Whenever an apparently non-breathing victim is found in the water, the rescuer is confronted with a difficult choice!

Conscious?
Movement or speaking

Unconscious?
No movement

Should attempt resuscitation or bring to shore and resuscitate?
Until 2005, there was no in-water resuscitation (IWR) strategy supported by evidence-based medicine.

The CoSTR(*) process reviewed the available information and assigned a “level of evidence (LOE)” and “class of recommendation”.

(*) Consensus on Science and Treatment Recommendations

How was the process of Consensus on Science and Treatment Recommendations (CoSTR)?

First: Formulate the Hypothesis…
Ventilation only or CPR (unconscious victim), are safe, effective and feasible interventions for rescuers to perform on drowning victims before removal from water.

1. Szpilman D Worksheet to 2005 Guidelines - American Heart Association (AHA) & International Liaison Committee for Resuscitation (ILCOR), Budapest, September 2004. http://circ.ahajournals.org/cgi/content/full/CIRCULATIONAHA.105.170522/DC266
How is the process of CoSTR?

2. Declare any conflict of interest: No Conflicts

3. Discriminate what kind of proposal: Create a guideline

4. Search Strategy
   - Key Words used: drowning, refine using resuscitation and "in water".
   - Search Sources: Cochrane database (reviews and trials), Medline (PubMed), Embase, ECC
   endnote library, references from previous articles and review articles and Books.

5. Evaluate all articles founded
   - Cochrane - 13 articles – all excluded.
   - Medline - 2,932 articles abstracts using “drowning” refined to 633 using “resuscitation”. Following search using key words selected 167 abstracts but only 18 are related. After a review there were only 8 articles. A search for “drowning AND c-spine” found only one article.
   - Embase, ECC endnote library – No articles
   - Review articles and Books – 2 references

   And come up with those really important
   - 11 references were evaluated

1. Szpilman D Worksheet to 2005 Guidelines - American Heart Association (AHA) & International Liaison Committee for Resuscitation (ILCOR), Budapest, September 2004. http://circ.ahajournals.org/cgi/content/full/CIRCULATIONAHA.105.170522/DC266
How is the process of CoSTR?

6. Each article is then reviewed and evaluate on science evidence to support or not the Hypothesis:

Ventilation only or CPR (unconscious victim), are safe, effective and feasible interventions for rescuers to perform on drowning victims before removal from water.

1. Szpilman D Worksheet to 2005 Guidelines - American Heart Association (AHA) & International Liaison Committee for Resuscitation (ILCOR), Budapest, September 2004. http://circ.ahajournals.org/cgi/content/full/CIRCULATIONAHA.105.170522/DC266

Supporting Evidence

1. Szpilman D Worksheet to 2005 Guidelines - American Heart Association (AHA) & International Liaison Committee for Resuscitation (ILCOR), Budapest, September 2004. http://circ.ahajournals.org/cgi/content/full/CIRCULATIONAHA.105.170522/DC266
### Table 2
Outcome evaluation for FWR and NTWR cases \((n = 45)\)

<table>
<thead>
<tr>
<th></th>
<th>NWR group ((n = 27))</th>
<th>FWR group ((n = 18))</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-hospital outcome (death vs. survival)</strong></td>
<td></td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td>Death</td>
<td>17 (63.0%)</td>
<td>1 (5.6%)</td>
<td></td>
</tr>
<tr>
<td>Survival</td>
<td>10 (37.0%)</td>
<td>18 (94.7%)</td>
<td></td>
</tr>
<tr>
<td>Hospitalization</td>
<td>8</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Resuscitated patient</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital outcomes</strong></td>
<td></td>
<td></td>
<td>0.005</td>
</tr>
<tr>
<td>Death</td>
<td>6 (23.0%)</td>
<td>2 (12.5%)</td>
<td></td>
</tr>
<tr>
<td>Survived with severe residual neurological damage</td>
<td>2 (7.4%)</td>
<td>6 (37.5%)</td>
<td></td>
</tr>
<tr>
<td>Survived without sequel</td>
<td>2 (7.4%)</td>
<td>6 (37.5%)</td>
<td></td>
</tr>
<tr>
<td><strong>Final outcome (poor outcome vs. good outcome)</strong></td>
<td></td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td>Poor outcome</td>
<td>25 (92.6%)</td>
<td>9 (47.4%)</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>23</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Survived with severe residual neurological damage</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Severe neurological sequel</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Persistent vegetative state</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Good outcome (survival without sequel)</td>
<td>2 (7.4%)</td>
<td>10 (55.6%)</td>
<td></td>
</tr>
</tbody>
</table>

FWR: in-water resuscitation; NWR: no in-water resuscitation.

### Opposing Evidence
(only to in-water Compressions)

1. Szpilman D. Worksheet to 2005 Guidelines - American Heart Association (AHA) & International Liaison Committee for Resuscitation (ILCOR), Budapest, September 2004. [http://circ.ahajournals.org/cgi/content/full/CIRCULATIONAHA.105.170522/DC1](http://circ.ahajournals.org/cgi/content/full/CIRCULATIONAHA.105.170522/DC1)
Evidence-based evaluation for the ILCOR Consensus on Science 2005

Published science used by individual resuscitation councils when producing practical guidelines.

The CoSTR Process
International Consensus on Science and Treatment Recommendations

In-water resuscitation

CPR for drowning victim in water
W160A, W160B

Consensus on science. Expired-air resuscitation in the water may be effective when undertaken by a trained rescuer (LOE 5;\textsuperscript{173,178} LOE 6\textsuperscript{177}). Chest compressions are difficult to perform in water and could potentially cause harm to both the rescuer and victim.

Treatment recommendation. In-water expired-air resuscitation may be considered by trained rescuers, preferably with a flotation device, but chest compressions should not be attempted in the water.
Recommendations for in-water resuscitation are for cases where the submersion time is unknown or is known to be less than 15 minutes.

LOE 4

Highlights and pitfalls from CoSTR

• Whenever a non-breathing 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.

• If in shallow water, or deep water with one rescuer using lifesaving equipment, or 2 or more rescuers, check for breathing. This attempt should not be done by only one lifeguard in deep water.

• If no spontaneous breathing, ventilate for approximately one minute (12 to 16 ventilations/min).

• If ventilation is restored keep airways opened while proceed rescuing without any further care other than a quick stop to monitor breathing and restart mouth-to-mouth if necessary.

• If not restored, consider to proceed ventilation for one minute in place and if no response, bring the victim to shore without further ventilations – victim is on a cardiac arrest.

LOE 4
Rescuers should not check victim’s pulse or start compressions while in the water.

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. It 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

After resuscitation, always keep the victim under observation because during the first minutes victim could again stop breathing.

LOE 5
In-water cervical immobilization is indicated in a victim who is highly suspected of trauma, or is in trouble in shallow water for unknown reasons.

In unconscious victims, the time spent on immobilizing the cervical spine could lead to a cardiopulmonary deterioration and even death.

Routine cervical spine immobilization of all water rescues, without reference to whether a traumatic injury was sustained, is not recommended.

**LOE 5**

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### Highlights and pitfalls from CoSTR

Rescuers, who suspect a spinal cord injury, should:

- Float the victim, supine, onto a horizontal position allowing the airways to be out of the water and check if there is spontaneously breathing.
- If not, start mouth-to-mouth, while maintaining the head in a neutral position as much as possible.
- If there is spontaneous breathing, use the rescuer's hands to stabilize the victim's neck in a neutral position;

**LOE 7**
Pitfalls

1. There were only a limited number of human in-water procedures and resuscitation studies identified, and a very few considering pre-hospital setting.

2. Although there is no cross infection acquired report from in-water mouth-to-mouth ventilation without barrier there is still a possibility to consider.

3. Even trained lifeguards cannot always accomplish IWR technique effectively, especially in deep water (LOE 4).

Pitfalls

“load and go”
In-water resuscitation

Feasibility and potential efficacy of in-water unsupported rescue breathing with a victim in deep water.

Technique was not associated with an undue prolongation of the rescue duration over a 50m rescue.

Start IWR can increase by more than 600% the probability of an unconscious drowning victim to survive without sequela.

Lifeguards should be well trained in IWR.

The decision of IWR is a matter of lifeguard judgment, taking into account: daily beach conditions, distance from shore, lifeguard’s fitness, experience, skill and self-confidence.

Conclusion:

An algorithm has been produced summarizing IWR.