

Dangerous Underwater Breath-holding Behavior-Related Drownings in New York State, 1988-2011

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Drowning in the United States

- Drowning is an important cause of preventable injury and mortality, ranking fifth among leading causes of unintentional injury death in the United States
 - ▣ Males are at the most risk
 - ▣ Second leading cause of injury-related deaths among children aged 1 to 19 years
 - ▣ Most prevalent among communities of color

Active Drowning Surveillance in New York

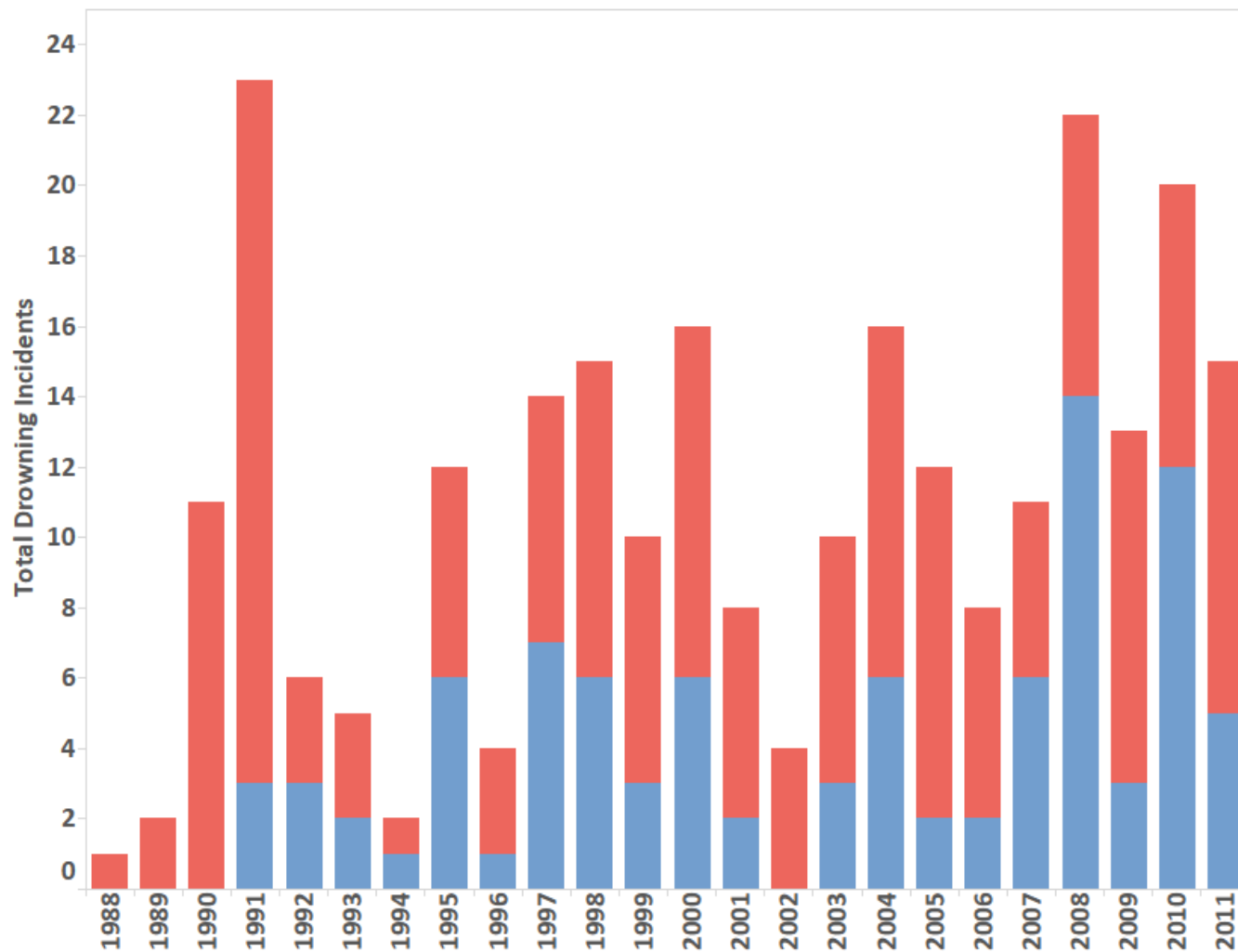
- New York State Department of Health (NYSDOH) Bureau of Community Environmental Health and Food Protection policy to investigate & report on drownings(*NYS Sanitary Code 6-1*).
- The Office of Public Health Engineering (OPHE) within the New York City Department of Health and Mental Hygiene (NYC DOHMH) conducts active surveillance of drowning incidents at NYC Permitted Bathing Facilities.

Fatal and Non Fatal Drowning Incidents in NYC

1988-2011*

Victim Status

- DECEASED
- RESCUED



*Data estimates are a compilation of WHO International classification of disease (ICD) 9 and 10 994.1 Drowning and nonfatal submersion incident reporting from NYC Emergency Department Syndromic Reporting, Unintentional Accidental incidents of drowning and nonfatal submersion from the Office of Vital Statistics, the Chief Medical Examiner, media reports, and incidents reported to OPHE on unintentional submersion incidents occurring at all bathing facilities and water bodies within NYC.

Drowning Investigation Process Overview



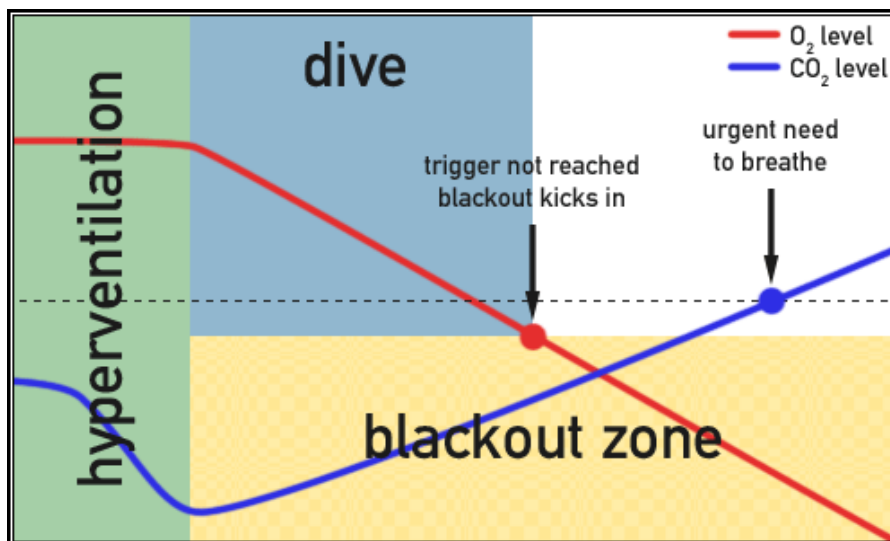
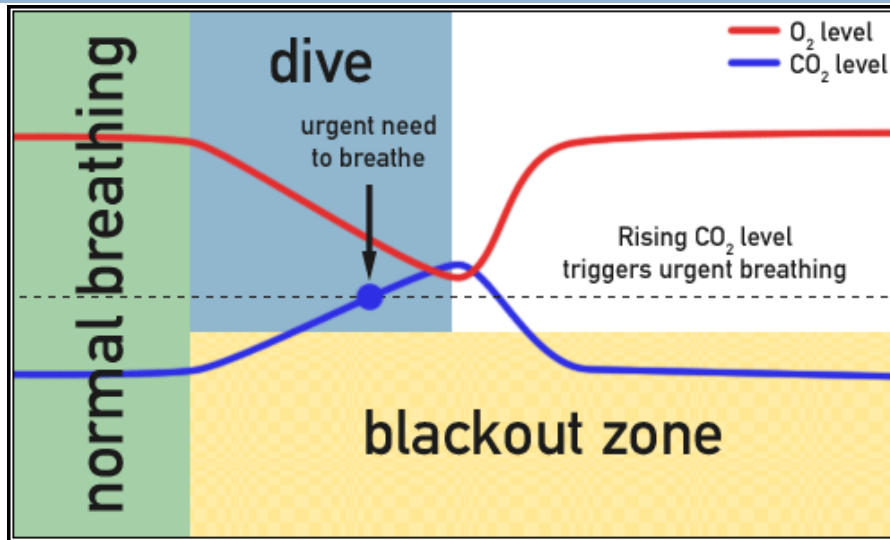
OPHE Drowning Incident Investigation

- Standard investigation:
 - Site & Supervision characteristics
- Environmental Risk Factors:
 - Location of drowning
 - Activity at the time of the incident (*Interviews**)
- Victims Personal Risk Factors:
 - Gender
 - Age
 - Swim ability
 - Medical history
 - Drug and Alcohol consumption

Precipitating Event: Hyperventilation Before Breath-Holding Underwater

- ❑ In 2011, a drowning incident was reported to OPHE of two healthy young men that died at a NYC regulated outdoor swimming pool.
- ❑ Environmental Risk Factors:
 - Prolonged duration of submersion
 - Supervision Level
- ❑ Victims Personal Risk Factors:
 - Male
 - 21 and 22 years old
 - Good Health
 - Advanced Swim Ability
 - Training for U.S Military Fitness Testing

Physiology of Breath-Holding and Prolonged Submersion



Epidemiology of Breath Holding Behaviors

- Differential diagnosis – phenomenon of hypoxic blackout.
- Hyperventilation prior to submersion reduces carbon dioxide sensitivity, allowing hypoxia to develop, leading to unconsciousness.
- Carbon dioxide reservoir is depleted due to hyperventilation

Physiology of Dangerous Underwater Breath-Holding Behaviors (DUBBS)



Drowning Case Review

- DOHMH collaborated with the NYSDOH to investigate historical drowning cases with similar dangerous behavioral underpinnings.
- Database case review of all drowning incidents at NYSDOH regulated swimming facilities from 1988 to 2011
- Record review of all drowning investigation documentation

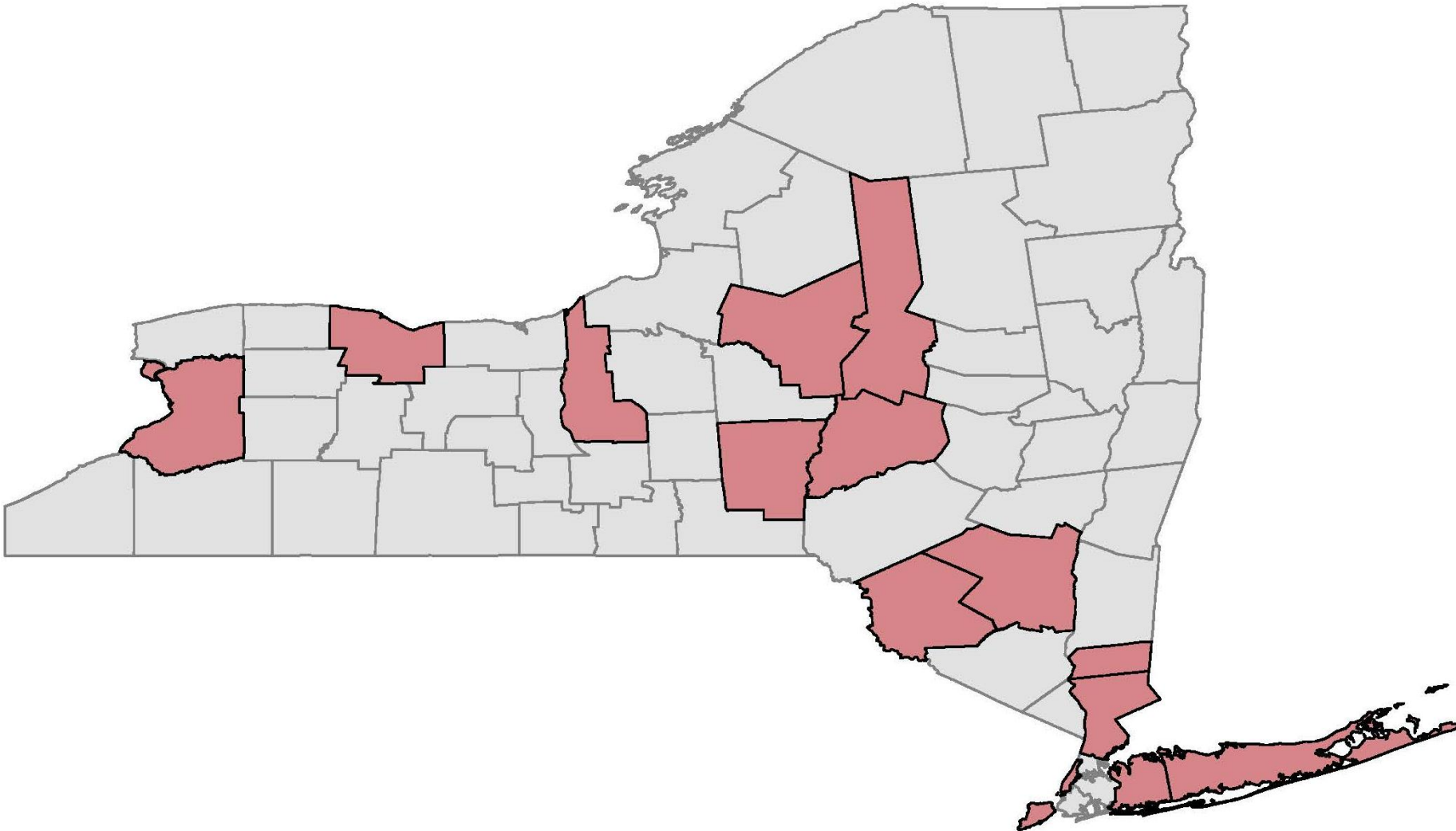
DUBBS Case Review

- ❑ Generated keywords through a review of the available literature and expert opinion from aquatic programs such as the American Red Cross and YMCA
- ❑ Victims' behaviors (keywords) included:
 - ❑ repeated breath-holding
 - ❑ breath-holding games/competition
 - ❑ prolonged/extended submersion
 - ❑ underwater distance swimming
 - ❑ hyperventilation

DUBBS Case Series

- Twenty two independent drowning cases identified:
 - ▣ Seizure disorders (3)
 - ▣ Substance abuse (1)
 - ▣ Not enough information (2)
- * Classification as a dangerous underwater breathing behavior (16)

New York County Distribution of Fatal and Non-Fatal Drowning Incidents Potentially Attributed to Dangerous Underwater Breath-Holding Behaviors 1988-2011



Case Summary

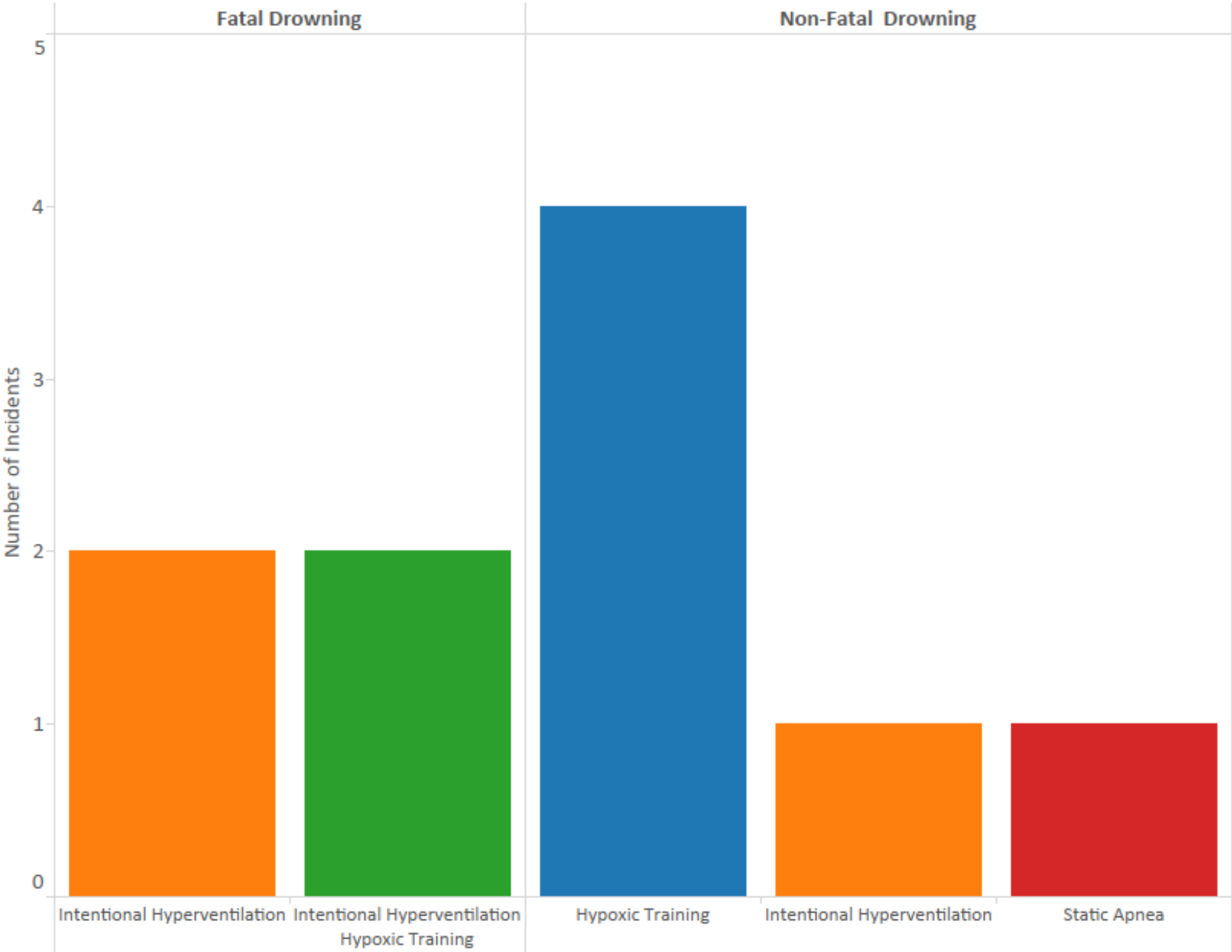
TOTAL CASES	N	%
Overall	16	100%
<i>Gender</i>		
Male	13	81%
Female	3	19%
<i>Age</i>		
< 15 years	7	44%
15-24 years	8	50%
> 25 years	1	6%
<i>Drowning type</i>		
Non-fatal Drowning	12	75%
Fatal Drowning	4	25%
<i>Swimming ability</i>		
Beginner	5	31%
Good	1	6%
Advanced	8	50%
Unknown	2	13%

Identification of DUBBS Behavior Types

DUBBS Behavior

Intentional Hyperventilation		Static Apnea		Hypoxic Training		Intentional Hyperventilation & Hypoxic Training Coactivity	
N	%	N	%	N	%	N	%
3	19%	6	38%	5	31%	2	13%

Dangerous Underwater Breath-holding Behaviors (DUBBs) by incident type



DUBBS Analysis & Outcomes

- Practicing more than one DUBB increased the risk for fatality.
- A significant proportion of the cases were either advanced or good swimming ability
- Educational and policy-level changes in order to prevent drownings attributable to dangerous behaviors.
- Pictographic Signage required by New York City Health Code

Learn to Swim Program

- ❑ Drowning prevention strategy for children and young adults.
- ❑ New York City Department of Parks and Recreation (DPR), Youth and Community Development (DYCD) and DOHMH.
- ❑ Provides free instruction on water safety and swimming skills to children and adolescents ages 6-18 years old in low-income neighborhoods.
- ❑ 1,400 participants to date.

Learn to Swim New York City



Pictorial Risk Messaging to Reduce DUBBS

- In 2013, OPHE conducted a signage evaluation study, to assess adolescents' understanding of three professionally designed signs
- Evaluate existing warning signs and messaging
- Design several draft versions of warning sign
- Focus group test signs with more than 250 young swimmers working with YMCA.
- Validate language with supplemental survey of young swimmers during Recreational Water Illness Week at NYC public pools.

Selected DUBBs Prevention Signage



Acknowledgements

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 - Eric Wiegert MPH, Douglas Sackett, Timothy Shay, Amanda Tarrier MPH

Additional Resources

- [Water Safety in New York City](#)
- [Pictographic Signage](#) required by [New York City Health Code](#)