WORKSHEET for PROPOSED Evidence-Based GUIDELINE RECOMMENDATIONS

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STEP 1: STATE THE PROPOSAL. State if this is a proposed new guideline; revision to current guideline; or deletion of current guideline. Existing guideline, practice or training activity:

Review 2000 guidelines and create a new guideline

Step 1A: Refine the question; state the question as a positive (or negative) hypothesis. State proposed guideline recommendation as a specific, positive hypothesis. Use single sentence if possible. Include type of patients; setting (in- /out-of-hospital); specific interventions (dose, route); specific outcomes (ROSC vs. hospital discharge).

Hypothesis: Only opening the airway in a conscious victim, providing only ventilation, providing only CPR (unconscious victim), and calling for help are safe, effective and feasible interventions for rescuers to perform on drowning victims before removal from water.

Step 1B: Gather the Evidence; define your search strategy. Describe search results; describe best sources for evidence.

Cochrane database using word "drown" found 13 reviews but none were related to the issue. Medline search using word "drowning" found 2,932 articles, which was refined to 633 by combining with "resuscitation" An additional search using words "in water OR in-water" selected 167 abstracts but only 18 were related (including a 1997 statement from ILCOR, one article in German and two letters). After a review we excluded all articles, which did not directly address the hypothesis and also those citations where we could not obtain.

List electronic databases searched (at least MEDLINE (http://igm.nlm.nih.gov/), Embase, Cochrane database for systematic reviews and Central Register of Controlled Trials, and hand searches of journals, review articles, and books. **Cochrane database (reviews and trials), Medline, Embase, AHA Endnote database, references from previous articles and review articles and Books.**

- State major criteria you used to limit your search; state inclusion or exclusion criteria (e.g., only human studies with control group? no animal studies? N subjects > minimal number? type of methodology? peer-reviewed manuscripts only? no abstract-only studies?)

Excluded all article abstracts when references to "in-water resuscitation" were made based on reference to others citations. Excluded all ILCOR statements before 2000 and articles not in English language. Accept all studies with full text based on "in-water resuscitation".

- Number of articles/sources meeting criteria for further review: Create a citation marker for each study (use the author initials and date or Arabic numeral, e.g., "Cummins-1"). If possible, please supply file of best references; End Note 4+ preferred as reference manager, though other reference databases acceptable.

11 articles met criteria for more detailed review.

STEP 2: ASSESS THE QUALITY OF EACH STUDY

Step 2A: Determine the Level of Evidence. For each article/source from step 1, assign a level of evidence—based on study design and methodology.

Level of Evidence	Definitions (See manuscript for full details)
Level 1	Randomized clinical trials or meta-analyses of multiple clinical trials with substantial treatment effects
Level 2	Randomized clinical trials with smaller or less significant treatment effects
Level 3	Prospective, controlled, non-randomized, cohort studies
Level 4	Historic, non-randomized, cohort or case-control studies
Level 5	Case series: patients compiled in serial fashion, lacking a control group
Level 6	Animal studies or mechanical model studies
Level 7	Extrapolations from existing data collected for other purposes, theoretical analyses
Level 8	Rational conjecture (common sense); common practices accepted before evidence-based guidelines

Step 2B: Critically assess each article/source in terms of research design and methods.

Was the study well executed? Suggested criteria appear in the table below. Assess design and methods and provide an overall rating. Ratings apply within each Level; a Level 1 study can be excellent or poor as a clinical trial, just as a Level 6 study could be excellent or poor as an animal study. Where applicable, please use a superscripted code (shown below) to categorize the primary endpoint of each study. For more detailed explanations please see attached assessment form.

Component of Study and Rating	**Excellent**	**Good**	**Fair**	***Poor***	***Unsatisfactory***
Design & **Methods**	Highly appropriate sample or model, randomized, proper controls **AND** Outstanding accuracy, precision, and data collection in its class	Highly appropriate sample or model, randomized, proper controls **OR** Outstanding accuracy, precision, and data collection in its class	Adequate, design, but possibly biased **OR** Adequate under the circumstances	*Small or clearly biased population or model* ***OR*** *Weakly defensible in its class, limited data or measures*	*Anecdotal, no controls, off target end-points* ***OR*** *Not defensible in its class, insufficient data or measures*

A = Return of spontaneous circulation C = Survival to hospital discharge E = Other endpoint
B = Survival of event D = Intact neurological survival

Step 2C: Determine the <u>direction</u> of the results and the statistics: supportive? neutral? opposed?

DIRECTION of study by results & statistics:	**SUPPORT the proposal**	**NEUTRAL**	**OPPOSE the proposal**
Results	Outcome of proposed guideline superior, to a clinically important degree, to current approaches	Outcome of proposed guideline no different from current approach	Outcome of proposed guideline inferior to current approach

Step 2D: Cross-tabulate assessed studies by a) *level,* b) *quality* and c) *direction* (ie, supporting or neutral/ opposing)**; combine and summarize.** Exclude the *Poor* and *Unsatisfactory* studies. Sort the *Excellent*, *Good*, and *Fair* quality studies by both *Level and Quality of evidence,* and *Direction of support* in the summary grids below. Use citation marker (e.g. author/ date/source). In the *Neutral* or *Opposing* grid use bold font for *Opposing* studies to distinguish them from merely neutral studies. Where applicable, please use a superscripted code (shown below) to categorize the primary endpoint of each study.

Supporting Evidence

Only opening the airway in a conscious victim, providing only ventilation, providing only CPR (unconscious victim), and calling for help are safe, effective and feasible interventions for rescuers to perform on drowning victims before removal from water.

Quality of Evidence		1	2	3	4	5	6	7	8
	Excellent				**Szpilman2004** [C, D (#, $, &)]	**Suominen2002** [C, D ($)] **Szpilman1997** [A, B, C, D (#, $)] **Quan 1992** [($)] **Quan 1990** [($)]			
	Good					**Bierens1990** [C, D ($)] **Manolios1988** [C (#, $)]			
	Fair						**March1980** [E ($, *)]	**Cummings2003** [(#, $, &)] **Orlowski2001** [(#, $, &)]	

Level of Evidence

A = Return of spontaneous circulation C = Survival to hospital discharge E = Other endpoint
B = Survival of event D = Intact neurological survival
# = open airway only $ = ventilation only * = CPR & = C-spine stabilization

Neutral or Opposing Evidence

Only opening the airway in a conscious victim, providing only ventilation, providing only CPR (unconscious victim), and calling for help are safe, effective and feasible interventions for rescuers to perform on drowning victims before removal from water.

Quality of	Excellent								
	Good				Szpilman[C, D (*)] (opposing)				
	Fair					Manolios1988[C (*)] (opposing)		Cummings2003 [(*)] (opposing)	
				3	4	5	6	7	8
		Level of Evidence							

A = Return of spontaneous circulation | C = Survival to hospital discharge | E = Other endpoint
B = Survival of event | D = Intact neurological survival
# = open airway only | $ = ventilation only | * = CPR & | = C-spine stabilization

STEP 3. DETERMINE THE CLASS OF RECOMMENDATION. Select from these summary definitions.

CLASS	CLINICAL DEFINITION	REQUIRED LEVEL OF EVIDENCE
Class I *Definitely recommended.* Definitive, **excellent** evidence provides support.	• Always acceptable, safe • Definitely useful • Proven in both efficacy & effectiveness • Must be used in the intended manner for proper clinical indications.	• One or more Level 1 studies are present (with rare exceptions) • Study results consistently positive and compelling
Class II: *Acceptable and useful*	• Safe, acceptable • Clinically useful • Not yet confirmed definitively	• Most evidence is positive • Level 1 studies are absent, or inconsistent, or lack power • No evidence of harm
• *Class IIa:* *Acceptable and useful* **Good** evidence provides support	• Safe, acceptable • Clinically useful • Considered treatments of choice	• Generally higher levels of evidence • Results are consistently positive
• ***Class IIb:*** *Acceptable and useful* **Fair** evidence provides support	• Safe, acceptable • Clinically useful • Considered optional or alternative treatments	• Generally lower or intermediate levels of evidence • Generally, but not consistently, positive results
Class III: *Not acceptable, not useful, may be harmful*	• Unacceptable • Not useful clinically • May be harmful.	• No positive high level data • Some studies suggest or confirm harm.
Indeterminate	• Research just getting started. • Continuing area of research • No recommendations until further research	• Minimal evidence is available • Higher studies in progress • Results inconsistent, contradictory • Results not compelling

STEP 3: DETERMINE THE CLASS OF RECOMMENDATION. State a Class of Recommendation for the Guideline Proposal. State either a) the intervention, and then the conditions under which the intervention is either Class I, Class IIA, IIB, etc.; or b) the condition, and then whether the intervention is Class I, Class IIA, IIB, etc.

Intervention: Opening only the airway (in a conscious victim) and providing ventilation only, providing CPR (unconscious victim) with C-spine stabilization (if indicated) and calling for help, are safe, effective and feasible interventions for rescuers to perform on drowning victims before removal from water.
Class of recommendation: variable. See guideline section below.

REVIEWER'S PERSPECTIVE AND POTENTIAL CONFLICTS OF INTEREST: Briefly summarize your professional background, clinical specialty, research training, AHA experience, or other relevant personal background that define your perspective on the guideline proposal. List any potential conflicts of interest involving consulting, compensation, or equity positions related to drugs, devices, or entities impacted by the guideline proposal. Disclose any research funding from involved companies or interest groups. State any relevant philosophical, religious, or cultural beliefs or longstanding disagreements with an individual.

Intensive Care & Internist Specialist. ILS Medical member Commission. Studied pre-hospital provider care on drowning for 14 years. Beginning PhD. No intellectual or commercial conflicts.

REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK: Summarize your final evidence integration and the rationale for the class of recommendation. Describe any mismatches between the evidence and your final Class of Recommendation. "Mismatches" refer to selection of a class of recommendation that is heavily influenced by other factors than just the evidence. For example, the evidence is strong, but implementation is difficult or expensive; evidence weak, but future definitive evidence is unlikely to be obtained. Comment on contribution of animal or mechanical model studies to your final recommendation. Are results within animal studies homogeneous? Are animal results consistent with results from human studies? What is the frequency of adverse events? What is the possibility of harm? Describe any value or utility judgments you may have made, separate from the evidence. For example, you believe evidence-supported interventions should be limited to in-hospital use because you think proper use is too difficult for pre-hospital providers. Please include relevant key figures or tables to support your assessment

Summary

The original question was, "What are safe, effective and feasible potential interventions that rescuers could perform on drowning victim before removal from water?" This included only opening the airway, providing ventilation only, providing CPR and C-spine stabilization and when to call for help.

There were only a limited number of human studies identified concerning in-water procedures and resuscitation, and no Level 1, 2 or 3 studies were identified. The highest Levels of Evidence were a number of retrospective studies, almost exclusively from a hospital perspective. There are only a very few studies which consider the interventions in a pre-hospital setting, which is the focus of this worksheet's question.

Consider only opening the airway, only providing ventilation, or providing CPR:

In the first study, the authors demonstrated that hypoxia caused by drowning results first in respiratory arrest. (**Manolios1988, Szpilman1997**) When respiratory arrest is not corrected, it is followed by cardiac arrest within a variable, but short interval, which is determined by different factors (**Manolios1988, Szpilman1997, Bierens1990, Orlowski2001**).
In drowning, resuscitation efforts started on-shore result in a lower death rate, if respiratory arrest is corrected prior to cardiac arrest onset (mortality in 0%-44% with on-shore resuscitation vs. 33%-93% if resuscitation is delayed). (**Manolios1988, Szpilman1997, Bierens1990**)
Studies demonstrate that "**only opening the airway**" should be achieved and maintained in any unconscious victim requiring rescue who is breathing on their own (**Manolios1988, Szpilman1997, Bierens1990, Orlowski2001)**.
Cardiac compression in the water was shown to be ineffective, except when a boat with a flat deck is available, and pulse checks in the water are highly unreliable. (**Manolios1988, Cummins2003, Orlowski2001**) There is only one study (**March1980**) which is in favor of positioning a victim on the rescuer's chest and initiating CPR in-water. In this one study supporting in-water chest compressions, respiratory support was provided with a slightly modified scuba regulator, and procedures were tested on an instrumented aquatic CPR mannequin in the water and anesthetized dogs on land. Most results in this study were confusing, without statistical significance and full of errors.
In-water resuscitation (IWR) (ventilation only) is quite difficult to perform and can be expected to be less effective than resuscitation ashore. However, delaying resuscitation efforts in an unconscious victim with a heartbeat until reaching shore may lengthen the time interval that results in cardiac arrest, with significant reduction in the probability of successful resuscitation. (**Manolios1988, Szpilman1997, Bierens1990, Orlowski2001**).
Lifeguards around the world have been teaching IWR procedures since 1976 (**Manolios1988**) although this recommendation was based only on anecdotal information and preliminary studies with animals. (**March1980**).
In studies considering time of submersion and/or time elapsed to begin CPR, Quan and coworkers (**Quan1990**) found that the longer the submersion duration, the greater the frequency of death and severe neurologic damage (SND). In a further analysis of 77

pediatric submersion victims, none survived when the submersion or the resuscitation durations were greater than 25 minutes**.** **(Quan1992)**. Bierens report better survival for submersion of less than 10 minutes. (**Bierens1990).**
Cummings **(Cummins2003**) demonstrated that the longer it takes from recognition that someone has submerged to the start of in-water resuscitation (ventilation only) or the victim's rescue to shore, the worse the outcome. Although submersion time is usually an estimate, higher cardiopulmonary arrest duration was independently associated with poor outcome and it is the best prognostic factor after a drowning incident. Suominen and co-workers in a retrospective study of 61 post-drowning resuscitation victims age range: 0.5-60 years (26 were children (<16 years)), median 29 years with a median water temperature of 17 degrees C (range: 0-33 degrees C) found: a median submersion time for the 43 survivors (70%) was 10 min (range: 1-38 min). Intact survivors and those with mild neurological disability (n=26, 43%) had a median submersion time of 5 min (range: 1-21 min). In non-survivors the median submersion time was 16 min (range: 2-75 min). Submersion time was also the only independent predictor of survival in linear regression analysis (P<0.01). (**Suominen2002)**
Besides submersion and cardiopulmonary arrest times, water temperature could be another factor that influences the decision to begin IWR. Small children were reported to have survived after submersion in icy water for more than one hour. (**Watson2001**) Bierens report that the following factors were associated with better survival: young age and a central body temperature of less than 35C at admission.(**Bierens1990**) Suominem reported that patient age, water temperature and rectal temperature in the emergency department were not significant predictors of survival. In this report, children did not have a better outcome than adults. (**Suominen2002)** However, in icy waters in-water rescue attempts are impractical and resuscitation should be started as early as it can be effectively accomplished.
The highest level of evidence was (**Szpilman2004**) a non-randomized, case-control study, where the authors identified for the first time that attempting to conduct in-water resuscitation (IWR) (ventilation only) resulted in a significant outcome improvement for severe drowning victims (unconscious victim). It further confirms that estimated cardiopulmonary arrest (CPA) duration is a crucial parameter to consider when deciding to start any resuscitation efforts either in-water or subsequently after removal from the water after drowning. Among the 19 patients receiving IWR the on-scene and in-hospital mortality rates were significantly lower than in the 27 drowning victims who did not receive IWR (hospital mortality: 15.8% versus 85.2%). They were less likely to require full CPR on the beach or pool deck and almost half of them did not need any additional resuscitation maneuver after IWR. They also had a higher probability of being successfully transferred to a hospital. In multivariate analysis, providing IWR reduced the probability of death almost 20-fold. Nonetheless, although most patients receiving IWR had good outcomes, about one third developed severe neurological damage (SND). A higher estimated CPA duration interval was the unique independent variable selected in the logistic regression. When a ROC curve was constructed, estimated CPA duration showed a very good accuracy in predicting a poor outcome (ROC_{area}=0.881). Of great concern, was the cutoff point found, in which every patient with CPA duration greater than 14 minutes died or developed SND. The study has substantial limitations. First, it was based on retrospective data assessment and, consequently, 28 (32.6%) patients were excluded due to missing data. Since the mortality rate for excluded cases was higher than for included ones, we cannot rule out the possibility that a selection bias included cases that had been rescued more appropriately. Second, it was not possible to assess some variables related to patient characteristics (body mass, for example), beach conditions, rescue site, as well as factors such as lifeguard experience and self-confidence in the rescue, any of which could potentially affect the decision to offer IWR. Therefore, they cannot exclude a bias has occurred because lifeguards were given the prerogative of deciding whether to attempt IWR or not. Although IWR was shown to be very beneficial, it remains difficult, even for a trained rescuer, to recognize an isolated respiratory arrest and to perform mouth-to-mouth ventilation in-water, particularly in deep water. Several factors can affect the decision to attempt IWR, such as the following: water surface conditions (calm vs. rough); depth of water; distance to shore; availability of lifesaving equipment; and victim characteristics (obesity, high suspicion to neck or facial trauma). It is reasonable to recommend IWR if the CPA duration is less than 15 minutes or is unknown. An algorithm was developed to assist in on-scene decision-making (**Szpilman2004).**
Moreover, lifeguards are reluctant to perform mouth-to-mouth ventilation without a barrier device to minimize the risk of communicable disease. However, use of a barrier device in-water adds a complicating element to an already difficult maneuver. While lifeguards should be provided with this option, they should also be advised of the extremely low chance of contracting a communicable disease via mouth-to-mouth ventilation, especially in water where fluids are continually flushed. (**Adult Basic Life Support. Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiac Care (ECC). Circulation. 2000;102:I22-I59**)

When to call for help?
There is no study referring to this issue other than expert opinion (Orlowski2000, Cummings2003). Contrary to popular opinion and the picture popularized by film and television, the typical drowning victim does not wave or call for help. Because breathing instinctively takes precedence, the drowning victim is unable to cry for help. The panicked and struggling drowning victim can be dangerous to a would-be rescuer. A victim attempting to cling to life and breathe can drown their would-be rescuer. For this reason, a rescuer should call for help whenever possible before the rescue take place. If it is impossible to call before the rescue, it should be just after checking a non-breathing drowning victim (unconscious). It is always best to approach a struggling victim with an intermediary object such as a rescue or torpedo buoys that also can double as a neck flotation device to keep the head of an unconscious victim out of the water.

Preliminary draft/outline/bullet points of Guidelines revision: Include points you think are important for inclusion by the person assigned to write this section. Use extra pages if necessary.

Publication: ___ Chapter: ___ Pages:
Topic and subheading:

Final Class of recommendation: As follows:

1. Whenever a breathing drowning victim (conscious) is found in the water, the rescuer should: avoid unnecessary risks to both victim and rescuer by using a floating device positioned between the rescuer and the victim, await for the victim to calm down, if needed, and bring the victim to dry land without any in-water aid procedures other than to reassure and maintain airways opened (Szpilman2004, Cummings2003, Orlowski2001). (LOE 4, 8)

2. Whenever a non-breathing drowning victim (unconscious) is found in the water, the rescuer should bring the victim's face out of water and extend the neck to open the airway (CLASS IIa – LOE 4)
If in shallow water or deep water with one rescuer using lifesaving equipment, or 2 or more rescuers, check for breathing. Breathing assessment is <u>not</u> indicated when there is only one lifeguard in deep water. If there is no spontaneous breathing, ventilate for approximately one minute (12 to 16 ventilations/min). If ventilation is restored keep the airway opened while proceeding with rescuing the victim without any further care other then a quick stop to monitor breathing and restart mouth-to-mouth if necessary. If breathing is rechecked and spontaneous breathing is not restored ventilate one additional minute in place while checking for signs of circulation. If signs of circulation are present, proceed with the rescue while ventilations are continued or by stopping every 1 or 2 minutes to ventilate again for one minute. If there is no circulation (ie, signs of life), the rescuer should bring the victim to shore without further ventilations (Szpilman2004). (LOE 4)

2.1. Recommendations for in-water resuscitation are for cases where the submersion time is unknown or is known to be less than 15 minutes (Szpilman2004, Quan1990, Quan1992, Suominen2002, Cummings2003). (LOE 4)
2.2. After resuscitation, maintain observation of the victim since during the first 5 to 10 minutes the victim could again stop breathing (Manolios1988). (LOE 5)
2.3. Rescuers should not check the victim's pulse or start compressions while in the water. Cardiac compressions in the water are ineffective, except when a boat with a flat deck is available, and pulse checks in the water are highly unreliable. (Manolios1988). Attempting chest compressions will also slow the rescue process, and even if CPR is necessary, this may place the victim in further danger of more aspirations and needlessly tire the rescuer. (LOE 5)
2.4. Lifeguards should be trained regarding the indications and procedures of IWR and given the prerogative of deciding whether to attempt IWR or to bring the victim to shore and then attempt resuscitation. This decision should takes into account daily beach conditions (water temperature, rough water, water depth, and surf conditions), and rescue site (distance from shore), as well as lifeguard fitness, experience, skill and self-confidence that this procedure can help the victim (Szpilman2004). Even trained lifeguards cannot always accomplish this difficult technique effectively, especially in deep water (i.e. overhead). (LOE 4)

3. When to call? (Orlowski2001)
3.1. Always call for help before attempting to rescue a drowning victim.
3.2. If impossible to call before attempting rescue, it should be just after checking a non-breathing drowning victim (unconscious). (LOE 7)

4. Other in-water recommendations (Orlowski2001)
4.1. Do not attempt to drain water from the lungs.
4.2 Ventilate first and only check for foreign bodies in the airway, (eg, seaweed, sand, or mud) if effective ventilation cannot be achieved. (LOE 7)

Citation List (included studies)

Citation Marker	Full Citation*
Bierens1990#	Bierens JJ, van der Velde EAV, van Berkel M, van Zanten JJ. Submersion in The Netherlands: prognostic Indicator and results of resuscitation. Ann Emerg Med. 1990;19:1390-1395 STUDY OBJECTIVES: To analyze prognostic indicators and the outcome of resuscitation in submersion victims (drowning and near drowning). DESIGN: Retrospective study. SETTING: Intensive and Respiratory Care Unit. Between January 1, 1979, and December 31, 1985, 87 submersion victims were admitted. The files of 83 victims were available for statistical analysis. There were 66 male victims and 17 female victims; the average age was 31.4 +/- 25.8 years. There were ten salt water and 73 fresh water submersions. MEASUREMENTS AND MAIN RESULTS: Predictors for better survival potentials were a young age, submersion of less than ten minutes, no signs of aspiration, and a central body temperature of less than 35 C at admission. We did not detect factors that accelerated a decrease in core body temperature at admission and assume that lethal hypoxia had preceded protective hypothermia in our submersion victims. The Orlowski score had a predictive value but at the same time we found nonindependent indicators in this score. Neurologic outcome in our patients, who were not treated according to a brain protection protocol, was not worse than the outcome published by authors who have used such a protocol. Thirty-three percent of the victims with a cardioventilatory arrest (15) and all victims with a ventilatory arrest (11) survived resuscitation and were discharged. Five nonarrest victims died due to late complications. CONCLUSION: This study shows that no indicator at the rescue site and in the hospital is absolutely reliable with respect to death or survival. *Level 5 study (good) – retrospective, case series, hospital patient admission only. Not included of dead victim at the site and victim which do not need hospitalization. Consideration of time of submersion was important factor. Supportive except for in-water CPR*

Cummins2003#	**Cummins RO, Szpilman D. Submersion. In: Cummins RO, Field JM, Hazinski MF, Editors. ACLS - The Reference Textbook. Volume II: ACLS for Experienced Providers. Dallas, Tx: American Heart Association; 2003:97-107.** **No Abstract.** Level 7 – (Fair) Literature revision. Expert opinion. Supportive except for in-water CPR
March1980#	**March NF, Matthews RC. New techniques in external cardiac compressions. Aquatic cardiopulmonary resuscitation. JAMA. 1980 Sep 12;244 (11):1229-32.** Abstract: Despite the 8,000 drowning that occur annually in the United States, procedures for aquatic first aid are currently limited to mouth-to-mouth resuscitation, while cardiopulmonary resuscitation (CPR) must be delayed until the victim is transported to a solid surface for conventional closed-chest cardiac compressions. We discuss techniques of positioning a victim on the rescuer's chest and initiating CPR, on site. Respiratory support was provided with a slightly modified scuba regulator, and procedures were tested on an instrumented aquatic CPR mannequin in the water and anesthetized dogs on land. Most results were within specified criteria for successful CPR. *Level 6 – (Fair) - Animal and manequim experimental research. Historical study in favor of positioning a victim on the rescuer's chest and initiating CPR, on site (in-water). Results were confused, without statistical significance and full of errors. Supportive for in-water CPR*
Manolios1988#	**Manolios N, Mackie I. Drowning and near-drowning on Australian beaches patrolled by life-savers: a 10-year study, 1973-1983. Med J Aust. 1988 Feb 15;148(4):165-7, 170-1.** **Prince of Wales Hospital, Randwick, NSW.** Abstract: Resuscitation report-forms of the Surf Life-Saving Association of Australia, for the period 1973-1983, were analysed. During this period there were 262 immersion victims at beaches that were patrolled by life-savers. Of these, 162 victims survived, some of whom received expired-air resuscitation (n = 61) or cardiopulmonary resuscitation (n = 29). Among those who drowned, none was younger than five years of age. Vomiting and regurgitation were major problems during resuscitation. Respiratory and cardiopulmonary arrest occurred after apparently-successful rescue; this highlights the necessity for the close observation of victims and the early administration of oxygen to all immersion victims. Resuscitation in deep water has been shown to be effective, and instruction in these techniques is now standard teaching within the Surf Life-Saving Association of Australia. *Level 5 – (good) - Out-of-hospital retrospective case series. Supportive except for in-water CPR*
Orlowski2001#	**Orlowski JP, Szpilman D, "Drowning - Rescue, Resuscitation, and Reanimation" Pediatric Critical Care: A New Millennium, W. B. Saunders Company Pediatric Clinics Of North America - V48, N3, June 2001. Review.** **No Abstract.** *Level 7 – (Fair) - Expert opinion. Supportive except for in-water CPR*
Quan1990#	**Quan L, Wentz KR, Gore EJ, Copass MK. Outcome and predictors of outcome in pediatric submersion victims receiving prehospital care in King County, Washington. Pediatrics. 1990;86:586-593** Predictors of outcome in pediatric submersion victims treated by Seattle and King County's prehospital emergency services were studied. Victims less than 20 years old were identified from hospital admissions and paramedic and medical examiners' reports. The proportion of fatal or severe outcomes in patients were compared with various risk factors. Of 135 patients, 45 died and 5 had severe neurologic impairment. A subset of 38 victims found in cardiopulmonary arrest had a 32% survival rate, with 67% of survivors unimpaired or only mildly impaired. The two risk factors that occurred most commonly in victims who died or were severely impaired were submersion duration greater than 9 minutes (28 patients) and cardiopulmonary resuscitation duration longer than 25 minutes (20 patients). Both factors were ascertained in the prehospital phase of care. Submersion duration was associated with a steadily increasing risk of severe or fatal outcomes: 10% risk (7/67) for 0 to 5 minutes, 56% risk (5/9) for 6 to 9 minutes, 88% risk (21/25) for 10 to 25 minutes, 100% risk (4/4) for greater than 25 minutes. None of 20 children receiving greater than 25 minutes of cardiopulmonary resuscitation escaped death or severe neurologic impairment. Our rates for saving all victims, particularly victims in cardiopulmonary arrest, are considerably higher than has been reported before the children. Prompt prehospital advanced cardiac life support is the most effective means of medical intervention for the pediatric submersion victim. Prehospital information provided the most valuable predictors of outcome. *Level 5 – (Excellent) - retrospective case series. Considered from out-of-hospital approach. Supportive*

	except for in-water CPR

Quan1992#	**Quan L, Kinder D. Pediatric submersions: prehospital predictors of outcome. Pediatrics. 1992;90:909-13** This retrospective cohort study was conducted to test prehospital prognostic indicators in pediatric submersion victims. The authors studied all less than 20 years old victims submerged in the non-icy waters of King County, WA who were treated by Seattle or King County Emergency Medical Services between 1985 and 1989 and were hospitalized or died. Seventy-seven victims were identified from emergency medical services incident logs, hospital discharge records, and medical examiner's registries. Outcome predictors were correlated with the victim's condition at hospital discharge. Of 29 victims in cardiac arrest, 13 had return of spontaneous circulation following field resuscitation. Of these, 6 (21%) survived, with mild (n = 2) and severe (n = 4) neurologic impairment at hospital discharge. The best outcome predictors were obtained in the field. These were, for death or severe neurologic impairment, submersion durations > 10 minutes (6/6) and resuscitation durations > 25 minutes (17/17), and for good outcome, sinus rhythm (37/37), reactive pupils (43/43), and neurologic responsiveness (40/40) at the scene. Field-determined factors were reproducibly good outcome predictors. Aggressive emergency medical services may save the lives of pediatric victims in cardiac arrest following short submersion durations. The data support pronouncing dead in the field those pediatric victims of non-icy submersions who do not respond to advanced life support within 25 minutes. *Level 5 – (Excellent) - retrospective case series. Considered from out-of-hospital approach. Time of submersion was an important factor. Supportive except for in-water CPR*
Suominen2002#	**Suominen P, Baillie C, Korpela R, Rautanen S, Ranta S, Olkkola KT. Impact of age, submersion time and water temperature on outcome in near-drowning. Resuscitation. 2002 Mar;52(3):247-54.** Department of Anaesthesia and Intensive Care, Hospital for Children and Adolescents, Helsinki University Central Hospital, Stenbackinkatu 9, FIN-00029 HUS, Helsinki, Finland. pertti.suominen@hus.fi BACKGROUND: Because children have less subcutaneous fat, and a higher surface area to body weight ratio than adults, it has been suggested that children cool more rapidly during submersion, and therefore have a better outcome following near-drowning incidents. AIM OF THE STUDY: To study the impact of age, submersion time, water temperature and rectal temperature in the emergency room on outcome in near-drowning. MATERIAL AND METHODS: This retrospective study included all near-drowning victims admitted to the intensive care units of Helsinki University Central Hospital after successful cardiopulmonary resuscitation between 1985 and 1997. RESULTS: There were 61 near-drowning victims (age range: 0.5-60 years, median 29 years). Males were in the majority (40), and 26 were children (<16 years). The median water temperature was 17 degrees C (range: 0-33 degrees C). The median submersion time for the 43 survivors (70%) was 10 min (range: 1-38 min). Intact survivors and those with mild neurological disability (n=26, 43%) had a median submersion time of 5 min (range: 1-21 min). In non-survivors the median submersion time was 16 min (range: 2-75 min). Submersion time was the only independent predictor of survival in linear regression analysis (P<0.01). Patient age, water temperature and rectal temperature in the emergency room were not significant predictors of survival. CONCLUSIONS: Although submersion time is usually an estimate, it is the best prognostic factor after a near drowning incident. Children did not have a better outcome than adults. *Level 5 - (Excellent) - retrospective, case series, hospital patient admission only. Did not include victims who were pronounced dead at the site and victims who did not need hospitalization. Consideration of time of submersion was an important factor. Supportive except for in-water CPR*
Szpilman1997#	**Szpilman D. Near-drowning and drowning classification: a proposal to stratify mortality based on the analysis of 1831 cases. Chest. 1997 Sep;112(3):660-5.** **ABSTRACT** Objective: To establish an updated classification for near-drowning and drowning(ND/D) according to severity, based on mortality rate of the subgroups. Materials and Methods: We reviewed 41,279 cases of predominantly sea water rescues from the coastal area of Rio de Janeiro City, Brazil, from 1972 to 1991. Of this total, 2,304 cases (5.5%) were referred to the Near-Drowning Recuperation Center, and this group was used as the study data base. At the accident site the following clinical parameters were recorded: presence of breathing, arterial pulse, pulmonary auscultation, and arterial blood pressure. Cases lacking records of clinical parameters were not studied. The ND/D were classified in 6 subgroups: Grade 1 - Normal pulmonary auscultation with coughing; Grade 2 - Abnormal pulmonary auscultation with rales in some pulmonary fields; Grade 3 - Pulmonary auscultation of acute pulmonary edema without arterial hypotension; Grade 4 - Pulmonary auscultation of acute pulmonary edema with arterial hypotension; Grade 5 - Isolated respiratory arrest; Grade 6 - Cardiopulmonary Arrest(CPA). Results: From 2,304 cases in the data base, 1,831 cases presented all clinical parameters recorded and were selected for classification. From these 1,831 cases, 1,189(65%) were classified as Grade 1 (mortality = 0%); 338(18.4%) as Grade 2 (mortality = 0.6%); 58(3.2%) as Grade 3 (mortality = 5.2%); 36(2%) as Grade 4 (mortality = 19.4%); 25(1.4%) as Grade 5

	(mortality = 44%); and 185(10%) as Grade 6 (mortality = 93%)(P<0.000001). Conclusion: The study revealed that it is possible to establish 6 subgroups based on mortality rate by applying clinical criteria obtained from first-aid observations. These subgroups constitute the basis of a new classification. *Level 5 – (Excellent) - retrospective case series from out-of-hospital to hospital discharge. The improved prognosis with a respiratory arrest compared with a cardiopulmonary arrest was strongly documented. Supportive except for in-water CPR*
Szpilman2004#	**Szpilman D. & Soares M., In-water resuscitation— is it worthwhile? Resuscitation 63/1 pp. 25-31 October 2004.** **Abstract:** Objectives: Until now, there is no solid information indicating the best option of rescuing a non-breathing drowning victim in the water. Our objectives were to compare the outcomes of performing immediate in-water resuscitation (IWR) or delaying resuscitation until the victim is brought shore. Material and Methods: A retrospective data analysis was conducted of non-breathing drowning victims rescued by lifeguards in the coastal area of Rio de Janeiro, Brazil. Patients were coded as IWR and no-IWR (NIWR) cases based on the lifeguard's decision whether to perform IWR. Death and development of severe neurological damage (SND) were considered poor outcome.Results: Forty-six patients were studied. Their median age was 17 (9-31) years. Nineteen (41.3%) patients received IWR and 27 (58.7%) did not. The mortality rate was lower for IWR cases (15.8% vs. 85.2%, p<0.001). However, among surviving IWR cases, 6 (31.6%) developed SND. In multivariate analysis, higher age [odds ratio (OR)=1.117 (95% confidence interval (CI)=1.006-1.240)] was associated with death, while IWR [OR=0.052 (95%CI=0.005-0.501)] was protective. When death and SND were set as the dependent variable, longer cardiopulmonary arrest (CPA) duration was the unique variable selected (OR=1.775 (95%CI=1.128-2.792). Every patient with CPA duration higher than 14 minutes had poor outcome. Conclusions: Delaying resuscitation efforts were associated with a worse outcome for non-breathing drowning victims. In the cases studied, IWR was associated with improvement of the likelihood of survival. An algorithm was developed for its indications and to avoid unnecessary risks to both victim and rescuer. *Level 4 – (Excellent) - retrospective, non-randomized, case-control study, where the authors identified for the first time, that attempting to conduct in-water resuscitation (IWR) (ventilation only) can result in a significant outcome improvement for severe drowning victims (unconscious victim). It further confirms that estimated cardiopulmonary arrest (CPA) duration is a crucial parameter to consider when deciding to start any resuscitation efforts either in-water or not on drowning. Patients receiving IWR had lower scene and in-hospital mortality rates than those who did not receive IWR. They were less likely to require full CPR on the beach or pool deck and almost half of them did not need any additional resuscitation maneuver after IWR. They also had a higher probability of being successfully transferred to a hospital. In multivariate analysis, providing IWR reduced the probability of death almost 20-fold. Nonetheless, although most patients receiving IWR had good outcomes, about one third developed severe neurological damage (SND). A higher estimated CPA duration interval was the unique independent variable selected in the logistic regression. When a ROC curve was constructed, estimated CPA duration showed a very good accuracy in predicting these poor outcomes (ROC_{area}=0.881). Of great concern, was the cutoff point found, in which every patient with CPA duration greater than 14 minutes died or developed SND. The study has substantial limitations. First, it was based on a retrospective data assessment and, consequently, 28 (32.6%) patients were excluded due to missing data. Since the mortality rate for excluded cases was higher than for included ones, we cannot rule out the possibility that a selection bias selected cases that had been rescued more appropriately. Second, it was not possible to assess some variables related to patient characteristics (body mass, for example), beach conditions, rescue site, as well as factors such as lifeguard experience and self-confidence in the rescue, any of which could potentially affect the decision to offer IWR. Therefore, they cannot exclude a bias has occurred because lifeguards were given the prerogative of deciding whether to attempt IWR or not. Supportive except for in-water CPR.*
	ARTICLES EXCLUDED
Kizer1982# **EXCLUDED**	**Kizer K. Aquatic rescue and in-water CPR. Ann Emerg Med. 1982 Mar;11(3):166-7.** **No abstract available.** PMID: 7065496 [PubMed - indexed for MEDLINE] **NOT FOUND**

Quan2003# **EXCLUDED**	**Abstract for submission to the Vienna World Congress on Injury Prevention** **Linda Quan, MD, Melissa A. Schiff, MD, MPH, Peter Cummings, MD, MPH; Open Water Drowning: Determinants of Outcome, 2003** Background: Open water is the most common site for drowning involving adolescents and adults. There has not been an evaluation of factors in outcome of open water drownings. Anecdotal reports of good outcomes despite prolonged submersion and cardiac arrest have driven recommendations for prolonged rescue and resuscitation efforts. Setting: 3 counties in Western Washington, USA Patient Population: Victims of all ages who had a drowning incident in open water (lakes, rivers, ponds, ocean), while not wearing a PFD, resulting in death or hospitalization between 1980-1995 Methods: Evaluated prehospital, hospital, and medical examiner records of drowning victims for submersion interval, outcome, and first body temperature in the ED. Results: A total of 1285 open water drowning incidents were identified. Most (82%) victims were male and most (79%) were >15 years of age. Good outcomes, occurring in 20%, included 18% who were normal and 2% with mild/moderate neurologic sequelae. Bad outcomes included 79% who died and 1.5% who survived in severe neurologic or vegetative states. Of the 397 whose submersion intervals were known; 132/153, 86% of those submerged < 6 min and 148/221, 67% of submerged <16 minutes were good survivors. No drowning victim with >15 min. submersion intervals had good outcomes (p=.000). Of the 883 victims with unknown submersion intervals, 11% had good outcomes compared to 149/397, 38%, of victims with known submersion intervals, p=.000. Good outcome was less likely in males than females (862/1048 vs 168/232, p=.02) and decreased with increasing age (74/136, 54%, of those <5yo and 19/203, 9%, in those >50 years, p=000.) Three of the 11 who drowned in icy water had good outcomes compared to 244/1012, 19% (p=.08) of those drowning in non-icy waters. Victims with an initial body temperature >34 degrees C. had good outcomes compared to victims whose temperature was ≤34 degrees C. (39/134 (29%) versus 291/323, 90%, p=000). Conclusion: Open water drownings involve primarily adolescent and adult males and have very high case fatality rate (80%). Good survival was associated with submersion intervals <6 minutes and normothermia in the ED. The bad outcomes in adolescents or adults with unknown or >15 minute submersion intervals have implications for limiting rescue attempts with present resuscitation techniques. **COMMENT**: Not all are in CPA Cutt of was in 15 min, that's why less than 16 min. What kind of body temperature they used? Rectal The cases who reach the hospital (ED) were those who have better chances, as the paramedic did not give up first at the accident site. That's why they have greater body temperature?
Ghaphery1981# **EXCLUDED**	**Ghaphery JL. In-water resuscitation. LETTER referring to March1980 paper** **JAMA. 1981 Feb 27;245(8):821. No abstract available.** **NO IMPORTANCE FOR THE ISSUE** PMID: 7463667 [PubMed - indexed for MEDLINE]
Szpilman2002# **EXCLUDED**	**Szpilman D, Brewster C, Cruz-Filho FES, Aquatic Cervical Spine Injury – How often do we have to worry? World Congress on Drowning, Amsterdam 2002, oral presentation.** **ABSTRACT** Purpose: During in-water shoreline rescue, lifeguards usually need to decide if it's important to proceed with cervical spine (CS) immobilization or not. This could mean the difference between a normal or a severe, lifelong disability. Immobilization of CS is clearly indicated in a conscious victim who is either witnessed to be or highly suspected of trauma, or is in trouble in shallow water for unknown reasons. On the other hand, for unconscious victims the time spent on immobilizing the CS could lead to cardiopulmonary deterioration and even death. Some factors need to be considered in this decision. One of them is how often CSI occurs among beach-line water incidents ? Method: We retrospectively analyzed all rescues and medical emergencies at the Drowning Resuscitation Center(DRC), dispatched between 1991 and 2000 which were suspected or confirmed to have CSI by clinical(pre-hospital) or radiological methods(hospital). Results: There were 46,060 rescues made by lifeguards. From these, 930(2%) were referred to the DRC. The remaining 45,130 cases were released directly from the beach with no clinical complaints. From the total of 930 immersion/submersion incidents, 13 cases had associated trauma with head or cervical spine injury. Two cases had missing data. The other 11 cases had a mean age of 23,9(SD+/-9,45) and nine were males. From these suspected CSI cases(0,02% of rescues), only 4 had confirmed CSI(0,009%). All were released home (2-normal, 1-light disability and 1-tetraplegic). Conclusions: Rio de Janeiro beaches have a very low incidence(0,009%) of CSI among bathers rescued by lifeguards. Other water locations may have different rates depending on a wide variety of elements which require individual evaluation. On Rio de Janeiro beaches we recommend that lifeguards carry out the CS immobilization only in conscious cases where trauma is evident. All unconscious cases should first have their breathing checked and only if they are alive and CSI is suspected should the lifeguard worry about immobilizing it.