



# Drowning

## Resuscitation

Justin Sempstrott, MD, FAAEM

[www.LifeguardsWithoutBorders.org](http://www.LifeguardsWithoutBorders.org)

[justin@LifeguardsWithoutBorders.org](mailto:justin@LifeguardsWithoutBorders.org)



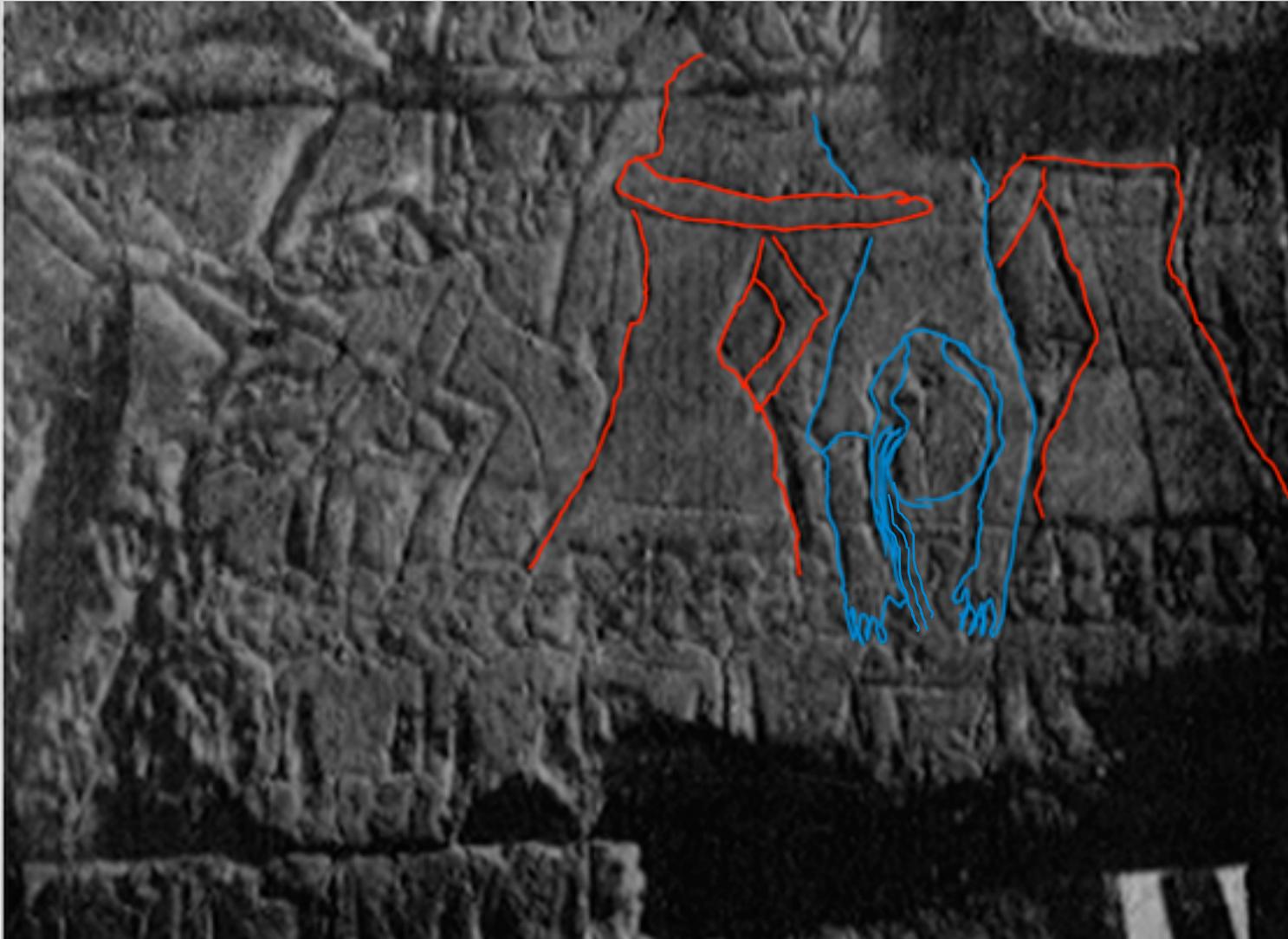
# Disclosure

No financial conflicts

Images and videos of fatal  
and non-fatal drowning  
patients

Follow your protocols and  
medical direction





The "Great of Aleppo" held upside down after drowning. 1237 B.C.

From the Pylon of the Ramesseum, Thebes. Photographed by Mr. W. M. F. Petrie

# History of drowning treatment

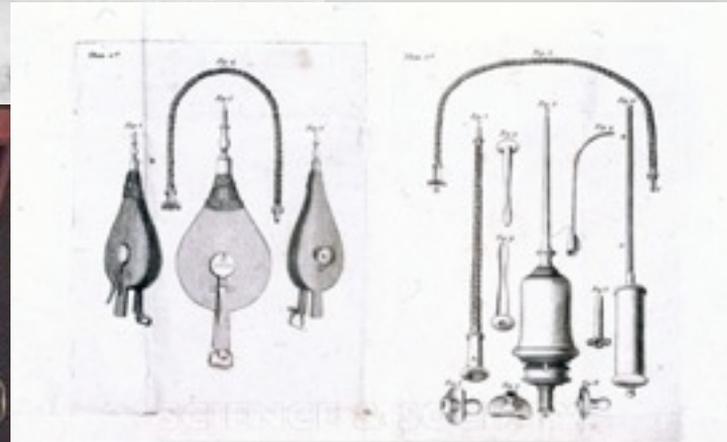
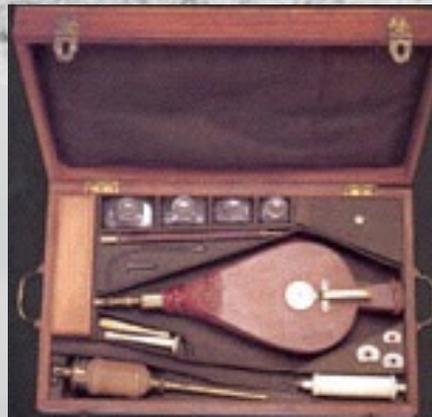


PLATE I. Fig. 1, 2, 3, are different Views of a Pair of Bulbs, for the Artificial Respiration of Infants the Large and smaller Bulbs being for Infants and Children. Fig. 2, is a Case for holding the Bulbs with their respective Tubes. Their Invention, and Use that Bulbs with great Success, is made

# Objectives

- Understand definition of drowning
- Emergent Management
- Disposition of drowning patients
- Don't blow smoke up pt's (or colleagues) asses



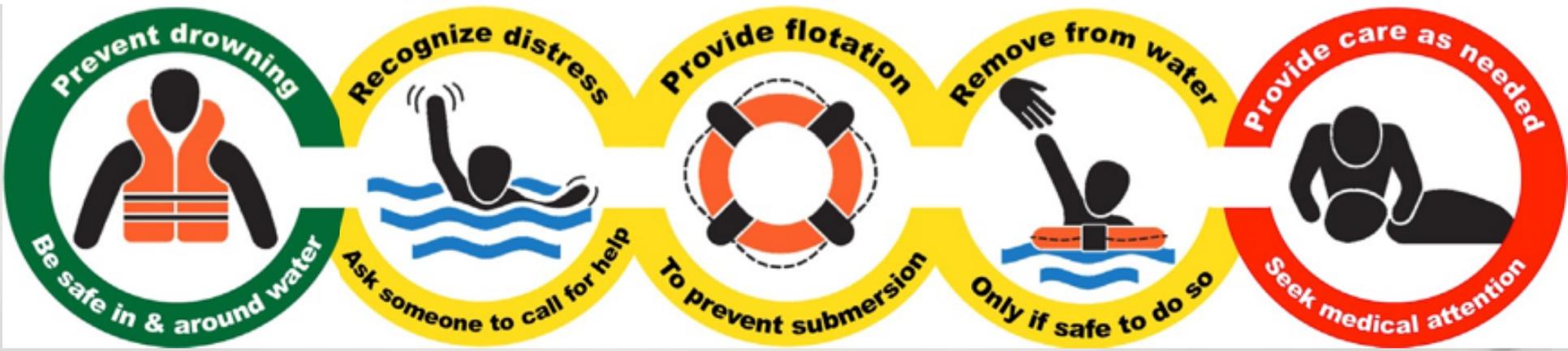
# What we will not cover

- Epidemiology
- Rescue Techniques
- Post Resus Care
- Hypothermia
- Shallow Water Blackout
- ICU Management



# DROWNING CHAIN OF SURVIVAL

A call to action



# Who is Drowning?

- Excludes Floods/Boating/Natural Disasters
  - 2014 USCG Responded to 4,064 incidents
    - 2,678 injuries
    - 610 deaths
      - 77% Drowning
        - ❖ 84% without lifejackets
        - ❖ 80% vessel <21 ft



# Definition

- “The process of experiencing respiratory impairment from submersion/immersion in liquid”
- Only 3 outcomes
  - Death
  - Brain Damage
  - No Brain Damage



Bangladesh, Lifeguards Without Borders, Aug2009

# Definition

- Old terms that should NOT be used
  - Dry
  - Wet
  - Active
  - Passive
  - Secondary
  - Near ← Especially



Lima, Peru, 2009

- No difference between salt, chlorine, freshwater

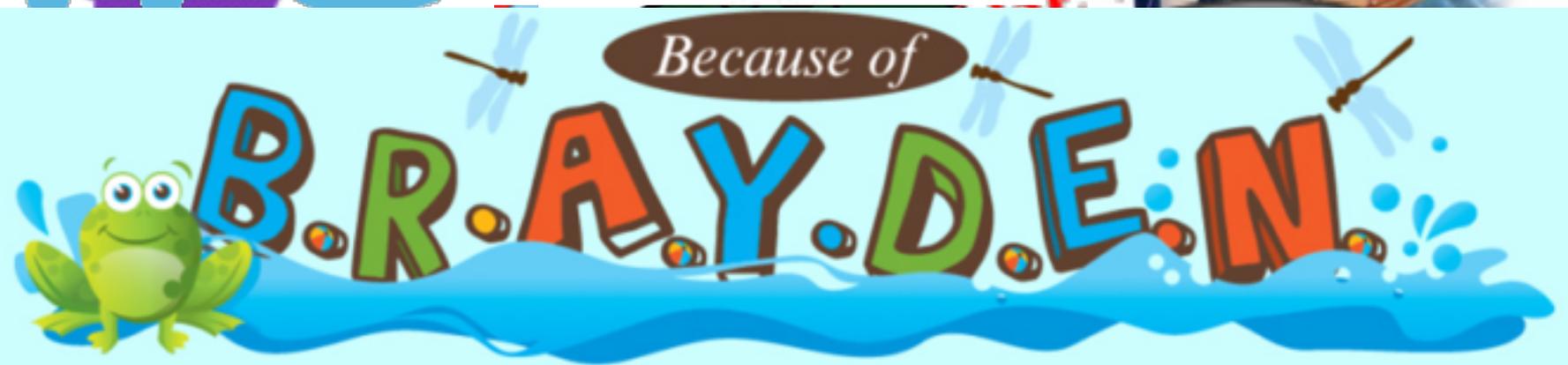
Drowning



COLIN'S HOPE  
we



BMF

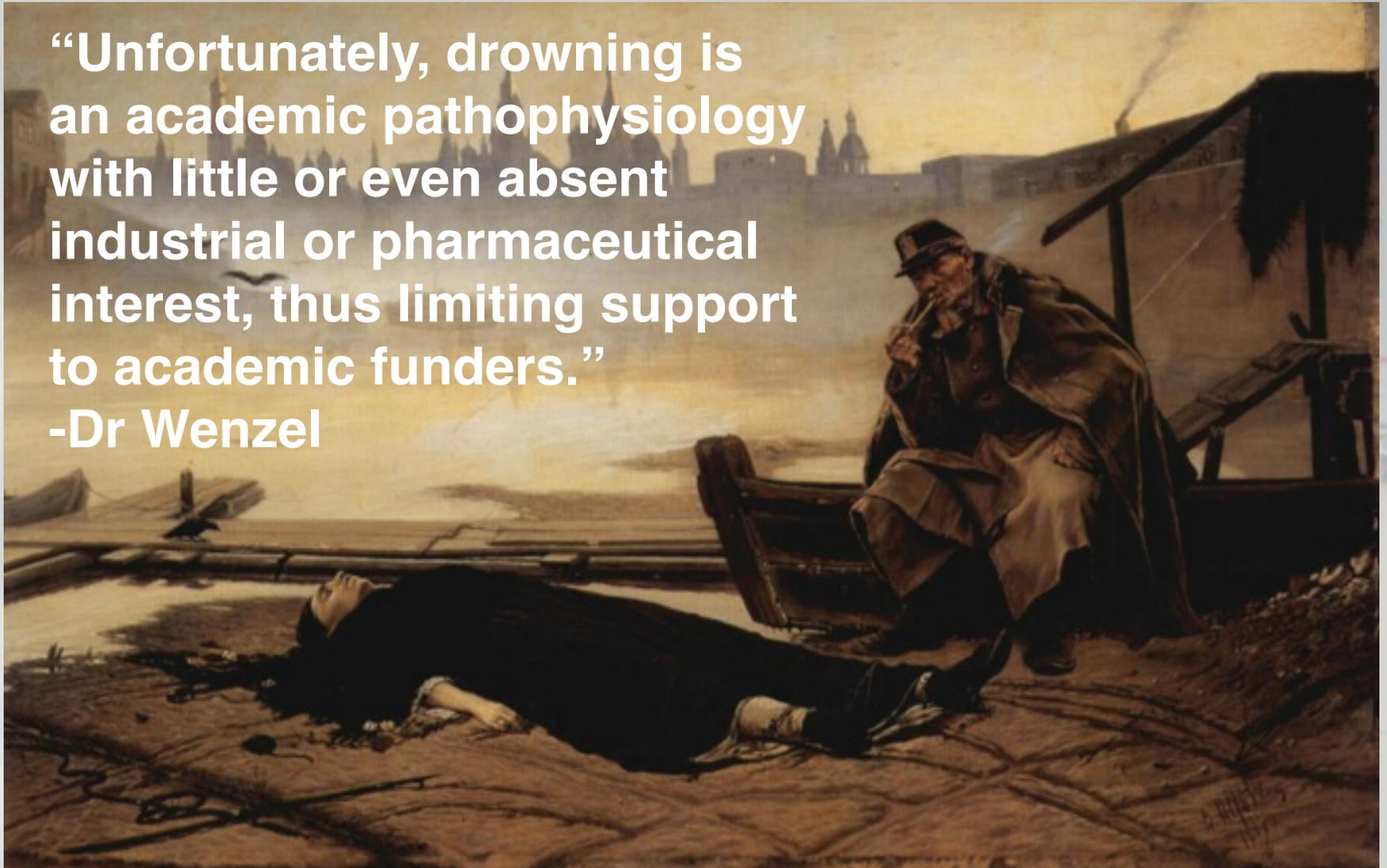


*Building Resources & Awareness of Youth Drownings through Encouragement & Networking*

# Physiology of Drowning

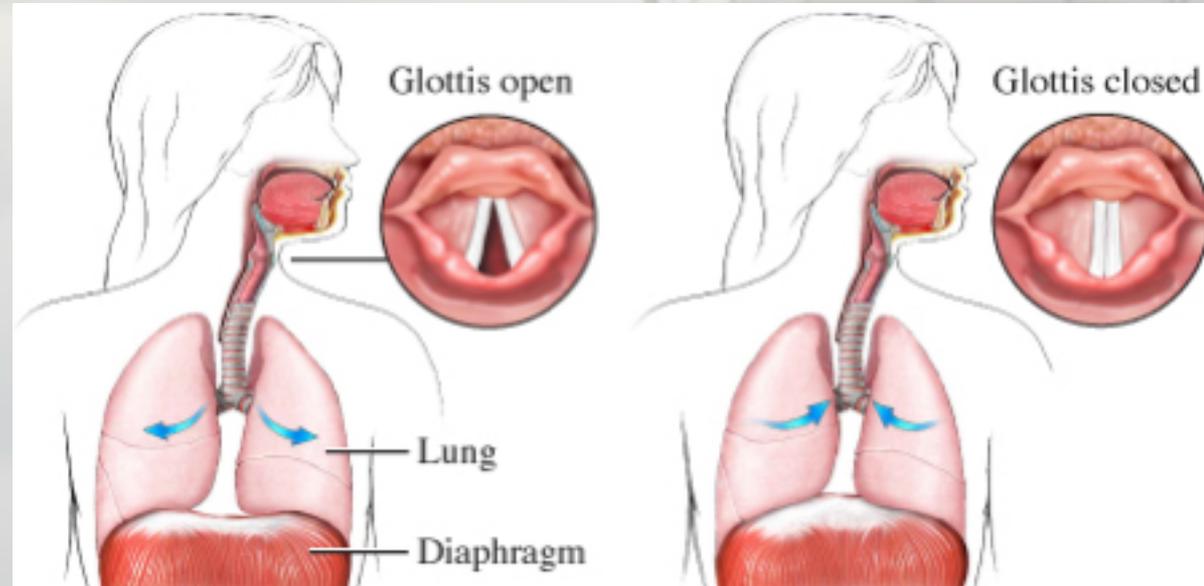
“Unfortunately, drowning is an academic pathophysiology with little or even absent industrial or pharmaceutical interest, thus limiting support to academic funders.”

-Dr Wenzel



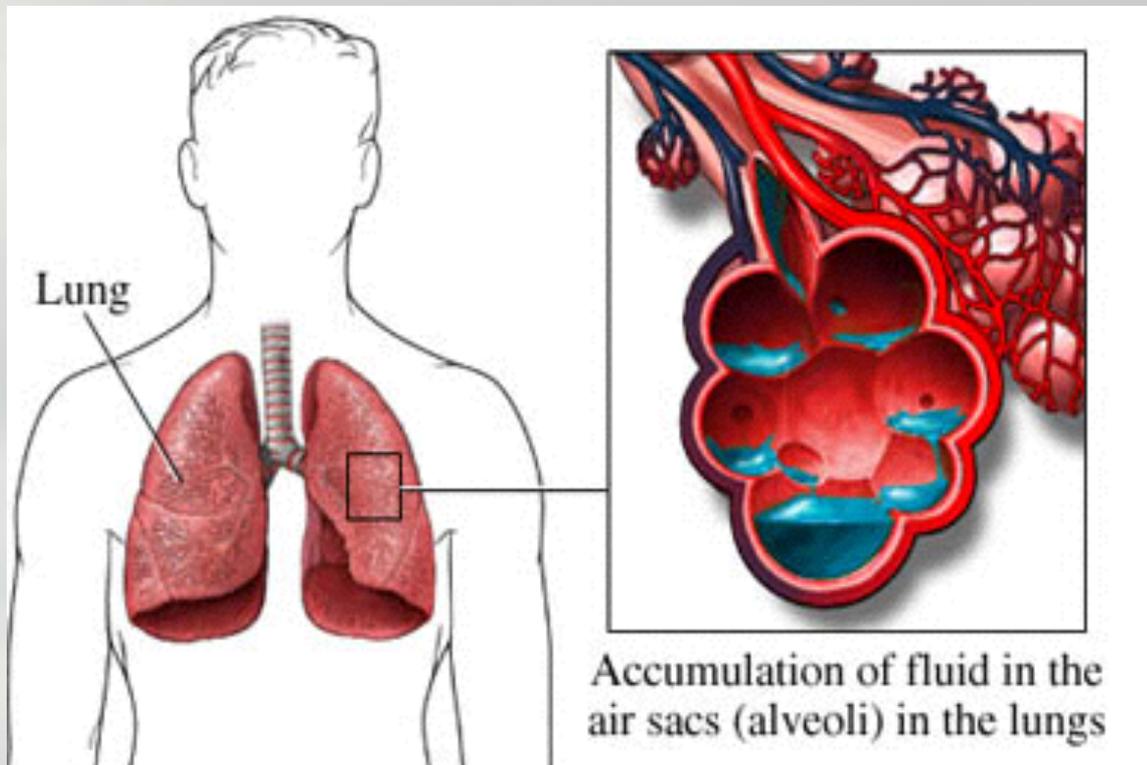
# Physiology of Drowning

- Breath holding during struggle
- Attempt to inhale water results in ?laryngospasm
  - Usually little (<30mL) or NO fluid in lungs
  - Reflex Swallowing



# Physiology

- Water may enter (1-2mL/kg)
  - Relaxation after unconsciousness



# Physiology

Articles | 1 July 1967

## The Effects of Fluid Volume in Seawater Drowning

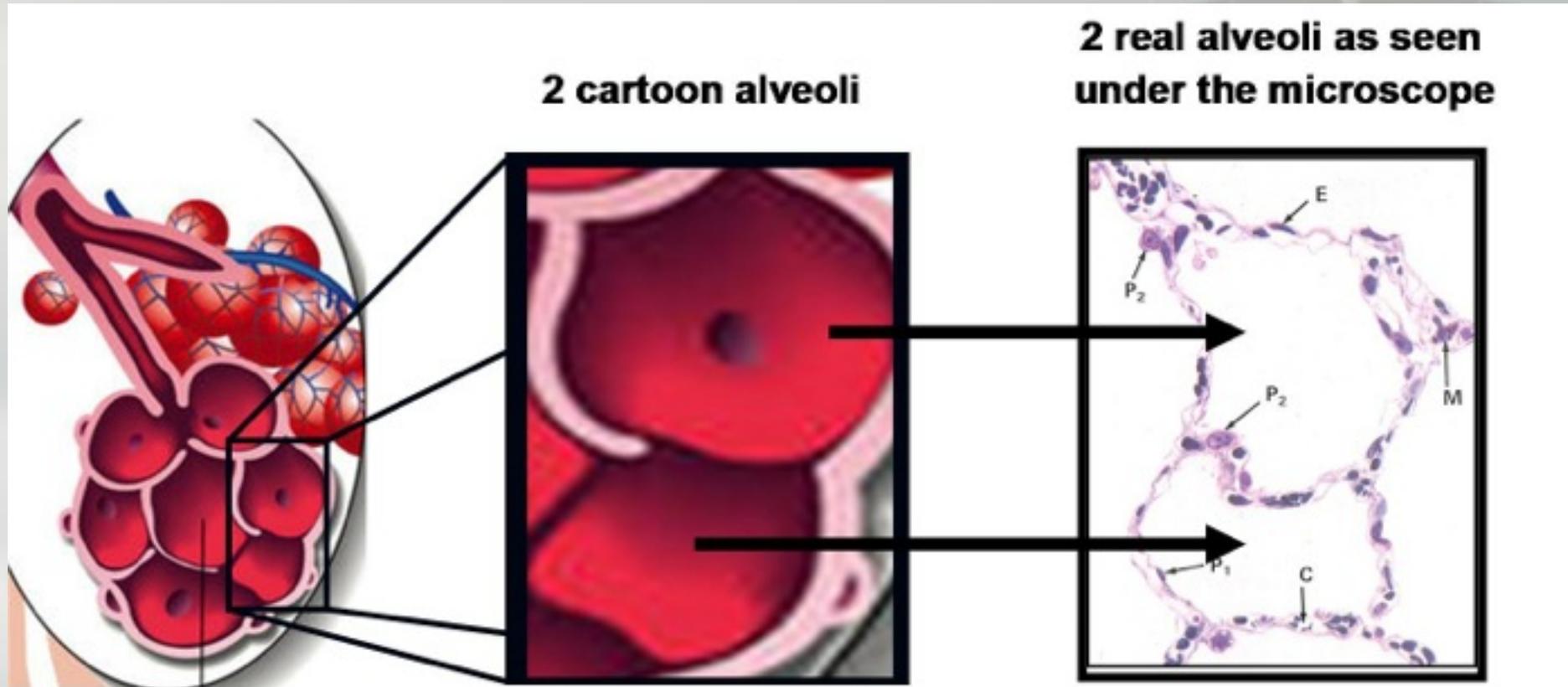
JEROME H. MODELL, M.D.; FRANK MOYA, M.D.; EARLENE J. NEWBY; BRUCE C. RUIZ; and APRIL V. SHOWERS, R.N.

*Ann Intern Med.* 1967;67(1):68-80.



# Mechanism

- Surfactant wash-out (pulmonary edema)
- Direct cellular injury



# ↓ O2 Delivery to brain



# Physiology

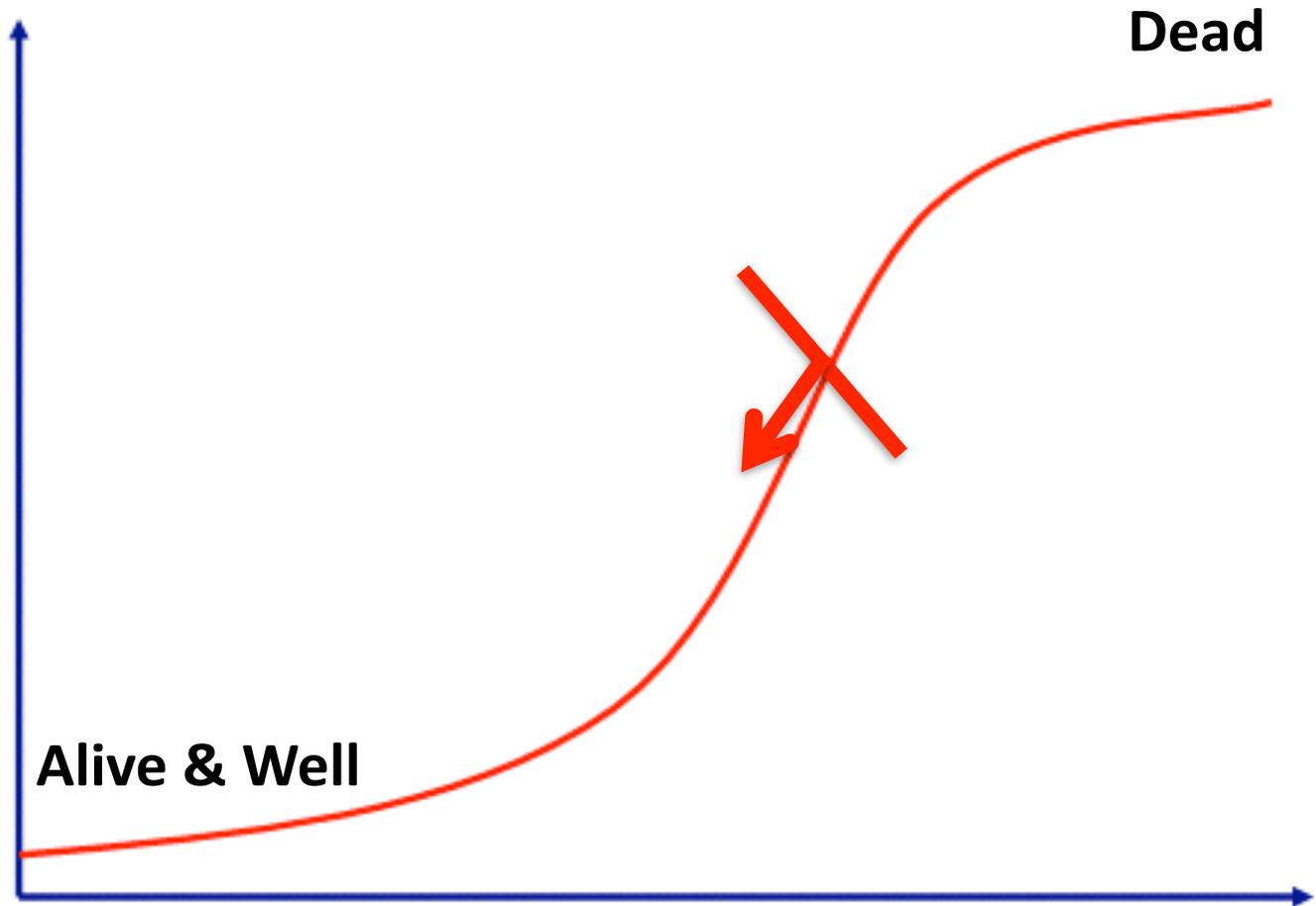
- Cause of death or morbidity
  - Anoxic Brain Injury
- Treatment → Oxygen to the Brain



Drowning is a **BRAIN** problem  
with **LUNG** complications.



# Physiology



# The Spectrum of Drowning

- 41,729 oceanfront lifeguard rescues in Rio de Janeiro from 1972 – 1991
  - 93% Released at scene without further treatment
  - 2,304 required additional medical care
    - 89% lived
    - 11% died



# The Spectrum of Drowning

Grade	Signs/Symptoms (s/sx)	Mortality	Treatment
1	Cough, no foam at mouth/nose -Lungs Clear	0%	Thorough history – Release home with education
2	Small amt foam in mouth or nose, +Rales	0.6%	N/C O
3	Large amt foam, normal BP (+radial pulse)	5.2%	ETT/NRB O
4	Large amt foam, LOW BP (-radial pulse)	19.4%	ETT/NRB O <b>Hospital</b>
5	Respiratory Arrest	44%	ETT/NRB O <b>Hospital</b>
6	Cardiopulmonary Arrest	93%	ETT/NRB O <b>Hospital</b> Do not resuscitate if down >1 hour

# The Spectrum of Drowning

Grade	Signs/Symptoms (s/ sx)	Mortality	Treatment
1	Cough, no foam at mouth/nose -LCTAB	0%	Thorough history – Release home with education
2	Small amt foam in mouth or nose, +Rales	0.6%	N/C O
3	Large amt foam, normal BP (+radial pulse)	5.2%	ETT/NRB O



# delighted **momma**

Hello,



My name is Lindsay,  
welcome to  
Delighted Momma!



## **Secondary Drowning + My Recent Experience & Real Life Almost Nightmare**

TUESDAY, MAY 20, 2014



IMG 7028

from Lindsay Kujawa





Jennifer Margulis

A writer who's not afraid  
to stick her neck out.

HOME [BOO](#) [BOOKSHELF](#) [EVENTS](#) [ARTICLES](#) [IN THE](#)

How my son nearly drowned, and what you need to know  
about secondary drowning



 **TODAY HEALTH**   

# Boy's death highlights a hidden danger: Dry drowning

10-year-old died more than an hour after getting out of swimming pool

Kids' Health

## Toddler's near-fatal 'secondary drowning' a warning to parents

Linda Carroll  
TODAY contributor

June 2, 2014 at 11:33 AM ET

REAL LIFE

# My daughter almost died in her sleep

Apr 15, 2015



**A fun day at the beach almost ended in tragedy for this five-year-old and her terrified mum.**

“One doctor told me that about 70 percent of kids don’t pull through delayed drownings, also known as ‘secondary’ or ‘near drownings’.





## Lifeguards Without Borders

Published by Justin Sem Srott [?] · August 26 at 11:48am · 🌐

There's some incorrect terminology, but a good article to educate on NON-Fatal Drowning. Includes quotes and discussion from Dr Justin.

<https://www.yahoo.com/.../mom-shares-photo-of-3-year-old-son-...>



### Mom Shares Photo of 3-Year-Old Son After Dry Drowning Scare

"People think that something like this won't happen to you but it can," Darcy McQueeney tells Yahoo Parenting about nearly losing her son, Ezra, 3, to...



# The Reality

- **2010**

- 12,900 ED visits
- 2,600 admitted to same hospital (20.3%)
- 4,521 (1,106\*) Deaths

- **2008**

- 0.3/100,000 Fatal\*
- 2.1/100,000 Non Fatal\*



Uganda, Lifeguards Without Borders, Nov 2014

\*Pediatric Only



## Lifeguards Without Borders

Published by Justin Sem Srott [?] · August 27 at 5:34pm · 🌐

Great story and great to see the correct terminology on non-fatal drowning!!!



## 2 Olympic Swimmers Who Drowned As Kids Share Their Scary Stories

They learned to swim the hard way, after nearly fatally drowning as kids, and now Olympic medal winning swimming champions Cullen Jones and Jessica Hardy...

YAHOO.COM



## Position Statement 15-1

### *Use of the Terms Near, Dry, Delayed and Secondary Drowning*

#### **Position**

1. Any person - adult or child - who has been in or under the water and has symptoms of difficulty breathing, excessive cough, foam or froth in the mouth, or aren't acting right that occur immediately or within a few hours of being in the water had a non-fatal drowning and should seek care from a doctor. Symptoms usually appear immediately, but may be delayed by a few hours or get progressively worse. Onset or worsening of symptoms usually occurs within the first 8 hours of submersion.
2. There is no such thing as "dry" or "wet", "delayed", or "secondary" drowning. Anyone with respiratory impairment, not acting right, excessive cough, foam, or lethargy after being underwater, even briefly, should be taken to a hospital for further evaluation. Drowning is a spectrum ranging from mild to moderate to severe.

# Patient pulled from ocean

A- Lots of foam

B- Breathing fast, poor effort

C- Rapid, weak pulse

Critical Actions?



# Airway

- Ventilate / Oxygenate
  - Pediatric
  - Airway obstruction?
    - Foam, Sand, Mud, Taco Bell
  - Dec Compliance
  - Vomitus
    - 86% of Drowning resuscitations



# Hypoxic Arrest

- Cardiac BLS/ACLS
  - Heart stops, oxygen in blood needs circulating
  - C,A,B or C,C,C
- Drowning, Peds, Traumatic BLS/ACLS
  - Heart stops because no oxygen in blood
  - A,B,C



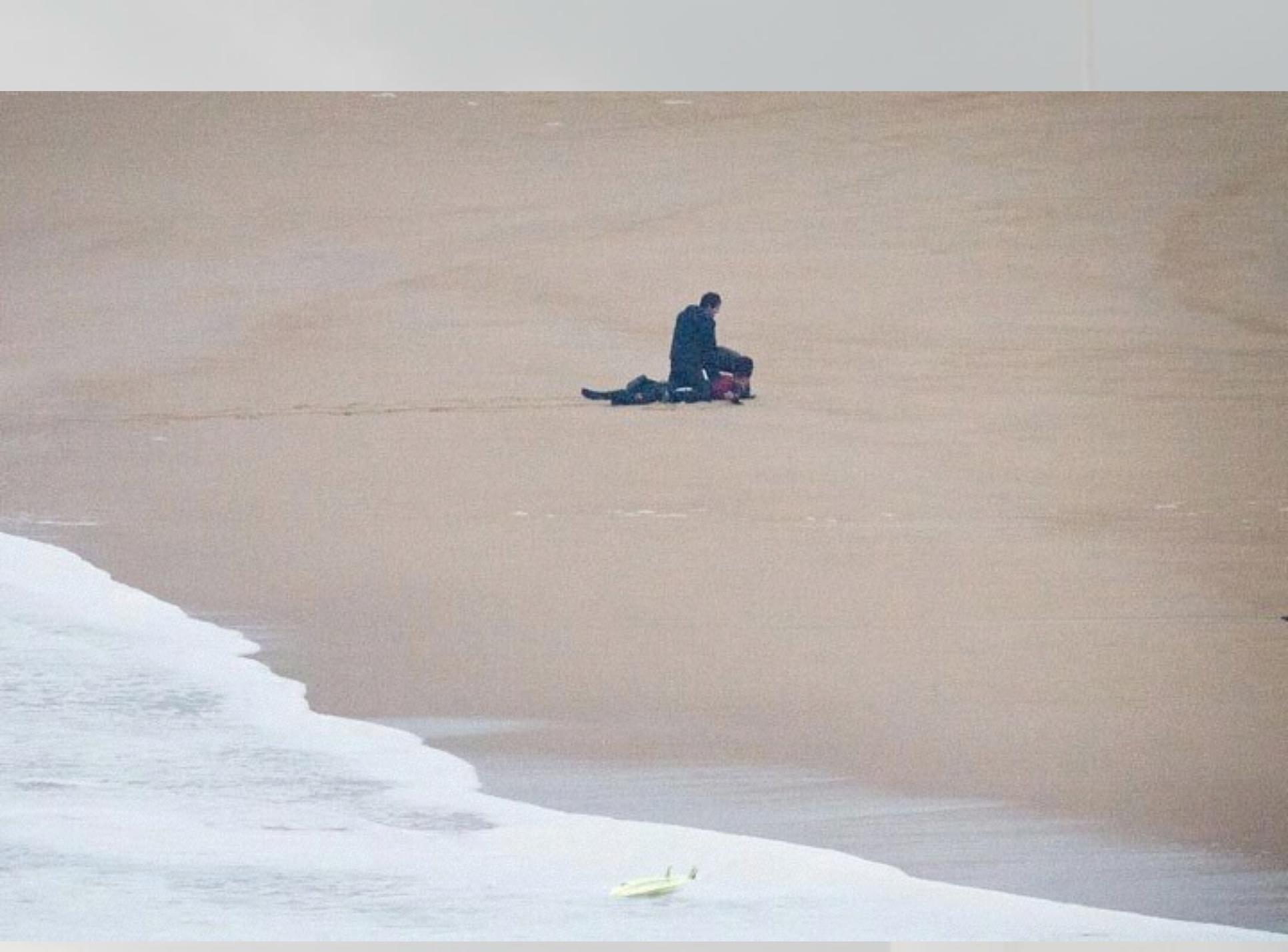
## **Part 12: Cardiac Arrest in Special Situations: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care**

Terry L. Vanden Hoek, Laurie J. Morrison, Michael Shuster, Michael Donnino, Elizabeth Sinz, Eric J. Lavonas, Farida M. Jeejeebhoy and Andrea Gabrielli

### **BLS Modifications**

The most important and detrimental consequence of submersion is hypoxia; therefore, oxygenation, ventilation, and perfusion should be restored as rapidly as possible. This will require immediate bystander CPR plus activation of the EMS system. With the *2010 AHA Guidelines for CPR and ECC*, CPR now begins with chest compressions in a C-A-B sequence. However, the guidelines recommend that health-care providers tailor the sequence based upon the presumed etiology of the arrest. **Healthcare provider CPR for drowning victims should use the traditional A-B-C approach** in view of the hypoxic nature of the arrest. Victims with only respiratory arrest usually respond after a few artificial breaths are given.

Starting CPR with 30 compressions followed by 2 ventilations should theoretically delay ventilations by only about 18 seconds for the lone rescuer and by an even a shorter interval for 2 rescuers. The CAB sequence for infants and children is recommended in order to simplify training with the hope that more victims of sudden cardiac arrest will receive bystander CPR. It offers the advantage of consistency in teaching rescuers, whether their patients are infants, children, or adults.





# Special considerations



# In Water Resuscitation



Survival



# C-Spine

- Less than 1% of Drowning patients, all with significant mechanism of injury



# AED's in Drowning

- V-Fib/V-Tach?
- Do not delay  
Oxygenation / Ventilation

Author	Year	Included	% VF
Suominen	2002	48	6.2
Eich	2007	12	0
Grmec	2009	29	9.7
Ballesteros	2009	20	5.0
Nitta	2013	1737	1.7
Claesson	2014	499	4.8

**“Do it by the book, but be the author.”**



**BALTIMORE CITY HOSPITAL  
DEPARTMENT OF ANESTHESIOLOGY  
RESUSCITATION EXPERIMENT, JULY 13, 1957  
VOLUNTEER: FELIX STEICHEN, M.D.  
RESIDENT IN SURGERY**

**Dr. Peter Safar (12 April 1924 – 2 August 2003)**



# Drowning



### History

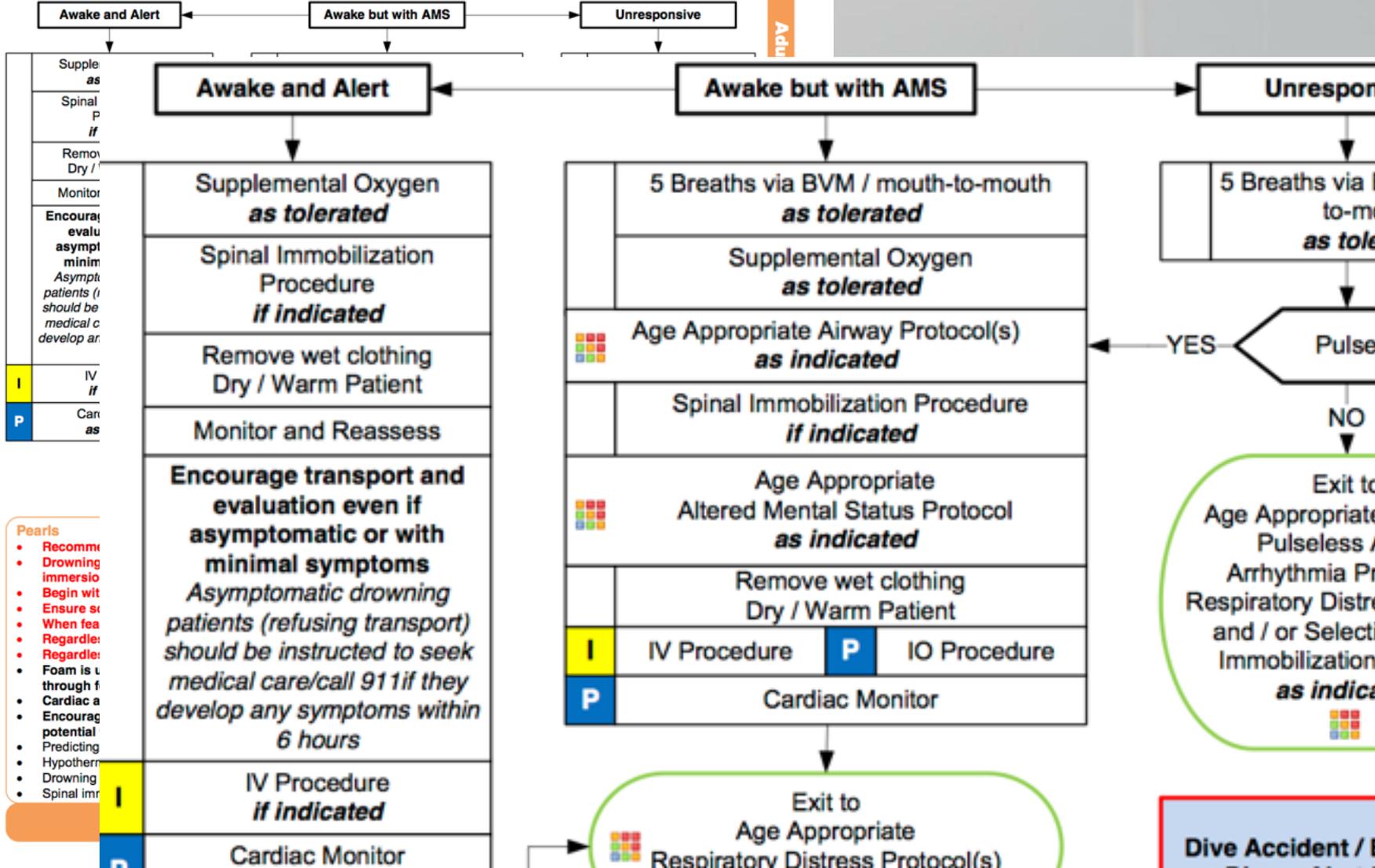
- Submersion in water regardless of depth
- Possible history of trauma
- Slammed into shore wave break
- Duration of submersion / immersion
- Temperature of water or possibility of hypothermia

### Signs and Symptoms

- Unresponsive
- Mental status changes
- Decreased or absent vital signs
- Foaming / Vomiting
- Coughing, Wheezing, Rales, Rhonchi, Stridor
- Apnea

### Differential

- Trauma
- Pre-existing medical problem
  - Hypoglycemia
  - Cardiac Dysrhythmia
- Pressure injury (SCUBA diving)
  - Barotrauma
  - Decompression sickness
- Post-immersion syndrome



Supple	as
Spinal	P
if	
Remov	Dry /
Monitor	
Encourag	evalu
asympt	minim
Asympt	patients (i
should be	medical c
develop ar	
I	IV
	if
P	Can
	as

### Pearls

- **Recomm**
- **Drowning**
- **immersio**
- **Begin wit**
- **Ensure sc**
- **When fea**
- **Regardle:**
- **Regardle:**
- **Foam is u**
- **through f**
- **Cardiac a**
- **Encourag**
- **potential**
- **Predicting**
- **Hypotherr**
- **Drowning**
- **Spinal imr**

Exit to  
Age Appropriate  
Pulseless /  
Arrhythmia Pr  
Respiratory Distre  
and / or Select  
Immobilization  
as indica

**Dive Accident /**



# Drowning



## History

- Submersion in water regardless of depth
- Possible history of trauma  
Slammed into shore wave break
- Duration of submersion / immersion
- Temperature of water or possibility of hypothermia

## Signs and Symptoms

- Unresponsive
- Mental status changes
- Decreased or absent vital signs
- Foaming / Vomiting
- Coughing, Wheezing, Rales, Rhonchi, Stridor
- Apnea

## Differential

- Trauma
- Pre-existing medical problem  
Hypoglycemia  
Cardiac Dysrhythmia
- Pressure injury (SCUBA diving)  
Barotrauma  
Decompression sickness
- Post-immersion syndrome

## Pearls

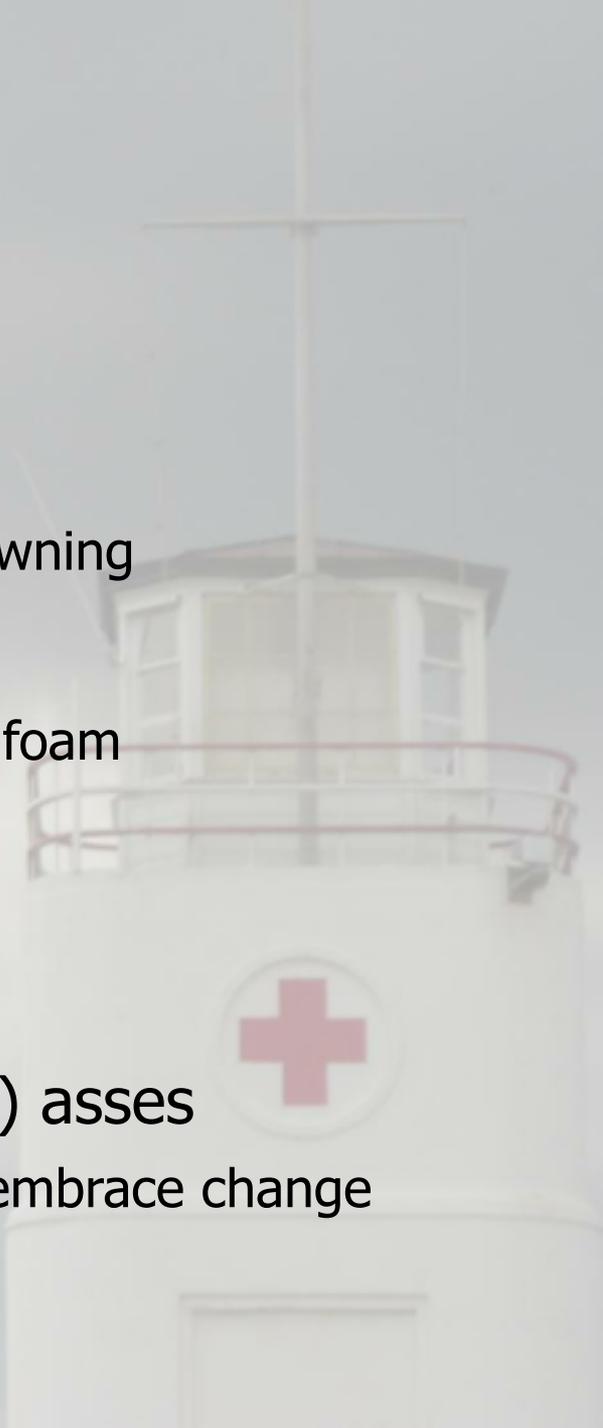
- **Recommended Exam: Respiratory, Mental status, Trauma Survey, Skin, Neuro**
- **Drowning is the process of experiencing respiratory impairment (any respiratory symptom) from submersion / immersion in a liquid.**
- **Begin with BVM ventilations, if patient does not tolerate then apply appropriate mode of supplemental oxygen.**
- **Ensure scene safety. Drowning is a leading cause of death among would-be rescuers.**
- **When feasible, only appropriately trained and certified rescuers should remove patients from areas of danger.**
- **Regardless of water temperature – resuscitate all patients with known submersion time of  $\leq 25$  minutes.**
- **Regardless of water temperature – If submersion time  $\geq 1$  hour consider moving to recovery phase instead of rescue.**
- **Foam is usually present in airway and may be copious, DO NOT waste time attempting to suction. Ventilate with BVM through foam (suction water and vomit only when present.)**
- **Cardiac arrest in drowning is caused by hypoxia, airway and ventilation are equally important to high-quality CPR.**
- **Encourage transport of all symptomatic patients (cough, foam, dyspnea, abnormal lung sounds, hypoxia) due to potential worsening over the next 6 hours.**
- Predicting prognosis in prehospital setting is difficult and does not correlate with mental status. Unless obvious death, transport.
- Hypothermia is often associated with drowning and submersion injuries even with warm ambient conditions.
- Drowning patient typically has  $<1 - 3$  mL/kg of water in lungs (does not require suction.) Primary treatment is reversal of hypoxia.
- Spinal immobilization is usually unnecessary. When indicated it should not interrupt ventilation, oxygenation and / or CPR.

## Protocol 80

Any local EMS System changes to this document must follow the NC OEMS Protocol Change Policy and be approved by OEMS

# Summary

- Understand definition of drowning
  - Process, not an outcome
  - No “Dry”, “Secondary”, “Wet”, “Delayed” Drowning
- Management
  - Rapid O<sub>2</sub> O<sub>2</sub> O<sub>2</sub>, anticipate vomitus, ignore foam
  - Hypoxic vs Cardiac cause of arrest
- Disposition of drowning patients
  - ALL Symptomatic patients require evaluation
- Don't blow smoke up pt's (or colleagues) asses
  - Engage your medical director or educators, embrace change



twitter



LifeguardsLoveYouTube.com

ISLASurf.org

Profile summary

**LifeguardsWO Borders**  
@LifeguardsWB

Lifeguards Without Border is group of medical professionals and ocean lifeguards with a vision to decrease the number of drownings around the world.  
lifeguardswithoutborders.org

190 TWEETS    369 FOLLOWING    104 FOLLOWERS    Follow

**LifeguardsWO Borders** @LifeguardsWB 3h  
@JabariWater @the\_ISLASurf #SMS ability is one of the most exciting features, since 95% of #Drowning deaths occur in low income countries.  
Details

**LifeguardsWO Borders** @LifeguardsWB 3h  
@SNCDPC Thanks. I'll be doing a presentation on the #History of #Drowning #Resuscitation  
Details

**LifeguardsWO Borders** @LifeguardsWB 4h  
@podmedic @HCDFRS We have taken the same approach to #Drowning. Community level prevention, train the #ED, #EMS, & #ICU.  
Details

**LifeguardsWO Borders** @LifeguardsWB 6h  
Tagging backboards to take to Macedonia for our upcoming collaboration with @the\_ISLASurf team pic.twitter.com/1ye3ihE4M1  
Details

**LifeguardsWO Borders** @LifeguardsWB 16 May  
Back from Zion and now doing #Drowning #Education for @CNLV North Las Vegas Fire. @SNCDPC @LasVegasEM pic.twitter.com/jA1MePkmFQ  
Details

**Lifeguards Without Borders is on Facebook.**

To connect with Lifeguards Without Borders, sign up

Sign Up    Log In

**Lifeguards Without Borders**  
1,335 likes - 36 talking about this

Safety & First Aid Service  
2 Oceanfront S Jacksonville Beach, FL