

OPINION

Drowning prevention in children: the need for new strategies

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Drowning is now the single leading cause of injury death in children 1–4 years of age in the US, surpassing both motor vehicle occupant and pedestrian deaths.¹ The article by Asher *et al* on water safety training in this issue represents a much needed new avenue of prevention research on drowning (see p 228). Despite the existence of proven strategies for preventing drownings in early childhood,² drowning rates in the US have proven refractory in this age group.³ Since 1971 these rates have changed little and have actually increased in infants. This is in contrast to drowning rates at ages 10–19, which have declined by more than 5% annually.

Central to any prevention effort is an understanding of how and why drownings occur. Drowning circumstances vary widely by age and to some extent also by geographic location. Under age 1 most drownings occur in bathtubs. After age 1, associated with increasing mobility, there is a transition to a higher incidence of drownings in home pools, hot tubs and whirlpools, buckets, and other sites. In the absence of good national data (due to lack of specificity in drowning E-codes), most regional studies find that by age 2 the leading site is home swimming pools.² For example in Los Angeles County among children ages 2–3 years (the target of the study under discussion) 89% of drowning occurred in private pools.⁴ Other sites in this age group were bathtubs (4%), hot tubs and whirlpools (3%), with the remainder at other sites. Although the importance of the home pool obviously varies by state it is the leading site for drownings under aged 5, especially in those states with high drowning rates, that is western states, Hawaii, and Florida — all of which have high rates of pool ownership. Thus the study by Asher *et al*, based as it is on swimming pools, represents a realistic simulation of the situation and environment where drownings to young children are most likely to occur.

While passive prevention methods, such as four sided pool fencing, are very effective and must remain our primary prevention strategy there are many barriers that prevent their implementation.² The lack of any significant decline in drowning rates to young children over time³ indicates the need to develop other strategies in addition to pool fencing. However, little research has been done on other approaches to drowning prevention. Asher *et al* have provided the first comprehensive study that demonstrates that teaching swimming and

water skills may be a useful supplement to other means of preventing drowning in young children. One other study of pool saves in Virginia is reported to have shown that children who had some form of swimming lessons (mostly at about 18 months of age) 'were only half as likely to require retrieval from the pool' (Whitehead cited by Spyker).^{5,6} However, we were unable to examine the methods used in that study. The study design used by Asher *et al* is, however, well documented, creative, and used sound, well thought out methods. Among those in both intervention groups significant improvements were found in the water skills necessary to survive a fall into a home pool. These skills included the ability to kick propulsively, ability to recover and stand up when dropped into two feet of water, and the ability to swim to the side of the pool after jumping in. These measures are reasonable surrogates for drowning risk, given the obvious human subjects concerns of other approaches. The study findings provide compelling evidence that water survival skills can be taught to children 2–3 years of age. Such skills may provide valuable extra time for rescue of the child from the pool during lapses in supervision or failure of other protective devices.

In considering the implications of these findings it is important to consider that the mean age of participants was 34 months. No children under 24 months old were included, although children even under 1 year of age are often targeted for 'drown proofing' programs. Many younger children do not have the necessary motor or cognitive skills to be receptive to the key elements in the intervention evaluated by Asher and his colleagues. In addition, potential adverse effects such as water intoxication and severe electrolyte imbalance have been reported after water skills training in children aged 5 to 12 months of age.^{6,7} Thus swimming training programs cannot be recommended at this time for very young children (under 2 years), even though drowning rates nationally are highest from age 12–23 months (6.2/100 000 population, unpublished data 1980–6, US National Center for Health Statistics). Children aged 2 and 3 have the second highest drowning rates (4.0 and 5.5/100 000 respectively) and thus represent an important population to target for better preventive measures, especially since high risk children (those with home pools) are likely to continue to use (and improve) their skills. It is of interest to note that drowning rates continue to decline at ages 4 and

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5 (2.9 and 2.2/100 000) and reach their lowest level of any age at 10 (1.6/100 000). More research is needed to find better and more appropriate strategies for drowning prevention in children less than 2 years of age.

One potential adverse consequence of swimming instruction is that it may increase exposure to risk by increasing the likelihood of children entering the water or encouraging over confidence once in the water. This is one reason the American Academy of Pediatrics has hesitated to recommend swimming instruction for young children.⁸ The authors were well aware of this potential and examined behaviors around the pool that could increase the risk of drowning, such as running around the pool edge, pushing, and entering water without an adult. It is reassuring that the training did not increase these risky pre-event behaviors. In fact 'deck behavior skills' showed a small improvement immediately after training. However, more extensive evaluation of the effect of this water safety training program on the potential risk of entering a pool unsupervised is needed (including longer post-intervention follow up), before we can be confident that such interventions do not increase exposure to risk. Unfortunately such studies are difficult to do because large sample sizes are needed if submersion injury is to be used as an outcome variable. As suggested by the authors, other evaluation techniques, including case-control studies that examine exposure to the intervention, maybe useful techniques to consider. Future studies, including those using qualitative research methods such as focus groups, should also examine if acquisition of new water skills in children influences parental attitudes regarding the need for constant vigilance around children near swimming pools. Some safety interventions may lull parents into a false sense of security.

What are the implications of this study for swimming training in older ages? Asher *et al* have clearly demonstrated that children 2–3 years of age can be taught a useful survival skill in the water. However, they were less effective in changing children's safety behavior outside the water. In older children and adolescents the value of acquiring swimming skills as a means to prevent drowning is much less evident. It appears that many drowning victims can swim, although few studies have examined this issue and the mechanism of drowning is poorly understood.⁹ The dramatic peak of drowning rates in male adolescents is not seen among females, and is highly related to differences in

lifestyle and behavioral factors, including alcohol use.

There are also concerns with regard to inadvertently increasing exposure to dangerous bodies of water such as rivers and lakes after swimming training. This applies even more to adolescent populations where pool drownings are rare. Isolated rivers, creeks, and lakes are much more common sites. As stated by Leon Robertson in his 1983 book, 'It is not known whether proficiency in swimming reduced drowning to an extent that would offset the increased exposure from exercising that skill.'¹⁰ This issue still remains today as one of the big health concerns in drowning prevention. A distinction must also be made between skill development and educational strategies aimed at reducing risky behavior. While Asher *et al* showed that swimming skills can reliably be taught to even 2 to 3 year olds it is much more difficult to influence behavior. There is therefore a need for more comprehensive research into the factors relating to drownings especially in adolescents, which are very different than for young children. Unlike early childhood drownings where we have a number of well proven interventions (including pool fencing), we have few proven effective strategies to prevent these tragedies in older ages. It is hoped that the refreshing new approach to drowning research used by Asher *et al* may stimulate others to follow the ground breaking lead given by these investigators.

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