	*Supplemental*

3) **Age:** In months if <24 months of age; in years if $\geq$ 24 months of age. Estimate age if date of birth is unknown.
4) **Incident date and time of day**.
5) **Precipitating event:** Indicate if a precipitating event or factor is known. A precipitating event or factor is causally related to the drowning (e.g. alcohol or drug intoxication, traumatic injury, or seizures). A cause of drowning is frequently unknown but several known precipitating events can have a powerful influence on outcome. Because it is

Table 4
Scene information

A. **Witnessed (submersion is observed) yes/no**	**Core**
B. **Body of water: bathtub, swimming pool, ocean, lake, river, or other bodies of water or containers**	**Core**
C. *Water/liquid type: fresh, salt, chemical, other*	*Supplemental*
D. *Approximate water temperature: nonicy, icy*	*Supplemental*
E. *Time of submersion if known*	*Supplemental*
F. *Time of removal of victim from water if known*	*Supplemental*
G. **Unconscious when removed from water: yes/no**	**Core**
H. *Cyanosis*	*Supplemental*
I. **Resuscitation before EMS arrived: yes/no**	**Core**
If yes, who gave CPR? Layperson, lifeguard, etc	*Supplemental*
J. *Method of CPR: mouth-to-mouth (MTM) ventilation alone, MTM+chest compression (CC), CC only, automated external defibrillation*	*Supplemental*
K. **EMS called: yes/no**	**Core**
L. *EMS vehicle dispatched: yes/no*	*Supplemental*
M. *Time of first EMS assessment*	*Supplemental*
N. **Initial vital signs (spontaneous breathing, palpable pulse)**	**Core**
O. Oxygen saturation, temperature, blood pressure, pupillary reaction	Optional
P. **Time of first EMS resuscitation attempt**	**Core**
Q. **Neurological status: awake, blunted, comatose (ABC) or other neurological assessment (AVPU, GCS)**	**Core**

AVPU indicates Alert, responds to Verbal stimuli, responds to Painful stimuli, Unresponsive to all stimuli; and GCS, Glasgow Coma Scale.

Table 5
Emergency department evaluation and treatment

A. **Vital signs: temperature, heart rate, respiratory rate, blood pressure**	**Core**
B. **Oxygen hemoglobin saturation**	**Core**
C. **Arterial blood gas analysis, if unconscious or SaO_2 $<$ 95% on room air**	**Core**
D. **Initial neurological status (GCS, AVPU, or ABC)**	**Core**
E. *Pupillary reaction*	*Supplemental*
F. **Airway and ventilation requirements**	**Core**
G. *Toxicology testing: blood alcohol level and other drugs*	*Supplemental*

GCS indicates Glasgow Coma Scale; AVPU, Alert, responds to Verbal stimuli, responds to Painful stimuli, Unresponsive to all stimuli; and ABC, awake, blunted, comatose.

difficult to capture these data, the true number of precipitating causes may be underestimated.

B. *Supplemental*

1) *Race or ethnic category:* These characteristics have been important risk factors and issues for preventive interventions. Reported differences are likely to reflect differences in exposure rates and risk factors cultural diversity, not differences in physiological responses. Racial or ethnic information may be difficult to ascertain clinically (e.g. Hispanic vs. Caucasian in the United States) or delineate (e.g. mixed marriages and names).
2) *Resident of city, county, state, country:* Population-based studies should identify the population being studied and confirm that the victims studied are indeed residents of the population base.
3) *Preexisting illness*: List preexisting illness such as psychological or medical disorders. It may be difficult to know if the drowning was related to the illness, but this judgment could be made by someone at the scene or later during epidemiological analyses. The illness should be described if it is known.

8.2. Scene information (Table 4)

A. **Core**

1) Was the **event witnessed?** Did someone see the drowning victim enter the water? If not, the event should be labeled "unwitnessed."
2) **Body of water:** Where did the drowning occur? In a bathtub, swimming pool, ocean, lake, river, creek, bayou, bucket, hot tub, or other body or container of liquid? This list should be modified as needed to include local hazards.
3) **Loss of consciousness:** Was the victim unconscious when removed from the water?
4) **Pre-EMS resuscitation:** Was resuscitation attempted before arrival of EMS personnel and equipment? If yes, who provided CPR: lay rescuer, lifeguard, other? (*The latter is supplemental data*.) List details if known.
5) **EMS called:** Was EMS called for this drowning event?
6) **Initial vital signs assessed by EMS:** The consensus group recommended a focus on two vital signs that are indicators of outcome: Was the drowning victim **breathing spontaneously** and was a **pulse palpable**? The importance of actual respiratory and pulse *rates* and the impact of these on outcome are unknown, but it is recommended that both be collected as supplemental data.
7) **Time of first EMS resuscitation attempt:** The time of the first resuscitation attempt is important because it is another indicator of the duration of hypoxemia. Furthermore, in both cardiac arrest and drowning studies, intervals from drowning or cardiac arrest to CPR are known to affect outcome [22,51,52,77–79].
8) **Neurological status:** Report the victim's neurological status at the scene of the drowning. Several neurological scoring systems are widely used and acceptable, including the GCS, AVPU (Alert, responds to Verbal stimuli, responds to Painful stimuli, Unresponsive to all stimuli), or ABC (awake, blunted, comatose) [23,38,56–58,80].

Table 6
Hospital course

A. **Airway and ventilation requirements**	**Core**
B. *Serial neurological function (admission, 6, 24, 72 h, discharge)*	*Supplemental*
C. *Complicating illness*	*Supplemental*

B. *Supplemental*

1) *Type of water/liquid:* Did the drowning occur in fresh water, salt water, water containing chemicals, or other types of water? This information is supplemental data because the type of water does not predict the clinical course of drowning in fresh water or seawater. On the other hand, heavily contaminated water or water containing chemicals may have clinical repercussions.
2) *Water temperature:* Is the water icy or nonicy? The only water temperatures associated with possible improved outcomes have been icy waters [81–83]. Report the ambient air temperature if known.
3) *Time of submersion and time of removal* from water if known. The time interval or duration that the victim was submerged is the most important predictor of outcome in drowning and should be recorded if possible [22,51,52]. Because the submersion interval is seldom documented with a timepiece such as a stopwatch, however, this is a subjective, imprecise observation [84–86]. Therefore, it is considered supplementary data rather than core data to reflect the difficulty in accurately assessing this element.
4) *EMS vehicle dispatched:* Was an EMS vehicle sent to the drowning site?
5) *Time of first EMS assessment:* When did EMS personnel make their first assessment of the drowning victim?
6) *Cyanosis:* Cyanosis can be an indicator of hypoxemia (an important marker for length of asphyxia, and therefore, outcome). Cold water may also produce the appearance of cyanosis. Significant hypoxemia may be present even when observers have not reported cyanosis. Furthermore, skin and mucous membrane color may vary considerably between victims.
7) *Method of CPR:* What CPR interventions were used? Mouth-to-mouth or mouth-to-nose ventilation only; mouth-to-mouth ventilation and chest compression; chest compression only? Note if an automated external defibrillator (AED) was used and if the device actually delivered a shock. Some experts considered this information of enough importance that it should be core data; because it may be difficult to capture this information reliably, however, it is listed as supplemental data.

Table 7
Disposition

A. **Alive or dead; if dead, report date, place, and time of death**	**Core**
B. **Date of hospital discharge**	**Core**
C. **Neurological outcome at hospital discharge**	**Core**
D. *Quality of life (OPC, CPC, other)*	*Supplemental*
E. *Cause of death: 1. How was cause of death determined? 2. Autopsy: yes/no 3. Forensic information (suicide, homicide?)*	*Supplemental*
F. *Other injuries and morbidities*	*Supplemental*

OPC indicates Overall Performance Category, and CPC, Cerebral Performance Category.

8) *Pupillary reaction, temperature, blood pressure, oxygen saturation:* Although it is clear that these parameters are important, many EMS systems cannot measure these data reliably. Capture whatever data can be measured. In the future most EMS providers will be able to measure these data reliably.

8.3. Emergency department treatment (Table 5)

A. **Core**

1) **Vital signs:** Indicate heart and respiratory rate, blood pressure, and temperature. If blood pressure is too low to measure, is the pulse palpable?
2) **Oxygen hemoglobin saturation:** Oxygen hemoglobin saturation may be measured with pulse oximetry.
3) **Arterial blood gas analysis:** Report arterial blood gas tensions and pH, especially in victims who are unconscious or who have an oxygen hemoglobin saturation below 95% when breathing room air.
4) **Initial neurological function:** Report results of the neurological examination when the victim first arrived in the emergency department using a validated, age-appropriate system (GCS, AVPU, or ABC). Specify the scale used.
5) **Airway and ventilation requirements:** Report whether the victim required ventilation with bag mask or invasive airway (tracheal intubation). Was mechanical ventilation used, with or without positive end-expiratory pressure (PEEP) or continuous positive airway pressure (CPAP)?

B. *Supplemental*

1) *Pupillary reaction:* Report pupillary reaction to light when the victim first arrived in the emergency department.
2) *Toxicology testing:* Report blood alcohol level and other drugs if present.

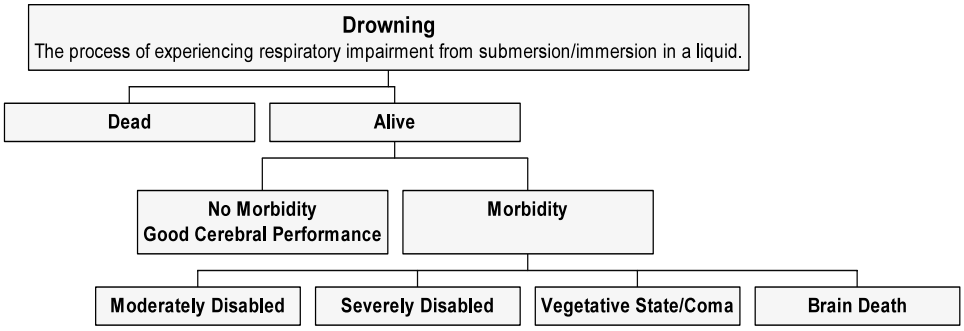

Fig. 2. A sample scheme for tracking outcome.

8.4. Hospital course (Table 6)

A. **Core**

Airway and ventilation requirements: Report whether the victim required ventilation by methods such as bag mask or invasive airway (tracheal intubation). Was mechanical ventilation used, with or without PEEP, or CPAP?

B. *Supplemental*

Serial neurological function: In addition to the core neurological examination, report the neurological examination on admission and at 6, 24, and 72 h after admission to the hospital and at discharge (ABC, AVPU, or GCS may be used). Report the time interval, using the initial drowning event as the first point in time.

C. *Complicating illnesses of drowning:* Report if the victim developed illnesses such as respiratory distress syndrome, disseminated intravascular coagulation, increased intracranial pressure, electrolyte disturbances, acute renal failure, seizures, sepsis, and myocardial failure.

8.5. Disposition (Table 7)

A. **Core**

1) **Death:** If the victim died, report the date, place, and time of death.
2) **Date of hospital discharge:** Report the date of discharge from the hospital.
3) **Neurological outcome at hospital discharge:** Use an age-appropriate, validated scoring system such as the CPC scale, OPC scale, pediatric CPC scale, or pediatric OPC scale. Other time reference points may be used, such as neurological status 1 year after hospital discharge.

B. *Supplemental*

1) *Quality of life:* Report quality of life at the time of discharge from the hospital using an age-appropriate, validated scoring system.
2) If the victim died, report the *cause of death* and the following items:
   a) How was the cause of death determined?
   b) Was an autopsy performed?
   c) Was a forensic investigation performed and was a forensic cause uncovered (suicide, murder)? This is included because it is likely that the risk of death is greater in victims whose injury was intentional, e.g. suicide, homicide, child abuse.
3) *Other injuries and morbidities:* Report other injuries and illnesses.

8.6. Outcome

Fig. 2 depicts a possible scheme that can be used to chart **outcome**. The outcome categories are derived in part from the Cerebral and OPC (Table 2).

9. Discussion

In summary, a group of international experts agreed on these recommendations for unified drowning-related definitions and guidelines for reporting data. These terms are intended to improve the clarity of scientific communication and the comparability of scientific investigations. Improved validity, clarity, and data compatibility of future scientific investigations of drowning will improve the knowledge base, epidemiological stratification, and appropriate treatment of victims of drowning and ultimately save lives.

The consensus task force welcomes comments or questions regarding these recommendations. Letters from organizations that wish to be represented at future conferences are also invited.

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