

Review article uncovers clues to the causes, risk factors for and prevention of drowning deaths

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For centuries, drowning has been one of the most significant causes of accidental death in the world. Drowning deaths disproportionately affect low- and middle-income countries: An estimated 375,000 people drown each year worldwide compared with 3,500 annual drowning deaths in the U.S. Despite its prevalence, the physiological cause of drowning remains unclear. Now, an international team of researchers have released a review article combing through scientific studies on the physiology of drowning to better understand the bodily processes that cause drowning fatalities. The article, published in the journal *Physiology*, may help to determine the type of future physiological studies that could contribute to the prevention, treatment and forensic investigation of drowning incidents.

Drowning is formally defined as the process of experiencing impairment from submersion (upper airway under water) or immersion (upper airway above water) in liquid. It can occur in hot or [cold water](#). Nevertheless, there is no clear picture of what causes a person to drown.

The authors of the article "Physiology of Drowning: A Review" are the first to explore the issue in detail in an attempt to create a comprehensive description of the [drowning](#) process. They report that 14 different mechanisms, which may often coincide in time and in a wide variety of combinations, determine the drowning process. They also found that many of these mechanisms can be prevented, avoided,

interrupted or treated by increased awareness, better equipment or targeted training.

According to the authors, the most important finding of the review is that there are many physiology-based interventions that might help to reduce the number of fatal drownings. For example, because drowning in fresh or salt water is a form of asphyxiation, the most important intervention is the rapid provision of oxygen. The researchers also outline how the fear of drowning, breath-holding, fitness level, fatigue, intoxication and other factors can contribute to negative outcomes and highlight warnings for people who may be at increased risk of drowning, such as those with heart conditions.

The researchers note that there is still much more to learn about the consequences of drowning on the brain. "What happens to the brain during and after submersion is poorly understood. Research specific to the brain's physiology and pathophysiology during drowning and post-drowning resuscitation is needed to understand how the best intervention should be directed to restore life and to avoid [long term disability](#)," they wrote.

"Understanding these mechanisms may be beneficial to medico-legal investigations, court evaluations of civil and penal liability and insurance disputes connected to drowning," the researchers wrote. The team said it hopes that future drowning-oriented research will benefit from international data sharing and collaboration among clinicians, scientists and forensic pathologists.

More information: Joost J. L. M. Bierens et al. Physiology Of Drowning: A Review, *Physiology* (2016). [DOI: 10.1152/physiol.00002.2015](#)

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