

## REVIEW ΑΝΑΣΚΟΠΗΣΗ

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### Message 6: “Be safe near water”

Drowning is the fifth commonest cause of unintentional injury death in the European Union (EU). As it constitutes the most fatal type of injury, drowning has been ranked by European Union experts as one of the top priorities for action. Based on the most recent Global Burden of Disease data, the global mortality rate from drowning is 6.8 per 100,000 people, which translates to about 400,000 deaths per year. This paper presents (a) the magnitude and the socio-economic burden of this epidemic in the countries of the EU, (b) the underlying risk factors that are associated with this type of injury and (c) the evidence based preventive practices that reduce the likelihood of drowning occurrence. Some of these measures are therefore included in the European Code Against Injuries (ECAI) aiming to raise public awareness regarding injury prevention. Given that drowning represents the second leading cause of unintentional injury death among children, the primary age group of concern in this review is the age group 0–14 years old.

#### 1. DEFINITION

The definition of drowning incidents has been for many years a source of confusion, leading to a limited scope for prevention. A recent systematic review of definitions for drowning incidents identified 33 different definitions, 20 for drowning and 13 for near drowning, along with approximately 20 different outcome measures.<sup>1</sup> In 2002, the need for a uniform approach of drowning led to the adoption of a simple and internationally accepted definition: “Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid. Drowning outcomes can be classified as: death, morbidity, and no morbidity”<sup>2</sup> Implicit in this new definition is that a liquid/air interface is present at the entrance of the victim’s airway, preventing the victim from breathing air. After this process, the victim may live or die, but whatever the outcome, he/she has sustained a drowning incident.<sup>1</sup>

#### 2. MAGNITUDE OF THE PROBLEM

Among all types of injury, drowning constitutes the

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Μήνυμα 6: «Φροντίστε  
για την ασφάλειά σας  
όταν βρίσκεστε κοντά σε νερό»

*Περίληψη στο τέλος του άρθρου*

#### Key words:

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most fatal. Based on the most recent Global Burden of Disease data, the global mortality rate from drowning is 6.8 per 100,000 people, which translates to about 400,000 deaths per year.<sup>3</sup> This places drowning as the second leading cause of unintentional injury death worldwide. Drowning affects all age groups, but certain groups are particularly vulnerable. Thus, over half of the global mortality occurs among children less than fifteen years of age, whereas 97% of all deaths from drowning occur in low- and middle-income countries.<sup>3</sup>

But drowning also impacts on morbidity; it has been estimated that, for each fatal childhood drowning, there are 1 to 4 nonfatal submersions serious enough to result in hospitalization.<sup>4</sup>

Within the European Union (EU), more than 700 children younger than fifteen years old lose their lives every year due to accidental drowning. Half of them are aged less than four years.<sup>5</sup> Figure 1 presents childhood drowning mortality rates in the EU Region during the period 1994–2004. Although the occurrence of drowning has taken a downward trend during the last years, there is still much potential for prevention. It is not clear, however, whether this decrease



**Figure 1.** Drowning mortality rates per 100,000 children aged 0–14 in the EU-27, by year and gender\* (Source: WHO mortality database, adjusted by CEREPRI).

\*Data for Cyprus are not available.

is due to medical intervention, better Emergency Medical Systems, more knowledge of cardiopulmonary resuscitation (CPR), increased number of risk reduction programs in general or whether it represents an actual decrease in exposure or in severe submersion episodes.

As shown in figure 2, the mortality rates for EU countries range greatly from 0.2/100,000 (United Kingdom) to 7.2/100,000 (Latvia) and so do the underlying causes. Nevertheless, this wide variation also indicates the vast potential for reduction of this type of injury across EU member states.

There are no readily available cost data for the EU, regarding the financial burden of drowning. Given that most of those dying from this type of injury are children, with a subsequent extensive loss of economically productive life years, the overall societal costs should be especially high. The annual cost of drowning injury in Australia was estimated at US\$ 85.5 million for the period 1995–1996, while for coastal drowning only in the United States amounted to over US\$ 273 million in direct and indirect costs,<sup>3</sup> though the methods and definitions used in each study may differ.

### 3. RISK FACTORS

#### 3.1. Demographic risk factors

Overall, males are more likely to die due to drowning than females. The global male to female ratio is about 2:1 and the ratio has been estimated even higher (4:1) in

the European Region.<sup>3</sup> This significant difference between the sexes has been mainly attributed to males' increased exposure to aquatic environments and to riskier behaviour, such as swimming alone, drinking alcohol before swimming and boating.<sup>6</sup> Children under five years of age appear to be at greatest risk, with drowning accounting for a high proportion of injury-related deaths in this age group.

#### 3.2. Environmental risk factors

Drowning occurs from a variety of activities and in a variety of places depending on the country. One could speculate that drowning incidents occurring in salt water are more prevalent in places with easy access to seawater, especially among individuals who practice recreational aquatic activities, e.g. diving, water skiing, jet ski and young tourists who are engaged with unfamiliar activities in unfamiliar settings. This seems to be the case for Greece, where it has been estimated that 76% of drownings and near-drownings occur in salt water.<sup>7</sup> In other EU countries, like France or Denmark, most cases of childhood drowning occur in swimming pools, either public or private, while in the United Kingdom, for instance, drowning mortality is highest in fresh water (rivers, canals and lakes).<sup>8–10</sup> Furthermore, most drowning incidents in low- and middle-income countries are associated with everyday activities near bodies of water and not with recreation or leisure, as is commonly the case in high-income countries.<sup>11</sup>

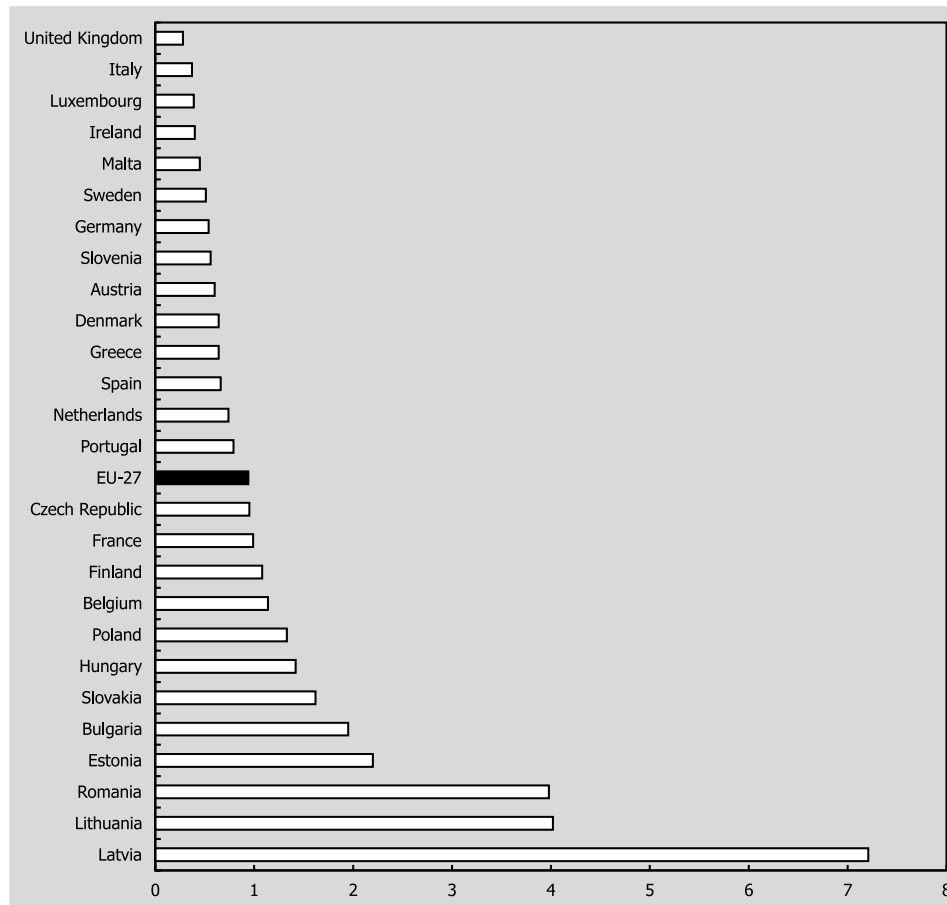
#### 3.3. Behavioural risk factors

Several surveys indicate that drowning and near-drowning in young children is often associated with a lapse in parental supervision. Most adolescent and adult drowning incidents are associated with alcohol consumption,<sup>12,13</sup> whereas other behavioral risk factors relate to parents not having children wear a life jacket or lack of CPR knowledge.

## 4. EFFECTIVE PREVENTIG PRACTICES

#### - Swimming pool fencing

Preventive measures aiming to reduce childhood drownings and near-drownings have mainly relied on passive protection, such as swimming pool fencing. Adequate fencing, that is, four-sided fencing that isolates the pool from the rest of the yard and the house, prevents a child from having access to the pool when a responsible adult is absent, and has been promoted as an effective environmental strategy. Several studies have documented the efficacy of pool fencing in preventing childhood drowning; the risk of drowning or near-drowning has been estimated



**Figure 2.** Drowning mortality rates per 100,000 children aged 0–14 by EU member state; average of the last available three years (circa 2002–2004)\* (Source: WHO mortality database, adjusted by CEREPRI).

\*Data for Cyprus are not available.

to be 3.76 times higher for unfenced than fenced pools, whereas a protection exceeding 75% has been suggested for four-sided versus three-sided fencing.<sup>14–18</sup> A study that was conducted in the United States of America in 1994 estimated that 88 pool-related drowning among children less than 5 years of age might have been prevented if all residential swimming pools were properly fenced.<sup>19</sup> Similarly, the Arizona Child Fatality Review Program concluded that the combination of pool fencing and adequate child supervision could have prevented 90% of child drowning in Arizona.<sup>20</sup>

### - Child supervision

Despite effective methods of environmental protection, childhood drowning prevention also requires an adequate level of parental supervision, at least to make sure that barriers are secured.<sup>21</sup> For some high-risk situations (e.g. protecting an infant while in the bathtub), proper adult supervision is probably the only factor that can protect against childhood drowning. But what constitutes adequate child supervision? A useful definition has been suggested

by Morrongiello: “Supervision refers to behaviors that index attention (watching and listening) in interaction with those that reflect state of readiness to intervene (touching/within arm’s reach/beyond arm’s reach), with both types of behaviors judged over time to index continuity in attention and proximity (constant/intermittent/not at all).”<sup>22</sup> This means that if a parent is within an arm’s reach of the child, the parent can constantly watch it, know and predict its actions and, therefore, be ready to prevent an injury from occurring.

Although it is difficult to assess the effectiveness of adult supervision in preventing childhood drowning, a substantial body of work has underlined its importance.<sup>23–27</sup> Yet, results from several studies suggest that young children are often inadequately supervised by their parents or caregivers. A recent study that sought to determine reported levels of children supervision while in the bathtub, found out that 31% of the caregivers left their child unsupervised for some period of time. Parent activities when leaving the child alone in the bathtub often included getting a towel or diapers, answering the phone, and cooking.<sup>28</sup> Moreover, a 20-year review of autopsied cases involving

bathtub drowning in Canada showed that nearly 90% of the cases were associated with inadequate adult supervision.<sup>29</sup> Similar were the findings of Kemp & Sibert who studied cases of children drowned or nearly drowned in the United Kingdom.<sup>10</sup> Further studies need to be done concerning the protective effect conferred in beaches and other swimming areas by lifeguarding, although swimming in unsupervised areas seems to be a major problem in countries with extensive coast lines.

#### - *Swimming lessons*

Surprisingly, there is no clear evidence available from the literature demonstrating that swimming lessons decrease the risk of drowning.<sup>30-31</sup> Reports from Australia suggest that swimming lessons for children may be associated with a reduction in drowning rates, as a more than 50% reduction in drowning rates in Victoria was observed following the introduction of school-based swimming and water safety training for children aged 5–14 years old.<sup>32</sup> Furthermore, a number of studies have shown that swimming lessons improve swimming ability and safety skills of children.<sup>33-35</sup> Nevertheless, it has also been suggested that increased swimming ability may lead to increased exposure to water and, consequently, to an increased risk of drowning. Or that acquisition of swimming skills by children may give parents a false sense of security leading to children being left unattended.

#### - *Personal flotation devices*

The use of an approved personal flotation device (PFD), when boating or participating in water sports, appears to decrease drowning morbidity and mortality rates in both children and adults. A study aiming to determine the effectiveness of PFDs in preventing drowning and near-drowning of individuals involved in personal watercraft crashes in Arkansas, estimated that PFDs saved the lives of 38 people who could have been drowned.<sup>36</sup> Also, a study conducted in Denmark between 1989 and 1993 found out that almost half of people who drowned during leisure boating did not wear a PFD and suggested that they could have been saved if wearing one.<sup>8</sup>

#### - *Cardiopulmonary resuscitation*

With regard to secondary prevention, CPR skills seem to be one of the most important means of drowning prevention. A case-control study sought to determine the effect of immediate resuscitative efforts on the neurologi-

cal outcome of children with submersion injury, indicated that those with good outcome were five-fold more likely to have a history of immediate resuscitation than children with a poor outcome.<sup>37</sup> Nevertheless, there is evidence to suggest that the vast majority of parents do not know how to perform CPR on an infant or a child.<sup>38</sup>

## 5. CONCLUSION

Accidental drowning accounts for about half a million deaths worldwide, most of them involving young children and older people. In the EU member states this figure amounts to an average of 7,500 deaths per year, out of which almost 10% among children aged 0–14.<sup>5</sup> Nevertheless, drowning is preventable and foreseeable despite the variable underlying causes among the EU member states. Evidence shows that effective prevention programs do exist, notably those addressing passive prevention as well as those entailing educational components to reduce drowning, especially among children. ECAI messages could be one piece of a comprehensive strategy that needs to be developed to prevent future drowning and disability due to near drowning. To this end, the following preventive messages could make a difference were they to be adopted by children, parents and the society at large:

- Learn to swim – make sure that children are taught how to swim from an early age by a qualified instructor.
- Wear appropriate flotation devices for all water sports undertaken in open water.
- Be aware that many children are drown in shallow water, including wading pools, bathtubs, buckets and toilet bowls.
- Teach your child how to be safe in and around the water. Actively supervise your child. Do not delegate supervision of your child to older children.
- Keep in mind that swimming pools can be dangerous if they don't have a climb-resistant fence with a self-closing and locking gate. Insist on the same standards for any private pool used by your children.
- Take a course to learn how to revive a victim of drowning.

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## ΠΕΡΙΛΗΨΗ

### Μήνυμα 6: «Φροντίστε για την ασφάλειά σας όταν βρίσκεστε κοντά σε νερό»

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Οι πνιγμοί είναι η πέμπτη αιτία θανάτου από ακούσιο τραυματισμό στην Ευρωπαϊκή Ένωση. Δεδομένου ότι πρόκειται για τον πιο θανατηφόρο τύπο ατυχήματος, οι πνιγμοί έχουν ταξινομηθεί από τους ειδικούς της Ευρωπαϊκής Ένωσης ως μία από τις πιο άμεσες προτεραιότητες για δράση. Σύμφωνα με τα στοιχεία της Global Burden of Disease Data, η παγκόσμια επίπτωση θνησιμότητας από πνιγμούς εκτιμάται στους 6,8 ανά 100.000 ανθρώπους, το οποίο μεταφράζεται σε περίπου 400.000 θανάτους ανά έτος. Αυτή η εργασία παρουσιάζει: (α) την έκταση και τις κοινωνικοοικονομικές επιπτώσεις που έχουν οι ακούσιοι πνιγμοί στην περιοχή της Ευρωπαϊκής Ένωσης, (β) με τους υποκείμενους παράγοντες κινδύνου, (γ) τις επιστημονικά αποδεδειγμένες πρακτικές που μειώνουν την πιθανότητα πνιγμού. Μερικές από αυτές τις πρακτικές έχουν συμπεριληφθεί στον Ευρωπαϊκό Κώδικα Κατά των Ατυχημάτων ώστε το κοινό να ενημερωθεί σχετικά με την πρόληψη ακούσιων τραυματισμών. Δεδομένου ότι οι πνιγμοί αντιπροσωπεύουν τη δεύτερη αιτία θανάτου από ακούσιους τραυματισμούς στα παιδιά, η βασική ηλικιακή ομάδα στην οποία αναφέρεται η εργασία είναι αυτή των παιδιών ηλικίας 0-14 ετών.

**Λέξεις ευρητήριο:** Ευρωπαϊκός Κώδικας Κατά των Ατυχημάτων, Πνιγμός, Πρόληψη

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