Drownings in Lifeguarded Pools
Why submerged victims go unnoticed

The public perceives lifeguards as the premier drowning prevention strategy. Lifeguards are expected to recognize and respond to patrons in distress before injury occurs.

However, according to a 2011 report[i] from the Centers for Disease Control and Prevention (CDC), lifeguards failed to prevent more than one hundred drownings from 2000 to 2008. The CDC reviewed media accounts for those years and identified 140 fatalities in swimming pools with at least one lifeguard on duty at the time of the drowning. As tragic as these numbers are, because not all drownings are reported by the media, these results underrepresent the true number of pool fatalities with lifeguards present. In Washington state, only 514 (52%) of 983 drownings were reported in newspapers between 1993 and 1998.[ii]

Focusing only on fatalities underestimates the public health burden of submersion injuries. Among children under 15 years of age, it is estimated that for every death there are two nonfatal submersion victims treated and released from emergency departments and two more that require hospitalization. Further, these statistics do not account for the emotional trauma suffered by patrons who witnessed a failed rescue, or post-traumatic stress disorder experienced by lifeguards who were on duty when a fatal drowning occurred.

When drownings occur with lifeguards on duty, lifeguards are often accused of being negligent and blamed for the tragedy. But, based on scientific studies conducted over the past five years, lifeguards are often positioned where drowning victims cannot be identified when just below the surface or on the pool bottom.

MATERIALS AND METHOD

The current gold standard for determining lifeguard placement, and for initial and ongoing training of lifeguards, involves the use of manikins and silhouettes. However, in order to identify optimal placement of lifeguards, it is necessary to have lighting and water conditions comparable to real-world conditions. A scientific study was initially conducted using the standard manikins and silhouettes. Photograph 1 shows how the use of a submerged manikin (circled in orange) caused patrons to move away from the lifeguard surveillance zone being tested. This common patron response substantially alters key environmental elements, such as turbulence and line of site obstructions, that contribute to the challenges lifeguards face when scanning under realworld conditions. Test results demonstrated that despite informing patrons that these life-like devices were merely testing equipment, children and adults became disturbed and changed their swimming activities. This modification of patron behavior directly altered the environment, and therefore the results were determined to be invalid.

Photograph 1

Conducting reliable lifeguard positioning testing required a test device that did not cause patrons to modify their behavior. Since refraction causes submerged bodies to break apart, lifeguards are taught to look for blotches in the pool while scanning. Therefore, testing devices did not need to be life-like in shape but did need to be life-like in size.

Investigations have shown that when children drown, after they cease struggling, some tuck into a fetal position. Toddlers are the smallest children likely to slip away from their caregivers and drown in public pools.

An anthropometrically accurate device was developed to represent a toddler in the fetal position (length, width, and height) without looking like a submerged child. To ensure safety, the device was constructed with vertical components that compress easily when stepped upon, and float upright when pressure is not applied.

Figure 1

These devices, referred to as ANGELS (Area Notification Gear for Effective Lifeguard Surveillance) (shown in the forefront of Figure 1) were placed in a variety of swimming pools (e.g. indoor, outdoor, institutional, private, municipal).

Testing demonstrated that patrons disregarded the ANGELS devices and continued to play and swim as though nothing unusual was on the pool bottom. Photograph 2 shows a child swimming over the ANGELS device and Photograph 3 shows an adult walking across the ANGELS device.

Photograph 2

Photograph 3

Testing commenced with ANGELS devices placed in a grid pattern, in one lifeguard surveillance zone at a time, throughout the shallow and deep ends of swimming pools at indoor and outdoor aquatic facilities. Safety protocol was established to ensure patrons were not at increased risk of drowning while testing was performed.

Lifeguards were asked to count the number of ANGELS devices that they could see under various loading (e.g. open swim, lessons, swim team, etc.) and lighting conditions (e.g. morning, mid-day, late afternoon, evening with underwater and/or overhead lights illuminated).

Equidistant placement of ANGELS in different sized and shaped surveillance zones necessitated adjustment in the number of testing devices used.

RESULTS

In testing scenarios where 25 ANGELS devices were positioned in the lifeguard's assigned zone of coverage, lifeguards identified 19 to 21 ANGELS. (76 to 84% identified)

In testing scenarios where 33 ANGELS devices were positioned in the lifeguard's assigned zone of coverage, lifeguards identified 21 to 27 ANGELS. (64 to 82% identified)

In testing scenarios where 47 ANGELS devices were positioned in the lifeguard's assigned zone of coverage, lifeguards identified 32 to 40 ANGELS. (68 to 85% identified)

Testing demonstrated that these lifeguards were not properly positioned to identify a submerged victim throughout their entire assigned surveillance zone.

Prior to testing using the ANGELS devices, neither lifeguards nor pool management were aware of the lifeguard's limitations.

During testing, photographs were taken simultaneously from elevations equivalent to the lifeguard's view when seated on stands located at the aquatic facility, as well as from standard 6-foot and 8-foot tall lifeguard stands.

The following photographs provide a frame of reference for understanding surveillance challenges of which lifeguards and management were not aware.

Lifeguards at the indoor pool shown in Photograph 4 were instructed to sit on 2½-foot tall lifeguard stands. Visibility beneath the surface of the water was substantially reduced by glare, turbulence, and line of site obstructions.

Photograph 4

Visibility was enhanced when the lifeguard was positioned on a 6-foot tall lifeguard stand, as shown in Photograph 5.

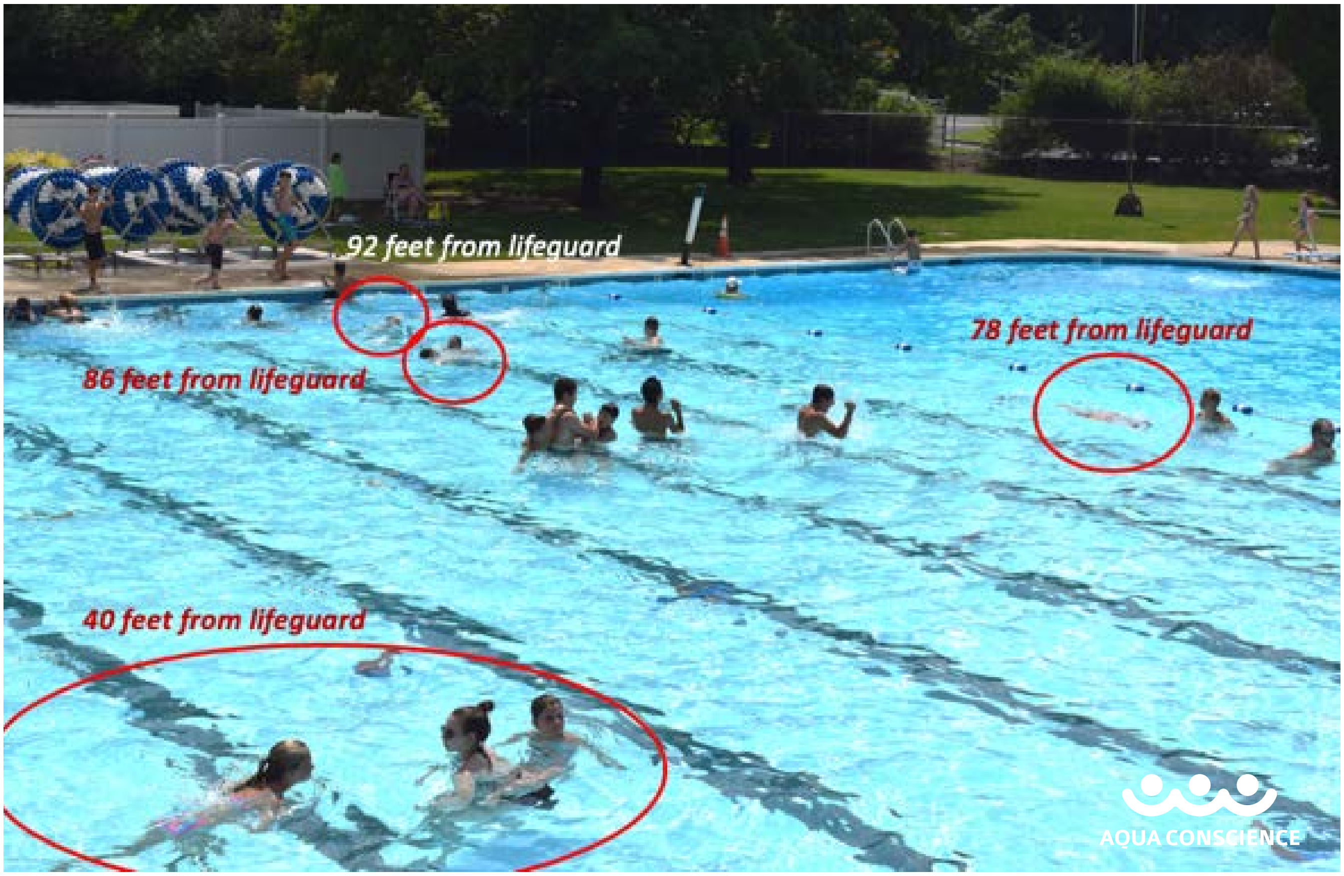
Photograph 5

Visibility was further enhanced when the lifeguard was positioned on an 8-foot tall lifeguard stand, as shown in Photograph 6.

Photograph 6

As the aquatic industry has moved towards pools with a greater percentage of shallow water, facilities have transitioned away from elevated lifeguard stands. This has resulted in lifeguards being positioned where their view of submerged bodies is obstructed by glare, turbulence, and obstacles in their line of sight.

However, testing demonstrated that elevation alone is not sufficient to provide lifeguards with an unobstructed view beneath the water surface. Photograph 7 shows the lifeguard's view when seated on a 6-foot tall stand. Visibility below the surface substantially decreased as distance from the lifeguard increased.



Photograph 7

ANGELS devices that could be viewed clearly in three dimensions (length, width and height) below the water surface correlated with an unobstructed view of patrons below the water surface.

Further, as a lifeguard's eyes tracked through the pool while counting ANGELS devices, the lifeguard learned to scan all the way to the pool bottom and efficiently view every cubic foot of water. When ANGELS devices were removed from the surveillance zone, lifeguards continued to scan in a consistent, thorough manner. Repeated use of ANGELS devices during in-service training developed muscle memory that improved lifeguard performance.

Also, as lifeguards placed and removed ANGELS devices in one surveillance zone at a time, lifeguards internalized accurate boundaries of each zone. Drawings of surveillance zones, shown in Figures 2 and 3, were created by lifeguards prior to the use of ANGELS devices. Drawings of surveillance zones, shown in Figures 4 and 5, were created by lifeguards following the use of ANGELS devices.

Created by Lifeguards prior to the use of ANGELS devices.

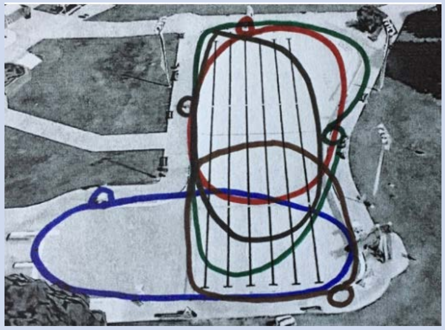


Figure 2

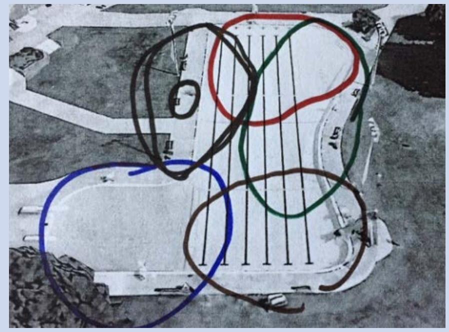


Figure 3

Created by Lifeguards following the use of ANGELS devices.

Figure 4

Figure 5

AQUA CONSCIENCE

To provide effective patron surveillance, lifeguards must be properly positioned, know the boundary of each assigned surveillance zone, and scan consistently throughout that entire zone.

CONCLUSION

Failing to properly position lifeguards provides a false sense of security to the public and sets lifeguards up to fail. This has resulted in serious injury and death of patrons, extensive emotional trauma to families and staff, and financial hardship for families, organizations, and communities.

By incorporating scientific testing for the positioning of lifeguards, in combination with previously established lifeguard training protocol, the aquatics industry can further reduce the risk of drowning.

Lifeguards have a critically important duty that can only be accomplished when management ensures that lifeguards are properly positioned and adequately trained to search every cubic foot of water in their assigned zone of patron surveillance.

By performing scientific testing of surveillance zones and consistently reinforcing effective scanning skills, aquatic facility managers can help their lifeguards to succeed and save lives.

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[i] Pelletier, A., Gilchrist, J. Fatalities in swimming pools with lifeguards: USA 2000-2008. Injury Prevention 2011; 17:250-253. doi: 10.1136/ip.2010.029751
[ii] Baullinger, J., Quan, L., Bennett, E., et al. Use of Washington State newspapers for submersion injury surveillance. Injury Prevention 2001; 7:339-42

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