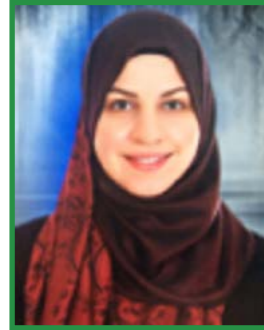


# Drowning: What We Need to Know



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Globally, an estimated 3 children aged 1 to 14 die every day as a result of drowning. According to WHO Global Burden of Disease, more than 360,000 individuals die every year due to drowning, almost 60% of these fatal drowning are young individuals under the age of 30. Drowning ranks 3rd in the leading causes of unintentional injuries worldwide for children aged 5 to 14, surpassing deaths caused by malnutrition and malaria. The World Health Organization refers to drowning as the ‘leading killer’. Children under the age of 4 represent the population with the highest risk of fatal drowning. It is estimated that a child between the

age of 1 and 4 is more likely to die of drowning than any other cause of death, except birth defect. Low and Middle Income Countries (LMICs) suffer the heaviest burden, claiming more than 90% of the global number of drowning fatalities.

Drowning is defined as the ‘process of experiencing respiratory impairment from submersion or immersion in liquid’. The primary outcomes of drowning are death or disability. **For every fatal drowning case, at least 4 cases of non-fatal drowning are reported.** Non-fatal drowning entails long-term hospitalization and rehabilitation and in many cases results in permanent disability and neurological damage due to prolonged submersion time or delayed life support assistance.

In addition to the human suffering, drowning imposes a substantial economic burden on nations worldwide. In Canada and the United States, the annual costs of drowning related injuries exceed \$170 and \$270 million respectively. As fatal drowning mostly affects the youth population, the economic costs are associated with lost of

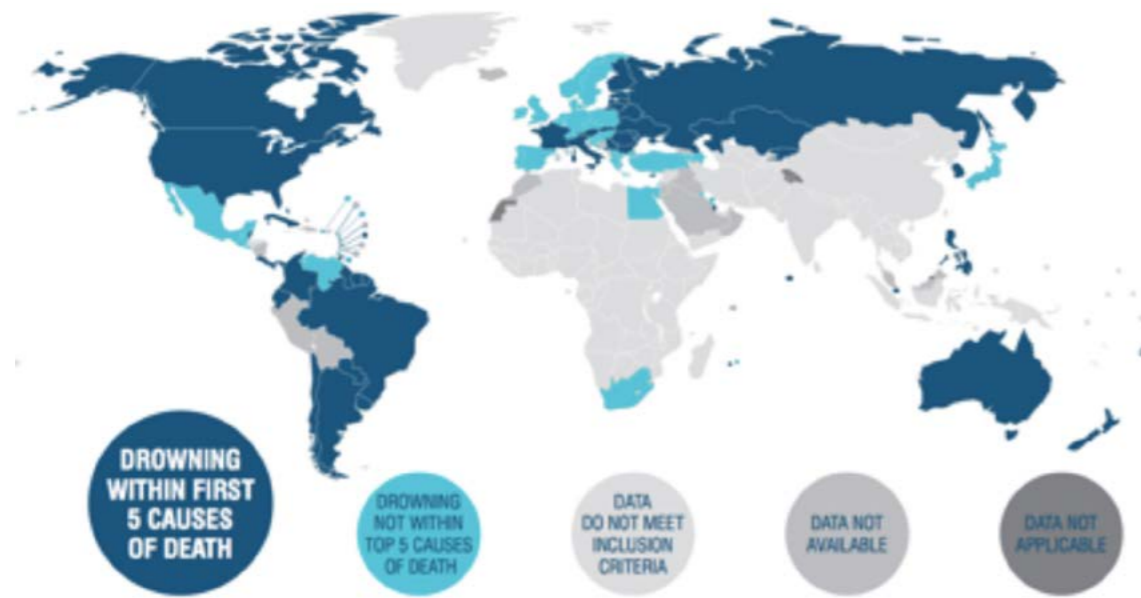


Figure 1: WHO figure represents drowning globally, showing Lebanon with no available drowning data.

productive years with victim’s Potential Years of Life Lost (PYLL). Non-fatal drowning entails direct health care costs (i.e. hospitalization, rehabilitation) and indirect costs related to Disability Adjusted Life Years (DALY) and lost of productivity of drowning survivors.

Lebanon, a Middle Eastern country bordering the Mediterranean Sea, faces a high risk of drowning related injuries. Lebanon coastline expands more than 200 km alongside the Mediterranean Sea and hosts the country’s main cities including its capital, Beirut. More than 70% of the Lebanese population resides in these coastal cities and many of them practice water related activities including fishing, swimming and water recreational sports. **Lebanon coastal location and wide exposure to water bodies increased the country’s risk of drowning.** Ample of research shows that countries with exposure to open bodies of water (i.e. sea, rivers, lakes) reports exacerbated high rates of drowning fatalities. For example, in Bangladesh where the population has access to numerous rivers and inland water bodies, drowning represents the leading cause of death among children under the age of 4 with incidence of drowning reaching 86.3 per 100,000 population compared to 1.2 per 100,000 population in high income countries.

Despite its compelling risks, drowning remains a neglected health problem in Lebanon. Lebanon lacks a national drowning surveillance system that collects primary data needed to measure the nation’s drowning morbidity and mortality rates. Consequently, there is no concrete assessment of the current burden of drowning injuries in the country. The lack of accurate and representative drowning data hinders government and policy makers’ efforts to design and implement drowning strategic measures and prevention programs.

## Risk Factors

Understanding the mechanism and circumstances of

fatal drowning is vital to assess drowning risk factors. Multiple risk factors are associated with fatal drowning, including:

### 1. Gender

Boys sustain the highest rate of fatal drowning in all regions around the world. Boys drowning mortality rate is twice as high as girls. In 2004, some high-income countries in the Eastern Mediterranean region reported male fatal drowning rate of 10.7 per 100,000 population, almost 10 times as high as females’ rate, making males the population at the highest risk of fatal drowning especially for young boys aged 20 years and under. One possible explanation is that boys tend to get involved in risky behavior while underestimating water hazards and overestimating their abilities to swim.

### 2. Age

Globally, an estimated 175,000 children and youth under the age of 20 die of preventable water related drowning every year. Children between 1-4 represent the population with the highest drowning mortality rate. In the US, drowning is the leading cause of death for children aged 1 to 2 years. Similarly in Australia, drowning ranks the 3rd leading cause of death for children under 3. In Bangladesh, drowning fatalities of children between 1 and 4 accounts for almost 45% of the total number of childhood death.

### 3. Location

An overwhelming 90% of drowning injuries occur in Low and Middle Income Countries (LMICs). According to the WHO Global Burden of Disease, LMIC’s rate of fatal drowning is six times higher than High-Income

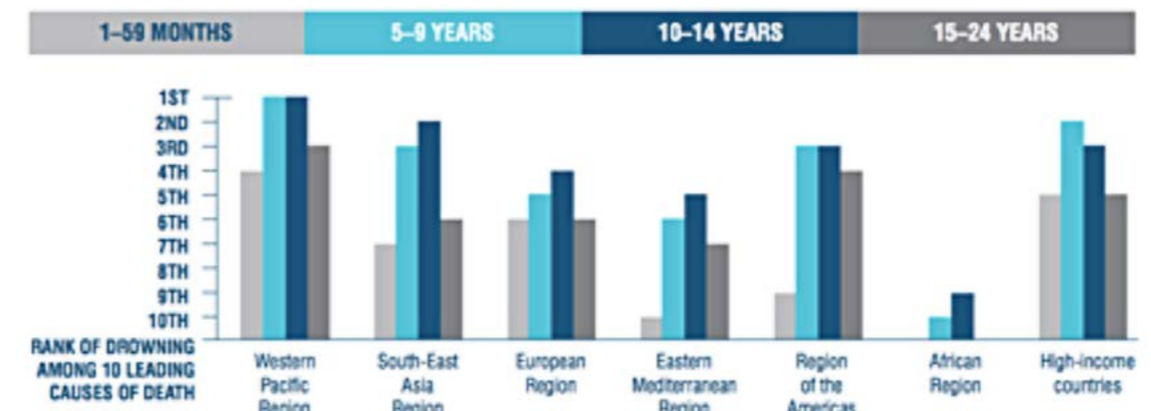


Figure 2: WHO figure depicting the ranking of drowning across region and age group worldwide.

Countries. Many LMICs lack injury surveillance systems and therefore many cases of fatal drowning are poorly documented or unreported. As a result, accurate reporting of the fatal drowning mechanism, circumstances and location is missing.

Within each country, the location of drowning varies significantly. Rural children suffer a higher rate of fatal drowning compared to urban children. In rural areas, drowning tends to take place in lakes, rivers and dams while in industrialized areas drowning occurs in swimming pools, bathtubs and garden ornamental ponds.

### Intervention

Drowning is a predictable and preventable injury. The implementation of evidence based drowning preventive measures in high-income countries such as the United States, Canada and Australia led to a tremendous success in preventing drowning injuries and reducing drowning fatalities. In-depth knowledge of drowning risk factors helps to recommend a set of guidelines and preventive strategies that could be adopted to reduce the risk of drowning on communities and individuals:

#### 1. Raise Public Awareness:

Public should be aware and knowledgeable of water related hazards and potential drowning risks associated with the water environment and its surrounding. Strengthening public awareness through educational materials and resource guides is essential to promote water safety practices and prevent water related injuries and fatalities. Water safety guidelines and instructions should be disseminated to the public through messages or social media sites to increase awareness and reduce risks. Knowledge of water associated hazards combined with water safety training can play a critical factor in preventing fatal drowning, particularly to the children and youth population at risk.

#### 2. Promote Safe Environment

Removing hazards and ensuring a safe environment represent a powerful strategy to prevent drowning injuries. House pools are as dangerous as open natural bodies of water (i.e. seas and rivers) especially for young children. To prevent poolside injuries and accidental childhood drowning, fences to outdoor pool with self-locking gates should be installed between the pool and the house to limit children's entrance to the pool except through a

locked gate. Personal floating devices and emergency kit including First Aid Kit should be present at the poolside and easily accessible by swimmers and pool users.

Village wells and underground cisterns represent potential drowning hazards for rural children. A study conducted in Mexico showed that open wells installed in houses increased childhood risk of drowning by as high as 7 times. Lockable safety covers should be placed on the well opening to protect children from falling through the whole and to prevent them from drowning.

#### 3. Teach Children to Swim

Learning how to swim can be a protective factor against drowning. Improving swimming abilities through swimming lessons and practices can protect individuals from fatal drowning. Case-control studies carried out in the US, China and Bangladesh show a positive correlation between learning how to swim and reducing fatal drowning among children. The studies reported significant reduction of childhood drowning with children's increased swimming skills and water competencies through lessons. It is therefore vital to enhance water safety skills, particularly for children under the age of 10 as a protective measure against fatal drowning. In all circumstances, children should wear lifejackets and should be observed at all times. Adults supervising children should keep them within arm reach and ensure an undistracted attention to young children in water.

#### 4. Knowledge of water hazards and Understanding of personal limitation

Swimming in open water carries hidden tricks compared to closed pools. Swimmers should be aware of hazards pertaining to various sources of open bodies of water. For instance, rivers embody intermittent shallow water zones leading to unpredictable hazardous and risky environments for swimmers. Rivers also include risks such as waterfalls, river current, sudden drop off, slippery riverbank and hidden underwater hazards like rocks, logs and ledges while sea hazards include exposure to high winds, strong currents and rough waves. It's always advisable to avoid swimming at nights and out of sight of lifeguard to reduce risk of drowning.

Swimmers should understand their personal limitations vis-à-vis water hazards. Boys tend to overestimate their physical capabilities and underestimate water hazards,

which make them vulnerable to risks of drowning injuries in and around open bodies of water. People with medical conditions and limited physical capabilities should recognize their personal limits and avoid water activities that pushed them beyond their abilities.

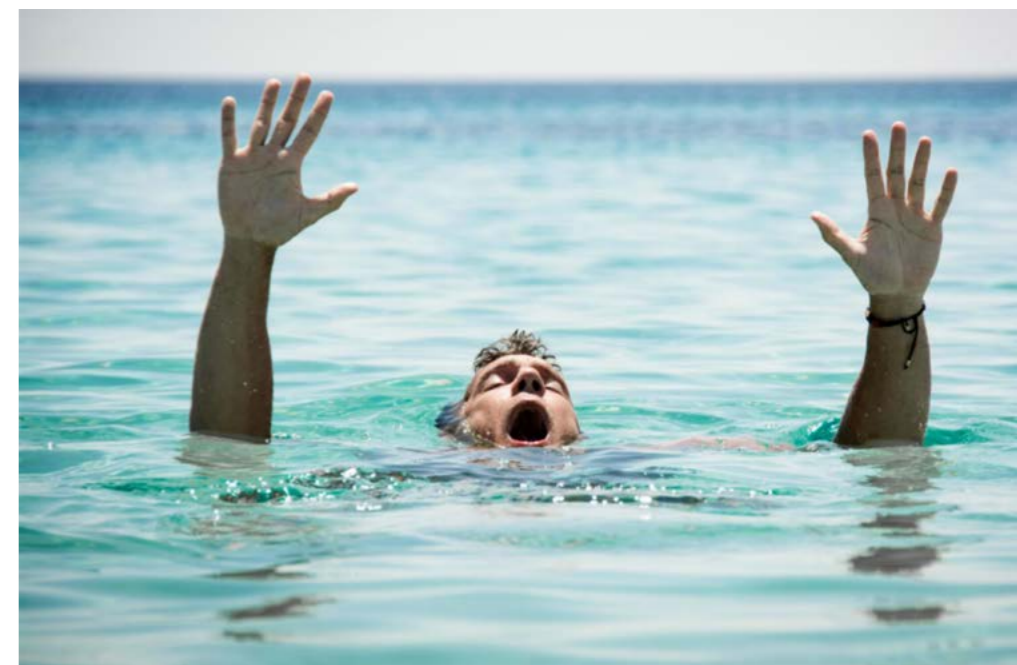
#### 5. Training and CPR

Acquiring cardiopulmonary resuscitation (CPR) training is crucial to save lives. Parents, older children and pool owners should be acquainted with essential life-saving CPR training to be able to intervene when needed and save lives. As every second counts, early CPR provided to drowning victims can dramatically improve the outcome of drowning regardless of the victim's age, gender and submersion duration. Having the right CPR training can prepare bystanders to offer CPR on time and take appropriate actions to save lives when a drowning emergency arise.

#### 6. Inform government Policies and Water Safety Regulations

Government should adopt drowning prevention legislations and policies. Enforcing these policies can play a major contributing factor in improving water safety and reducing the morbidity and mortality rates of drowning. Government should establish partnership and collaborate efforts with local NGOs and research institutions to collect representative and consistent drowning data and conduct evidence based research to understand the epidemiology of drowning injury in Lebanon. Furthermore, government should develop a national water safety strategic plan to strengthen governorates and municipalities across Lebanon to set and enforce water safety measures to prevent accidental drowning.

In Lebanon, drowning is a substantial yet neglected public health problem. Underreported drowning morbidity and mortality rates reflect on the underestimation of the burden of drowning and ultimately ineffective approach to address the drowning problem. Reducing drowning should be given the upmost priority to introduce strategic preventive measures and to inform government policies and regulations ensuring safer and healthier communities.



### References

1. Brenner RA, Committee on Injury, Prevention P, others. Prevention of drowning in infants, children, and adolescents. *Pediatrics*. 2003;112(2):440–445.
2. Brenner RA, Taneja GS, Haynie DL, Trumble AC, Qian C, Klinger RM, et al. Association between swimming lessons and drowning in childhood: a case-control study. *Archives of Pediatrics & Adolescent Medicine*. 2009;163(3):203–210.
3. Celis A. Home drowning among preschool age Mexican children. *Injury prevention*. 1997;3(4):252–256.
4. Moran K, Stallman RK, Kjendlie P-L, Dahl D, Blitvich JD, Petrass LA, et al. Can you swim? An exploration of measuring real and perceived water competency. *International Journal of Aquatic Research and Education*. 2012;6(2):4.
5. Peden MM. *World Report on Child Injury Prevention*. World Health Organization; 2008.
6. Szpilman D, Bierens JJ, Handley AJ, Orłowski JP. Drowning. *New England journal of medicine*. 2012;366(22):2102–2110
7. van Beeck EF, Branche CM, Szpilman D, Modell JH, Bierens JJ. A new definition of drowning: towards documentation and prevention of a global public health problem. *Bulletin of the World Health Organization*. 2005;83:853–856.
8. WHO. *Global report on drowning: preventing a leading killer [Internet]*. World Health Organization; 2014
9. Yang L, Nong Q-Q, Li C-L, Feng Q-M, Lo SK. Risk factors for childhood drowning in rural regions of a developing country: a case-control study. *Injury prevention*. 2007;13(3):178–182.