



Drowning in swimming pools [☆]

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ABSTRACT

Although fatal drowning rarely occurs in swimming pools, this event has a very grave impact on the swimming pool employees, notably when they have been directly involved in the rescue and resuscitation. At the same time, very little data is available on the incidence, causes and outcome of pool drowning. It is important that pool lifeguards understand that a cardiac arrest after drowning is different from the primary cardiac arrest due to an infarction or ventricular fibrillation and that oxygen is the most vital aspect of the resuscitation measures. The use of a pool safety plan and the implementation of a checklist, training in realistic pool-related resuscitation scenarios and record keeping of accidents and near-accidents may be helpful to be better prepared for a drowning incident.

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1. Introduction

The safety of swimming in pools is susceptible by a large variety of risks, including microbiological agents, chemical agents and technological and work related hazards [1,2]. Another possible concern for swimming pool visitors is the risk of dying from drowning. Although fatal drowning rarely occurs in swimming pools, the event has a grave impact [3]. It is quite normal that a pool is closed for a number of days. It takes years before the legal consequences have been solved and the reputation of the pool has improved [4,5]. Also relatives of the victim as well as members of the pool staff may have long-lasting psychological problems [6,7]. The first part of this article provides an overview on the world-wide burden of drowning and how swimming can reduce the drowning risk. The second part of the article describes the epidemiology of drowning in pools, the prevention, the risk factors

and the causes of pool drowning and the treatment of a pool visitor who has drowned. Suggestions are made on how to enhance the knowledge on pool drowning and how to reduce the risk of fatal accidents.

2. Statistics of drowning world-wide

Until the end of the 20th century, it is generally believed that some 200,000 persons world-wide had died each year from drowning. This has changed in 1999, when the World Health Organisation (WHO) publishes the International Injury Report, in which it is calculated that the number of fatal drowning is much higher: all over the world, almost half a million people drown each year, most of all in the low income and middle income countries and mostly children being the victims [8,9]. The numbers do not include fatal drowning due to water related disasters, traffic accidents, water transportation accidents, suicides and boat refugees. The exclusion of these large groups of drowning deaths also occurs in later reports and is an on-going deficiency in drowning statistics today [10]. In 2008, the United Nation's Children Funds (UNICEF) reported on world-wide child injuries and concluded that drowning was the second most important injury mechanism for a child to die, with a global incidence of 7.2 per 100,000 children [11]. Of all fatal injuries in children, 22% was due to road traffic injuries and 17% due to drowning. In the report, large geographical differences between high income countries and low income countries have been described (respectively 1.2 and 7.8 per 100,000 inhabitants). In some Asian low income countries, the death rate is as high as 30 per 100,000 inhabitants. Stimulated by these conclusions, the UNICEF, together with The Alliance for Safe Children (TASC), performed a study on all causes of death in south-east Asia. This study confirmed

Abbreviation: AEDs, automated external defibrillators; ARDS, adult respiratory distress syndrome; BLS, Basic Life Support; EMS, Emergency Medical Services; ICSPS, International Congress on Swimming Pools and Spas; TASC, The Alliance for Safe Children; UNICEF, United Nation's Children Funds; WHO, World Health Organisation.

[☆] This article is based on the presentation "Emergency management and drowning in pools" during the session "Health promotion and emergency management in pools" at the International Congress on Swimming Pools and Spas [ICSPS] in the Foro Italico in Rome (Italy) at April 11th, 2013, on the presentation "Cómo evitar muertes por ahogamiento en áreas recreativas" at the "VII Jornadas sobre Socorrismo y Soporte Vital Prehospitalario en el medio acuático" in La Coruna (Spain) at April 26th, 2013, discussions and literature searches.

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previous studies and also included the observation that in high-risk areas and high-risk groups, more 1–4 year old children die from drowning than all other causes of death together, such as diarrhoea, pneumonia, measles and tetanus (Fig. 1) [12].

Studies on drowning in Europe have also been finalised during the last decades. These studies also report a large difference in drowning statistics between European countries. Even in the European countries with a higher risk of fatal drowning, the risk is however low compared to Asian countries. The high-risk European countries are most of all those situated in the former Soviet Union, such as Kazakhstan, Uzbekistan and Latvia. In these countries, the incidence of fatal accidental drowning is between 6 and 7 per 100,000 inhabitants. In most other European countries the risk of fatal accidental drowning is less than 1 per 100,000 inhabitants. In absolute numbers this means, for example, that fatal drowning per year is on average 400 in Italy [13], 385 in the United Kingdom [14,15], 300 in The Netherlands [16], 150 in Ireland [17], 120 in Denmark [18], and 45 in Switzerland [19]. In all countries, children are the high-risk group [20]. Other specific high-risk groups can be detected within each European country [21]. For example in The Netherlands, typical high-risk groups are children of asylum seekers, young adults who go out for recreational swimming in large rivers and the, often old-aged and handicapped, drivers of mobile scooters [22–24]. In Italy, many unaware foreigners and tourists are involved in drowning accidents [25]. In most European countries with low drowning rates, there has been a decreasing trend in the incidence of drowning over several decades. For example, in Italy, death due to drowning reduces from about 1300 deaths per year in late 1970 to about 400 in 2007 [13,25]. A similar trend is shown in the Dutch accidental drowning statistics: 302 in 1970, and 81 in 2012 [26].

3. Swimming pools as a tool of drowning prevention

A possible role of this reduction can be referred to the increased swimming ability of the general population in the last decades. There is evidence that participation in formal swimming lessons is associated with a reduction in the risk of drowning in children [27,28]. After having learned how to swim, swimming pools permit the playing children to increase their swimming ability, to acquire many other aquatic skills and to learn how to deal with potentially dangerous situations. In this way, vigilantly supervised swimming pools are an important vehicle for drowning reduction [29–31]. Despite this preventive role, drowning also occurs in pools. The second part of this article reviews drowning in swimming pools.

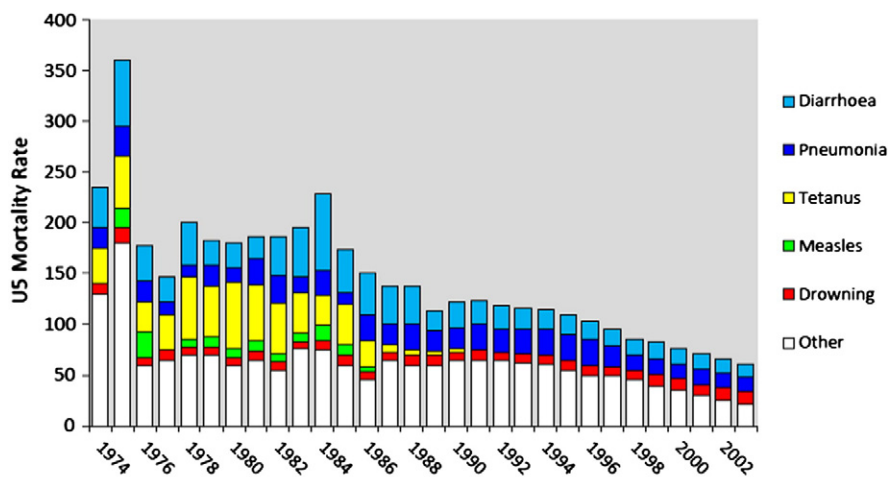
4. Drowning and swimming pools

Regarding drowning in swimming pools, very little international data is available. At the same time, the available data are inconsistent and cannot be compared. Many definitions of drowning that are used in these reports differ from the commonly accepted definition [32,33] and do not use standardised parameters [34]. One other probable reason for the absence of pool drowning data is related to the low number of pool drownings. An Australian study showed that only 22 out of the annual 284 drownings occurred in pools [35]. The same small figures have been described in the USA [36], including New York [37], and other countries like Canada [38,39], New Zealand [40], Hong Kong [41], the United Kingdom [14], Germany [42], Italy [13] and The Netherlands [16]. A study from Florida (USA) found that 0.8 drownings occur for every 100,000 home pools [43]. The low incidence rate makes it rather difficult to organise an effective infrastructure to collected data. The data collection is further hindered by the inconsistency of the presentation of additional information that is needed to allow the comparison of the data. Data analysis is further hampered by the large variety of pools and other water recreation facilities (Table 1) [44]. Furthermore the pool industry may be reluctant to collect and publish such data [45].

The limitedly available data suggest that more drownings occur in open-air pools than in in-door pools or water parks [43,46–50]. In general, the drowning victims in home pools are younger than the drowning victims in public pools; less than 5 years of age vs. 5–14 years of age [51]. In Italy, drowning in pools accounts for 0.5% of all fatal drownings and little children in private pools are involved more frequently. The lack of proper surveillance is the main cause [13]. There is also a relationship between drowning in home pools and race. In the USA, most home-pool drowning of white people occurs until the age of 4 years, while home-pool drowning in the black population is increased until the age of 25 [52]. A recent study in the Victoria district of Australia describes 336 drowning related cardiac arrests between 1999 and 2011; 57 (17%) cases occurred in pools and 52 (15.5%) in bathtubs, spas, ponds or buckers. Interestingly, 9 out of the 12 patients who survived to hospital discharge, drowned in pools, bathtubs or ponds [53].

5. Causes of drowning in swimming pools

Three major categories of causes of drowning in swimming pools can be distinguished: inability to swim, risk taking behaviour and medical causes [28,54].



Source: International Centre for Diarrhoeal Disease Research, Dhaka, 2003.

Fig. 1. As a result of the favourable effects of prevention programmes, the death rates of typical infant disease as diarrhoea, pneumonia, tetanus and measles are declining over the last decades all over the world. In some parts of the world the net result is that drowning has become the most important cause of death in children [12].

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