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2015 revised Utstein-style recommended guidelines for uniform reporting of data from drowning-related resuscitation An ILCOR advisory statement☆,☆☆

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ABSTRACT

Background: Utstein-style guidelines use an established consensus process, endorsed by the international resuscitation community, to facilitate and structure resuscitation research and publication. The first "Guidelines for Uniform Reporting of Data From Drowning" were published over a decade ago. During the intervening years, resuscitation science has advanced considerably, thus making revision of the guidelines timely. In particular, measurement of cardiopulmonary resuscitation elements and neurological outcomes reporting have advanced substantially. The purpose of this report is to provide updated guidelines for reporting data from studies of resuscitation from drowning.

Methods: An international group with scientific expertise in the fields of drowning research, resuscitation research, emergency medical services, public health, and development of guidelines met in Potsdam, Germany, to determine the data that should be reported in scientific articles on the subject of resuscitation from drowning. At the Utstein-style meeting, participants discussed data elements in detail, defined the data, determined data priority, and decided how data should be reported, including scoring methods and category details.

Results: The template for reporting data from drowning research was revised extensively, with new emphasis on measurement of quality of resuscitation, neurological outcomes, and deletion of data that have proved to be less relevant or difficult to capture.

Conclusions: The report describes the consensus process, rationale for selecting data elements to be reported, definitions and priority of data, and scoring methods. These guidelines are intended to improve the clarity of scientific communication and the comparability of scientific investigations.

The First International Utstein-style consensus conference on drowning convened in Amsterdam, the Netherlands, in June 2002 to develop guidelines for reporting outcome data related to drowning; these guidelines were published in 2003 [1]. We describe in the present report the results of the Second International Utstein-Style Consensus Conference on Drowning that convened in Potsdam, Germany, in October 2013.

In the 1980s, an international group of investigators in the field of resuscitation research noted a lack of common nomenclature, definitions, and consistency in scientific reports of research regarding sudden cardiac arrest. In response to these problems, the first Utstein conference on resuscitation research took place at the Utstein Abbey in Stavanger, Norway, in June 1990. The conference sought to establish uniform definitions and guidelines for reporting data for research regarding out-of-hospital cardiac arrest [2]. Utstein-style conferences use an established consensus process, endorsed by the international resuscitation community, to create a uniform reporting structure to enable comparison of outcomes. Subsequently, several Utstein-style conferences on out-

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of-hospital cardiac arrest research have taken place to update and refine the original recommendations. Since the first Utstein conference, Utstein-style guidelines have been published for in-hospital resuscitation, trauma resuscitation, drowning resuscitation, disaster resuscitation, and laboratory research in resuscitation [3–8].

The issues discussed at the first 1990 Utstein consensus conference are common to many specialties involved in resuscitation from causes other than primary cardiac arrest. Drowning is one important cause of death that shares many of the same definition and reporting problems as out-of-hospital cardiac arrest research. For example, a systematic review of drowning reports found 20 different definitions for drowning, 13 different definitions for near-drowning, and 13 related terms in the 43 articles reviewed [9]. In addition, 20 inconsistent outcome measures were identified.

In 2002, an international group of scientific investigators, including epidemiologists, and others concerned with resuscitation from drowning convened an Utstein-style consensus conference in Amsterdam at the World Congress on Drowning. The consensus conference developed guidelines for definitions and reporting of data related to drowning, published in 2003 [1]. The report defined drowning as "... 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." The report also defined other terms including the drowning process.

More than 10 years have passed since the first drowning reporting guidelines were published. During that time, resuscitation science has advanced considerably, which makes revision and refining of the guidelines timely. A review of the drowning literature identified 11 studies that used the reporting template from the 2003 publication [10–20]. These reports recommended that additional data elements be added to the Utstein drowning reporting template, such as initial cardiac rhythm, duration of cardiopulmonary resuscitation (CPR), serum potassium level, speed of rewarming, and more detailed neurological assessments.

The objective of the Second International Utstein-style consensus conference on drowning was to reassess and update data that should be reported in studies of drowning resuscitation. In addition, the participants reviewed all data elements in detail to determine priority for data reporting and to review and assess scoring methods and categories.

Methods

A group of international scientists and experts in drowning resuscitation, including representatives of international organizations, were invited to participate in the Second International Utstein-style consensus conference on drowning.

The following organizations were represented at the conference:

- Maatschappij tot Redding van Drenkelingen
- American Heart Association
- European Resuscitation Council
- US Centers for Disease Control and Prevention
- Australia and New Zealand Resuscitation Council
- InterAmerican Heart Foundation
- Heart and Stroke Foundation of Canada

Members were selected on the basis of demonstrated interest and expertise in the area of resuscitation research by having participated in the previous drowning consensus conference or in other resuscitation consensus conferences, having authored Utstein-based reports on drowning, or having served in leadership roles in organizations devoted to the rescue and resuscitation of victims of drowning.

After the consensus group was identified and finalized, data evaluation was performed via a Delphi consensus process [21,22]; a spreadsheet with data elements taken from the first drowning consensus report was sent to participants. Participants were instructed to indicate whether each data element represented core (definitely necessary) or supplementary data and to give the data element a priority score of its importance for research, which could be impacted by the feasibility of collecting the data element.

For each of the original data elements, participants were asked to suggest descriptions, categories, or tests and to suggest alternatives or additions, as appropriate. They were also asked to select a primary review group in which to participate (Prehospital Data, Quality of Resuscitation, or In-Hospital and Outcome Data) and were provided with a list of the most recent literature on the issue. Finally, we asked participants to suggest a research question and to indicate whether the data in the spreadsheet were sufficient to answer the question or whether other data would be needed.

Results from the first round of review were then collected, tabulated, and sent to participants for a second round of review. The second review included priority scores from the first round and new data elements that had been suggested. Participants were instructed to score the data elements in a fashion similar to the first review.

Results from the second review were collected, tabulated, and sent to participants ≈2 weeks before the Second International Utstein-style Consensus Conference on Drowning in Potsdam (Data Supplement Table).

The Potsdam consensus conference participants were organized into the 3 main sections, which met separately. Except for the section chairs and co-chairs, conference participants rotated through each section, spending 1 h in each section. Thus, all participants had an opportunity to engage in discussions in all 3 sections. Section chairs and co-chairs then summarized the results of the consensus and identified items that required further discussion.

All participants, including chairs and co-chairs, met in a plenary session to review the consensus results and to discuss further any remaining items that did not have consensus. Section chairs and co-chairs then summarized the final consensus results after the plenary session.

The results of the Potsdam conference were presented and discussed later that week at the 2013 World Congress on Drowning, Potsdam, Germany, and at the 2013 annual meeting of the European Resuscitation Council in Krakow, Poland. The consensus discussion continued through 2014 and 2015 by e-mail and teleconference. In addition, several members of the writing group of this report (A.H.I., J.B., G.D.P., V.W., V.N., P.M., A.T., A.J.H., M.F.H., B.L., L.Q., J.-T.G.) participated in the International Liaison Committee on Resuscitation (ILCOR) 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations (CoSTR) conference, which included sessions on drowning and basic life support, in Dallas, TX, January 31 to February 3, 2015. We have attempted to align recommendations in this report with CoSTR recommendations whenever possible.

Results

Recommended data to report

The Second International Utstein-style Consensus Conference on Drowning developed reporting tables to help investigators report methods and results for drowning research. A summary of

Table 1
Victim Information.

Data Element	Priority	Description	Categories
Victim identifier	**Core**	A number, code, or other information for unique identification of each victim	For data collection, not reporting
Sex	**Core**	Sex	Male/female
Age	**Core**	Record birthdate if known. If the birthdate is unknown but the age is known or can be estimated, record age in years.	Birthdate; age in years
Race/ethnicity	*Supplementary*	Race, ethnicity	Race: White, African, African American, Asian Ethnicity: Hispanic, non-Hispanic
Incident date and time of day	**Core**	Date/time	Use 24-h clock time
Precipitating event	**Core**	Is there evidence to suggest a precipitating event or factor is causally related to the drowning? Evidence may be obtained at the scene or from hospital or postmortem history/toxicology tests.	One or more: Alcohol; drug intoxication; traumatic injury; seizures or syncope; suspected cardiac cause; suicide; drowning related to boating accident, submerged vehicle, or flood; hyperventilation/breath holding; primary circulatory arrest; other (specify); unknown
Was the face submerged (underwater) at any time before or during rescue?	**Core**	A drowning occurs when a liquid covered the mouth and nose and prevented air from entering the lungs.	Y/N/U
Preexisting illness	**Core**	Preexisting illness causing impairment	Seizure disorders, chronic heart disease, chronic lung disease, chronic neurological disease, none, unknown

"Resident of city, county, state, and country" was in the 2003 guidelines and is no longer included even as supplementary data in the present guidelines. Y/N/U indicates yes/no/unknown.

Table 2
Scene Information.

Data Element	Priority	Description	Categories
Water temperature	**Core**	Was the water icy or non-icy? Report the water temperature if known.	Icy or non-icy
Who witnessed the drowning	**Core**	Did someone see the person going underwater? If not, the event should be labeled "unwitnessed."	Unwitnessed Witnessed by a bystander Witnessed by a lifeguard Witnessed by EMS
Bystander CPR	**Core**	Did a bystander (non-EMS person) perform CPR?	Y/N/U
	Supplementary	CPR method	Chest compressions and ventilation Chest compressions only Ventilation only Number of initial breaths
Bystander ventilation	**Core**	Was ventilation given?	Y/N/U
Did a trained first responder perform CPR or provide ventilation only?	**Core**	Did a lifeguard or other trained first responder with a duty to treat perform CPR or provide ventilation only?	CPR: Y/N/U Ventilation only: Y/N/U
Vital status at first trained responder/EMS assessment	**Core**	AVPU, ABC, GCS	Response (AVPU, ABC, or GCS) Normal breathing (Y/N/U) Pulse (Y/N/U)
Initial cardiac rhythm	**Core**	Cardiac rhythm from monitor or ECG	Ventricular fibrillation Ventricular tachycardia Pulseless electrical activity Asystole Other
Vital signs	*Supplementary*	Devices are necessary to measure vital signs	Heart rate Blood pressure Temperature Spo_2
Pulmonary status	*Supplementary*	Assess severity of lung injury	Normal lung examination; patient is coughing; unilateral rales; bilateral rales
Type of water/liquid (eg, salt/fresh/chemical/other)	*Supplementary*	In what type of liquid did the drowning occur?	Fresh water, salt water, water containing chemicals
Body of water (eg, river/ocean/swimming pool)	*Supplementary*	Where did the drowning occur?	Bathtub, swimming pool, ocean, lake, river, creek, bayou, pond, bucket, hot tub, or other body or container of liquid? This list should be modified as needed to include local hazards.

The following data elements that were present in the 2003 guidelines have been deleted from the present guidelines: Loss of consciousness, pre-EMS resuscitation, unconscious when removed from the water, was resuscitation attempted before arrival of EMS? was EMS called? was an EMS vehicle dispatched? was cyanosis present? These elements have either been replaced with updated elements or are considered unreliable (eg, cyanosis could be a result of hypoxia or submersion in cold water).
ABC indicates alert, blunted, coma; AVPU, alert, responds to verbal stimuli, responds to painful stimuli, unresponsive; CPR, cardiopulmonary resuscitation; EMS, emergency medical services; GCS, Glasgow Coma Scale; and Y/N/U, yes/no/unknown.

data to be reported is shown in Tables 1–7. **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. We expect that almost any investigator can reliably gather **core** data so that a minimum universal worldwide data set is feasible. *Supplementary* data were considered important but typically comprised information that is difficult to capture reliably (eg, time points and time intervals) or may be nonessential.

In this update, we deleted some items that were listed in the prior edition because the items were considered to be unreli-

Table 3
Pre-EMS Scene Information (Lifeguards and First Responders With a Duty to Treat).

Data Element	Priority	Description	Categories
Level of medical knowledge of the lifeguard delivering the patient care	**Core**	Level of training and certification	Paramedic Emergency Medical Technician First Responder certified Other (specify)
Interventions used by lifeguard or first responder during resuscitation	**Core**	Type of equipment used	Bag-mask device Supraglottic airway device Endotracheal intubation Other (specify)
Was the lifeguard or first responder performing CPR/patient care the same person who performed the water extrication (rescue)?	*Supplementary*	Describe rescuer(s)	Y/N/U
Number of lifeguards or first responders attending the patient	*Supplementary*	Number	Number of lifeguards/first responders attending the patient
If drowning was in the ocean or river, what were the water conditions?	*Supplementary*	Water conditions	Waves and currents vs flat water Moving water on a river with strong currents vs nonmoving water
How was the person removed from the water (if known)?	*Supplementary*	Specify method of removal	Who removed the victim? Lifeguard, first responder, citizen responder (bystander) How was the victim removed? Swimming, boat, personal watercraft, jet ski, rescue board, helicopter/air rescue

CPR indicates cardiopulmonary resuscitation; EMS, emergency medical services; and Y/N/U, yes/no/unknown.

Table 4
Time Points and Time Intervals From First Responder or EMS Data.

Data Element	Priority	Description	Categories
Time face/airway seen underwater	**Core**	hh:mm:ss or unknown	Hours:minutes:seconds
Time victim was removed from water	**Core**	hh:mm:ss or unknown	Hours:minutes:seconds
Time of fi trained responder/EMS treatment	**Core**	hh:mm:ss or unknown	Hours:minutes:seconds
Time CPR first begun	**Core**	hh:mm:ss or unknown	Hours:minutes:seconds
Time ROSC was achieved	**Core**	hh:mm:ss or unknown	Hours:minutes:seconds
Time first conscious/awake	**Core**	hh:mm:ss or unknown	Hours:minutes:seconds
Time intervals derived from time points			
Submersion duration (face underwater)	**Core**	Derived from time underwater to time of removal/commencing resuscitation	Minutes
Underwater to first treatment or CPR interval	**Core**	Derived from time underwater to time of first EMS treatment or CPR	Minutes

Times should be calculated by reference to fixed/measured time points (eg, EMS call time, EMS arrival time, EMS departure time). Duration underwater, time taken for removal from water, and time to CPR or first treatment is the interval: [⟵Duration Underwater⟶][⟵Removal⟶][⟵Initial EMS treatment or CPR⟶].
CPR indicates cardiopulmonary resuscitation; EMS, emergency medical services; hh, hours; mm, minutes; ROSC, return of spontaneous circulation; and ss, seconds.

able, difficult to capture, or had some other problem. Additionally, some data items were changed from **core** to *supplementary* or the other way around. There was some discussion regarding the meaning of the terms *immersion* and *submersion*, which were recommended in the 2003 guidelines. Some thought the term *immersion* was ambiguous because there are many situations that could be included under this term that are not associated with drowning. Immersion often signifies that the head is up and out of the water, whereas the rest of the body is immersed [23,24]. Drowning can occur with aspiration of even a small volume of water; even a wave splashing over the face could lead to drowning but often does not. However, the term *submersion* indicates that the head and face are underwater, which leads to drowning if the airway is submerged long enough. The term *submersion* reflects the most important aspect of drowning, namely, that liquid covering the nose and mouth prevents air from entering the lungs. We decided to retain *submersion* because it is most applicable to studies of resuscitation from drowning.

There are 3 new tables in this edition, 1 related to rescue and treatment by lifeguards (Table 3), 1 specifically devoted to time points and time intervals (Table 4), and 1 focused on resuscitation quality (Table 8).

Template

Victim information (Table 1)
Core data

1. **Victim identifier:** A number, code, or other information for unique identification of each victim.
2. **Sex:** Male or female.
3. **Race and ethnic categories:** *Supplementary: Race/Ethnicity*. These characteristics have been important risk factors and issues for preventive interventions. Reported differences likely reflect differences in exposure rates, risk factors, and socioeconomic status, not differences in physiological responses. Racial or ethnic information may be difficult to ascertain clinically (eg, Hispanic versus white in the United States) or delineate (eg, mixed marriages and names).
4. **Age:** Record birthdate, if known. If the birthdate is unknown but the age is known, record age in years. Age may be estimated.
5. **Incident date and time of day.**
6. **Precipitating event:** Report if a precipitating event or factor is known that is causally related to the drowning. Although the cause of drowning is frequently unknown, the type of precipitating event can have a powerful influence on the patient's care and outcome.
7. **Was the face submerged (face underwater or covered in water) at any time before or at the time of rescue (new)?** We recommend using the objective phrase indicating that the face (nose and mouth) was underwater or covered in water in a manner that prevents air from entering the lungs.
8. **Preexisting illness:** List preexisting illness such as psychological, developmental, or medical disorders. It may be difficult to know whether the drowning was related to the illness, but the

Table 5
Hospital Course, Core Data.

Data Element	Priority	Description	Categories
Date and time of hospital arrival	**Core**	Date and time	DD:MM:YY:hh:mm:ss or unknown
CPR ongoing at hospital arrival	**Core**	Was CPR ongoing when patient entered the hospital?	Y/N/U
Duration of CPR	**Core**	Record the total number of minutes that CPR was performed regardless of where it was stopped (scene, emergency department, hospital)	Minutes or unknown
First documented vital signs after hospital arrival	**Core**	Vital sign measurements	Temperature (centigrade) Heart rate Blood pressure (mm Hg) Respiratory rate (if spontaneous) Oxyhemoglobin saturation (%)
First cardiac rhythm after hospital arrival	**Core**	Cardiac electrical rhythm on cardiac monitor or ECG	Ventricular fibrillation Ventricular tachycardia Pulseless electrical activity Asystole Other
Initial hospital neurological examination	**Core**	GCS score or AVPU	GCS: Eyes, verbal, motor (total 3–15) or AVPU
Arterial blood gas analysis	**Core**	Arterial blood gas results	pH, Pao_2, $Paco_2$, base deficit
Pulmonary edema/ARDS	**Core**	Were bilateral lung opacities present on admission radiograph or within 1 wk of drowning?	Y/N/U
Airway and ventilation requirements	**Core**	What was the highest level of respiratory support the patient required during hospitalization?	(1) Nothing; (2) supplementary O_2; (3) noninvasive ventilation support; (4) conventional invasive ventilation support; (5) nonconventional invasive ventilation support
ICU admission	**Core**	Was the patient admitted to the ICU?	Y/N/U
Induced hypothermia	**Core**	Was the patient treated with induced hypothermia?	Y/N/U
Temperature management	**Core**	Was the patient treated with targeted temperature management?	Y/N/U
Temperature peak/trough (new)	**Core**	Highest and lowest temperatures in first 96 h after ROSC	Initial temperature Highest temperature Lowest temperature Unknown
Serum glucose levels	**Core**	Serum glucose levels in first 24 h after ROSC Was normoglycemia maintained?	Initial Highest Lowest Unknown Y/N/U
Hypotension	**Core**	Did the patient have 2 documented episodes of hypotension (defined as systolic blood pressure <90 mm Hg for adults and age adjusted for children)?	Y/N/U
Circulatory support	**Core**	Was continuous vasopressor/inotropic support initiated?	Y/N/U
ECMO/CPB	**Core**	Was the patient treated with ECMO or CPB?	Y/N/U
Neurological function	**Core**	Best GCS during hospitalization	Number (range, 3–15)
In-hospital resuscitation	**Core**	Did the patient have a cardiac arrest requiring chest compressions after hospital admission?	Y/N/U
Complicating illness of drowning	**Core**	Report if the victim developed complications/illnesses	Check all that apply: Acute respiratory distress syndrome Disseminated intravascular coagulation Pneumonia Pancreatitis Acute kidney injury Shock Multiple system organ failure Sepsis Electrolyte disturbance Glucose disturbance Other Unknown

ARDS indicates acute respiratory distress syndrome; AVPU, alert, responds to verbal stimuli, responds to painful stimuli, unresponsive; CPB, cardiopulmonary bypass; CPR, cardiopulmonary resuscitation; DD:MM:YY:hh:mm:ss, day, month, year, hours, minutes, seconds; ECMO, extracorporeal membrane oxygenation; EMS, emergency medical services; GCS, Glasgow Coma Scale; ICU, intensive care unit; ROSC, return of spontaneous circulation; and Y/N/U, yes/no/unknown.

illness should be abstracted from hospital data, if it is known. (This was previously *supplementary* data in 2003).

Although drowning has traditionally been an injury involving healthy people, changing demographics and recreational interests may contribute to drowning in nonhealthy people. With the increasing prevalence of chronic diseases and aging populations, cardiac, metabolic, and psychiatric conditions may predispose to drowning [25,26].

Note: "Resident of city, county, state, and country" was in the 2003 guidelines and is no longer included even as supplementary data in the present guidelines because the relationship with resuscitation outcomes is unclear.

Scene information (Table 2)

Core data

1. **Water temperature:** Was the water icy or non-icy? The only water temperatures associated with possible improved outcomes have been icy waters [27–29]. Report the water temperature, if known or estimated.
2. **Was the drowning witnessed?** Did someone see the drowning victim enter the water or struggling before disappearing

Table 6
Hospital Course, *Supplementary* Data.

Data Element	Priority	Description	Categories
If CPR was not ongoing on arrival, why?	*Supplementary*	Why was CPR not ongoing on arrival?	Pulse present Patient was considered deceased Unknown
Time CPR stopped in emergency department	*Supplementary*	Date and time	DD:MM:YY:hh:mm:ss or unknown
Number of defibrillation attempts after hospital arrival	*Supplementary*	Number of shocks	Number
Initial neurological function: FOUR score	*Supplementary*	Document the patient's admission FOUR score47,48	FOUR score or unknown
Serum lactate	*Supplementary*	Document the patient's serum lactate levels (mg/dL) (evidence of tissue hypoxia)	Initial Highest Lowest Unknown
Potassium level	*Supplementary*	Document the potassium levels (mEq/L); this can be obtained from either a blood gas or chemistry panel	Initial Highest Lowest Unknown
Prior substance abuse	*Supplementary*	Omit here if already documented under victim information	Y/N/U
Blood alcohol level	*Supplementary*	Document the initial blood alcohol level	mEq/L or unknown
Oxygenation	*Supplementary*	What was highest arterial oxygen tension (Pao_2) in the first 96 h after ROSC? What was lowest Pao_2 in the first 96 h after ROSC?	Initial Pao_2 Highest Pao_2 Lowest Pao_2 Unknown
Temperature goal	*Supplementary*	What was the target temperature and temperature range (degrees centigrade)?	Degrees centigrade or unknown
Neurological function tests	*Supplementary*	Did the patient have neuromonitoring/neuroimaging or biomarker measurement?	Yes: Computed tomography, magnetic resonance imaging, electroencephalography, evoked potentials, intracranial pressure, microdialysis, or tissue oxygen monitoring/serum biomarkers No Unknown

The following data elements that were present in the 2003 guidelines have been deleted from the present guidelines: pupillary reaction (because an abnormal reaction has many possible causes) and toxicology testing (because this is not universally available).
CPR indicates cardiopulmonary resuscitation; DD:MM:YY:hh:mm:ss, day, month, year, hours, minutes, seconds; FOUR, Full Outline of Unresponsiveness; and Y/N/U, yes/no/unknown.

Table 7
Disposition.

Data Element	Priority	Description	Categories
Date of hospital discharge	**Core**	Document the date of discharge from the hospital	DD:MM:YY or unknown
Vital status at discharge	**Core**	Did the patient survive to hospital discharge?	Y/N
Cause of death, if patient did not survive	**Core**	What were the causes of death?	Fill in causes per clinician, such as respiratory distress syndrome, disseminated intravascular coagulation, intracranial hypertension, electrolyte disturbances, acute renal failure, seizures, sepsis, or myocardial failure
Neurological outcome at hospital discharge, if patient survived	**Core**	Use an age-appropriate validated scoring system	CPC scale,50 OPC scale,50 pediatric CPC scale,51 or pediatric OPC scale51 or modified Rankin score52,53
A. If patient died in the hospital:			
How did patient die?	*Supplementary*	How did the patient die?	Brain death with withdrawal of life support Cardiac arrest without ROSC
Was an autopsy performed?	*Supplementary*		Y/N
Channelopathy evaluation?	*Supplementary*	Did the patient have an evaluation for cardiac channelopathies?	Y/N/U
B. If patient survived to hospital discharge:			
Neurological and quality-of-life outcomes 6 mo after hospital discharge	*Supplementary*	Use an age-appropriate validated scoring system	CPC scale, OPC scale, pediatric CPC scale or pediatric OPC scale, or modifi Rankin score Unknown

The following data elements that were present in the 2003 guidelines have been deleted from the present guidelines: How was the cause of death determined? Was a forensic investigation performed and was a forensic cause uncovered (suicide, murder)? Other injuries and morbidities.
CPC indicates Cerebral Performance Category; DD:MM:YY, day, month, year; OPC, Overall Performance Category; ROSC, return of spontaneous circulation; and Y/N/U, yes/no/unknown.

underwater? If not, the event should be labeled "unwitnessed." In drowning, it is not possible to witness the moment of cardiac arrest, which can happen before, during, or after drowning [30].

3. **Was bystander CPR performed?** Did a bystander (non-emergency medical services [EMS] person) perform initial CPR? Yes/No. If yes, did the bystander perform CPR with ventilation? Yes/No. *Supplementary: CPR Method*.
4. **Trained first responder:** Did a trained first responder perform CPR? Did a lifeguard or other trained responder with a duty to treat perform CPR (Yes/No) or provide ventilation only (Yes/No)?
5. **Vital status at first trained responder/EMS assessment:** The consensus group recommended a focus on vital indicators of outcome: **Was the drowning victim responsive** (ABC [alert,

Table 8
Quality of Resuscitation Factors.

Data Element	Priority	Description	Categories
Method of administering ventilation	**Core**	Type of equipment used	Mouth-to-mouth Bag mask Supraglottic airway device Endotracheal intubation Unknown
Ventilation rate	*Supplementary*	Breaths/min	Number or unknown
Chest compression rate	*Supplementary*	Chest compression rate measured during compressions, usually measured as average rate for each minute	Rate/min
Chest compression fraction	*Supplementary*	Proportion of time doing compressions for each minute	Percent or proportion or unknown
Chest compression depth	*Supplementary*	Depth of chest compressions, usually measured as average depth for each minute Other measurements: maximum depth	In mm or cm or unknown
Preshock pause interval	*Supplementary*	Interval between last chest compression and the shock	Seconds or unknown

Note: The following disposition data elements that were present in the 2003 guidelines have been deleted from the present guidelines: How was the cause of death determined? Was a forensic investigation performed and was a forensic cause uncovered (suicide, murder)? Other injuries and morbidities.

blunted, comatose], AVPU [alert, responds to verbal stimuli, responds to painful stimuli, unresponsive [31]], or GCS [Glasgow Coma Scale [32]] scores) and **breathing normally,** and was a **pulse palpable**? The importance of actual respiratory and heart rates and their impact on resuscitation outcome is unknown; therefore, we recommend that both be collected as *supplementary* data.

6. **Initial cardiac rhythm (new):** Report the initial cardiac rhythm from a cardiac monitor or an ECG.

Supplementary data

7. *Vital signs at first EMS assessment*: Report heart rate, blood pressure, temperature, peripheral capillary oxygen hemoglobin saturation (Spo_2, usually calculated with a pulse oximeter), and pupillary reaction to light.
8. *Pulmonary status at first EMS assessment (new):* When the patient is breathing, assess severity of lung injury. Such assessment could provide an approach to the stratification of the severity of drowning [33,34]. The severity of injury should be categorized; for example, report whether results of the lung examination are normal and whether the patient is coughing, and report the presence of unilateral rales or bilateral rales.
9. *Type of water/liquid*: Drowning in heavily contaminated water or water that contains chemicals may result in additional complications such as infection and pneumonitis [35].
10. Body of water.

Pre-EMS scene information (Table 3)

Lifeguards and other trained first responders with a duty to treat are often among the first people to attempt rescue and resuscitation of the drowning victim. In view of the great importance of these rescuers, we have added Table 3 to provide the opportunity for researchers to add additional detail, if applicable, to reports on drowning.

The following data elements that were present in the 2003 guidelines have been revised or deleted from the present guidelines: Loss of consciousness; pre-EMS resuscitation; unconscious when removed from the water; was resuscitation attempted before arrival of EMS? was EMS called? was an EMS vehicle dispatched? was cyanosis present? These elements have either been replaced with updated elements or are considered unreliable (eg, cyanosis could be a result of hypoxia or submersion in cold water). Water temperature was previously supplementary and is now core data.

Time points and intervals from EMS data (Table 4)

A general discussion took place during the meeting regarding the use of time points and time intervals. When available with sufficient accuracy, time points enable accurate calculation of time intervals. Often, data on the exact time points of interest are unavailable. Time intervals can be estimated but are less reliable. In the end, conferees recommended that if time points are unavailable, then estimated time intervals should be reported and the manner of estimation noted.

Core data

1. **Time face was first seen to be underwater**.
2. **Time victim was removed from water**.
3. **Duration underwater (see submersion duration):** The time interval or duration that the victim was underwater is the most important predictor of outcome in drowning, because it represents the amount of anoxia; it should be recorded, if possible [36–38]. Although the submersion interval is seldom documented with a timepiece such as a stopwatch, the estimate of time intervals (eg, less than or greater than 5–6 min; less than or greater than 10–11 min; less than or greater than 15–20 min; and >25 min) has proven to be the most important predictor of outcome [30,35,39–41]. Duration underwater is derived from the time the face was first seen to be underwater to the time of removal from the water. Obtain the estimated time in minutes from those closest to the scene or who talked with those at the scene. Cross-referencing with emergency call and ambulance arrival times (usually recorded centrally) can be helpful to determine time estimates.
4. **Time of first trained responder/EMS treatment:** The first EMS treatment may or may not be CPR and represents a point when "high-quality" medical intervention could be assured to have begun.
5. **Time trained responder/EMS started CPR (resuscitation) in the field:** Resuscitation is defined as the act of trying to maintain or restore life by establishing and/or maintaining breathing and circulation through CPR, defibrillation, and other related emergency care.
6. **Time ROSC achieved**.
7. **Time first conscious/awake**.
8. **Face submerged (underwater) to first treatment/CPR interval:** The time of the first resuscitation attempt is important because it is another indicator of the duration of anoxia. Furthermore, in both cardiac arrest and drowning studies, intervals from drowning or cardiac arrest to CPR are known to affect outcome [36–38,42–44].

Hospital course, core data (Table 5)

The core data included here have been expanded from the list included in 2003.

Core data

1. **Date and time of hospital arrival:** This may include time of arrival in an emergency department or, if directly admitted from the scene, to another type of inpatient care area.

2. **CPR ongoing at hospital arrival (new)?** Was CPR being administered when the patient arrived at the hospital door?
3. **Duration of CPR:** The total number of minutes CPR was provided during the initial cardiac arrest, regardless of where it was stopped (scene, emergency department, or hospital). Duration of CPR has predicted outcome [16,36].
4. **First documented vital signs after hospital arrival:** Report temperature, heart and respiratory rate, blood pressure (systolic and diastolic), oxygen hemoglobin saturation, and pupillary light reaction. If blood pressure is too low to measure, report whether the pulse is palpable. If blood pressure is sufficient to produce peripheral pulses, the oxyhemoglobin saturation (Spo_2) may be measured with a pulse oximeter.
5. **First cardiac rhythm after arrival at hospital:** Cardiac electrical rhythm noted on a cardiac monitor or ECG.
6. **Initial hospital neurological examination:** Report results of the neurological examination when the victim first arrived in the emergency department using a validated, age-appropriate system (eg, ABC, AVPU, or GCS scoring systems). Specify the scale used.
7. **Arterial blood gas analysis:** Report arterial blood gas tensions and pH, especially in victims who are unconscious or who have oxyhemoglobin saturations <95% when breathing room air.
8. **Pulmonary edema or acute respiratory distress syndrome (new):** Did the patient have signs of radiographic bilateral opacities not fully explained by effusions, lobar/lung collapse, nodules within 1 week of the drowning, or other signs of acute respiratory distress syndrome? The Berlin definition of acute respiratory distress syndrome has additional detail [45].
9. **Airway and ventilation requirements:** What was the highest level of respiratory support the patient required during the hospitalization? Choices include nothing, supplementary O_2, noninvasive ventilation support, conventional invasive ventilation support, nonconventional invasive ventilation support, extracorporeal membrane oxygenation, and cardiopulmonary bypass.
10. **Intensive care unit admission (new)**.
11. **Induced hypothermia (new)**.
12. **Temperature management (new):** Was the patient treated with a protocol aimed at targeted temperature management [46] (defined as an active therapy to achieve and maintain a specific target temperature for a defined duration)? Yes, No, or Unknown. If yes, what was the target temperature range (degrees centigrade)?
13. **Temperature peak and trough (new):** What were the initial, highest, and lowest temperatures in the first 96 h after return of spontaneous circulation (ROSC)?
14. **Serum glucose levels:** What were the initial, highest, and lowest serum glucose levels in the first 24 h after ROSC? Was normoglycemia maintained? Yes, No, or Unknown.
15. **Was hypotension documented ≥2 times during hospitalization (new)?** Did the patient have ≥2 documented episodes of hypotension (defined as systolic blood pressure <90 mm Hg for adults and age adjusted for children)? Yes, No, or Unknown.
16. **Circulatory support (new):** Was continuous vasopressor/inotropic support initiated? Yes, No, or Unknown.
17. **Cardiopulmonary bypass (new)**.
18. **Neurological function:** What was the best GCS (or pediatric equivalent) during hospitalization (score range 3–15)?
19. **In-hospital resuscitation (new):** Did the patient have another cardiac arrest requiring attempted resuscitation after hospital admission? Yes, No, or Unknown.
20. **Complicating illness of drowning (new):** Check all that apply.

Hospital course, supplementary data (Table 6)
Supplementary data

1. *If CPR was not ongoing on arrival at the hospital, what was the reason (new)?* Was CPR not indicated because the patient had a pulse, or was the patient deceased?
2. *Time CPR stopped in the emergency department (new).*
3. *Number of defibrillations administered (new):* If the patient was defibrillated after hospital arrival, document the number of shocks the patient received.
4. *Initial neurological function (new):* FOUR score (Full Outline of Unresponsiveness) [47,48].
5. *Serum lactate*: Document the patient's initial and highest serum lactate levels, because this can provide evidence of tissue hypoxia.
6. *Potassium level*: Document the initial, highest, and lowest serum or blood potassium levels on admission (in mEq/L). This can be an important predictor of outcome [49].
7. *Toxicology screening or history of prior substance abuse.*
8. *Blood alcohol level*: What was the first documented blood alcohol level?
9. *Arterial oxygen tension (Pao_2)*: What was initial, lowest, and highest Pao_2 in the first 96 h after ROSC?
10. *Temperature goal (new)*: What was target temperature range and temperature range (degrees centigrade)?
11. *Neurological function tests (new):* Did the patient have neuromonitoring/neuroimaging or biomarker measurement (computerized tomography, magnetic resonance imaging, electroencephalography, evoked potentials, intracranial pressure, microdialysis, or tissue oxygen monitoring/serum biomarkers)?

Disposition (Table 7)
Core data

1. **Date of hospital discharge.**
2. **Vital status at discharge:** Did patient survive to hospital discharge? Yes, No, or Unknown.
3. **Cause(s) of death (new):** Describe the factors contributing to death associated with drowning, such as alcohol or other drug intoxication, cardiac arrhythmia (prolonged QT), or myocardial infarction. Indicate clinical causes listed in the medical record, such as respiratory distress syndrome, disseminated intravascular coagulation, intracranial hypertension, electrolyte disturbances, lucose disturbances, acute renal failure, seizures, sepsis, or myocardial failure.
4. **Neurological outcome at hospital discharge**: Use an age-appropriate validated scoring system such as the Cerebral Performance Category scale [50], Overall Performance Category scale [50], pediatric Cerebral Performance Category scale [51] or pediatric Overall Performance Category scale [51], modified Rankin score [52,53], or other.

Supplementary data
A. If patient died in the hospital:

1. *How did the patient die (if applicable) (new):* Multiorgan failure, intractable shock, recurrent cardiac arrest without ROSC, brain death, withdrawal of life support.
2. Was an autopsy performed?
3. *Channelopathy evaluation (new):* Did the patient have an evaluation for cardiac channelopathies? Yes, No, or Unknown.

B. If patient survived to hospital discharge:

4. *Neurological and quality-of-life outcomes 6 months after discharge (new):* Report quality of life at the time of discharge from the hospital using an age appropriate validated scoring system

(eg, Cerebral Performance Category scale, Overall Performance Category scale, pediatric Cerebral Performance Category scale or pediatric Overall Performance Category scale, or modified Rankin score).

Quality of resuscitation factors (Table 8)

Over the past decade, a number of studies have demonstrated the importance of factors related to CPR quality (eg, rescuer compression rate, depth of chest compressions, compression fraction, and preshock pause interval [ie, time elapsed between last compression and shock delivery during attempted defibrillation]) and their effect on ROSC and neurologically intact survival to hospital discharge in patients with out-of-hospital cardiac arrest [54–58]. Because drowning is primarily a respiratory problem, information regarding the quality of ventilation is important. Data regarding CPR quality for each patient can be displayed in real time and recorded for later analysis by many commercially available automated external defibrillators and monitor-defibrillators used during resuscitation. These data are important for quality assurance and quality improvement programs that have been used to improve survival from sudden cardiac arrest in prehospital systems [59].

The following factors are considered important indicators of resuscitation quality:

1. **Method of administering ventilation:** Mouth-to-mouth, bag-mask, supraglottic airway device, or endotracheal intubation.
2. *Ventilation rate:* Breaths per minute
3. *Chest compression rate:* Chest compression rate measured during compressions
4. *Chest compression fraction:* Proportion of time compression was performed for each minute of total resuscitation time (percent or fraction of resuscitation).
5. *Chest compression depth:* Usually measured as average depth for each minute
6. *Preshock pause interval:* Interval (in seconds) between the last chest compression and shock delivery when defibrillation is attempted.

Discussion

This report describes the results of the Second International Utstein-style Consensus Conference on Drowning that convened in Potsdam, Germany, in October 2013, as well as additional conferences and meetings through 2014 and 2015. This report is an update of the 2003 publication [1], is based on a 3-stage Delphi consensus process that was used to arrive at consensus recommendations, and expands the number of reporting parameters from 47 to 68 on the basis of advances in resuscitation science and study experience since the first report. The conference had wide geographic representation, including participation from members residing in Austria, Australia, Brazil, Canada, Denmark, Germany, the United Kingdom, Korea, Japan, New Zealand, the Netherlands, and the United States of America, representing a number of international organizations. Drowning is a neglected public health issue with a significantly disproportionate burden in low- and middle-income countries [60]. In low- and middle- income nations, rescue, resuscitation, emergency response systems, and hospital care may be immature, rare, or absent. Several participants were acquainted with the problem of drowning in developing countries and contributed factors for reporting related to the environment that might be found in developing countries.

The data suggested for reporting in studies of resuscitation from drowning are thought to be important demographic, patient-centered factors, as well as factors related to EMS response and resuscitation. We clarified times and time intervals that are related to outcomes in a separate table (Table 4). Factors related to severity of illness, in-hospital resuscitation, and advanced care are also recommended for reporting. Table 6 now includes data related to hypothermia or temperature management, which could have an impact on mortality and neurological outcomes after spontaneous ventricular fibrillation cardiac arrest, although this remains under investigation with regard to the specific relevance to drowning [46,61–63].

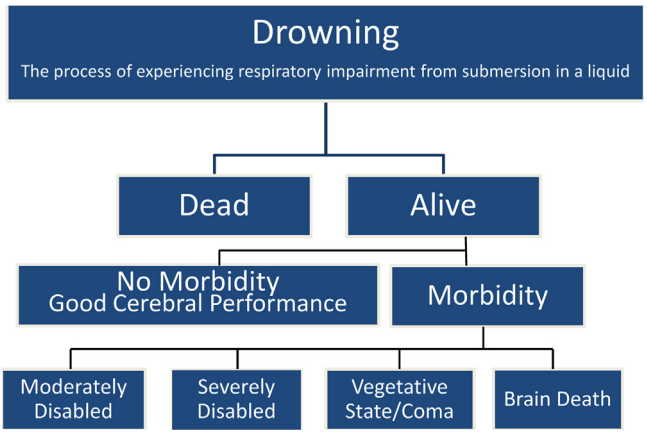

Fig. 1. Possible scheme for tracking outcomes.

Many drowning events require only ventilation for resuscitation, and many patients are not transported to the hospital. New data elements have been added to the reporting template that include events in which drowning victims required ventilation only, may have been treated by first responders but not by EMS, or may not have been transported to a hospital (Tables 3–5).

The quality of prehospital resuscitation has emerged in the past decade as a factor associated with ROSC and survival to hospital discharge, and it is recommended that those systems capable of collecting data on this factor do so (Table 8). Drowning prevention remains the most important strategy in all nations, regions, and communities to save lives and minimize the tragic impact of drowning.

Outcomes

A number of outcomes are important after drowning, such as ROSC, admission to hospital, survival to hospital discharge, and short- and long-term neurological function. When death is an outcome, it can be difficult to assign drowning as a specific cause, especially if the person was hospitalized and had other intervening illnesses before death. The original report used the term “death due to drowning” if a person died after drowning, even if other illnesses occurred before death. The present report has revised that term to “drowning-related death” and recommends inclusion of complications during the hospital stay that have contributed to morbidity and mortality. We suggest a possible scheme for tracking outcomes (Fig. 1).

Summary

A group of international experts agreed on these modifications to the recommended elements for unified reporting of outcome data in studies of resuscitation from drowning. These guidelines are intended to improve the clarity of scientific communication and the comparability of scientific investigations.

The Second International Utstein-style consensus welcomes comments or questions regarding these recommendations.

Disclosures

Writing Group Disclosures

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*Modest.

†Significant.

Reviewer Disclosures

Reviewer	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
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*Modest.

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