Brief Report: A Brief Intervention to Improve Lifeguard Surveillance at a Public Swimming Pool

David C. Schwebel,[1] PhD Sydneia Lindsay,[1] and Jennifer Simpson[2]
[1]*Department of Psychology, University of Alabama at Birmingham and* [2]*Department of Psychology, Northwestern University*

Objectives Drowning is the second leading cause of unintentional death for American children in middle childhood, but behavioral research designed to prevent pediatric drowning is limited. This study tested the efficacy of a brief intervention to improve lifeguard attention and surveillance at a public swimming pool. **Method** Observational data on patron risk-taking and lifeguard attention, distraction, and scanning were collected at a public swimming pool, both before and after a brief intervention. The intervention was designed to increase lifeguards' perception of susceptibility of drowning incidents, educate about potential severity of drowning, and help overcome perceived barriers about scanning the pool. **Results** Postintervention, lifeguards displayed better attention and scanning and patrons displayed less risky behavior. Change was maintained for the remainder of the season. **Conclusion** Theoretically driven brief interventions targeting lifeguard attention and surveillance might prove effective in reducing risk of drowning in public swimming pools.

Key words attention; drowning; lifeguards; swimming pool; surveillance.

Drowning is the second leading cause of unintentional injury death in American children, killing almost 1000 American youngsters in 2003 (National Center for Injury Prevention and Control [NCIPC], 2007). In middle childhood—ages 5 through 11 years—only motor vehicle crashes, malignant neoplasms, and congenital anomalies kill more children than drowning (NCIPC, 2007). Although a large portion of drownings occur in unguarded locations such as unfenced backyard swimming pools, about a dozen deaths are documented each year at lifeguarded swimming locations that are members of the United States Lifeguarding Association (United States Lifeguarding Association [USLA], 2007). Many more deaths probably occur at lifeguarded swimming locations not affiliated with the USLA, but these are poorly documented. Given these statistics, it is not surprising that both government (e.g., Branche & Stewart, 2001) and nonprofit (e.g., American National Red Cross, 2001) agencies have recently published booklets on swimming safety and lifeguard training.

Several approaches are available to prevent pediatric swimming pool drownings. Some are passive interventions—they focus on construction and installation of environmental barriers such as fences around pools and floating ropes to divide deep water from shallow depths. Other strategies are more active: young children are advised to obtain instruction in swimming skills, for example. Still other strategies—and the focus of the present investigation—target lifeguards and lifeguard behavior as a means of preventing drowning.

In many domains of pediatric safety—including safety in the home (Morrongiello, 2005), playground (Schwebel, 2006), and pedestrian settings (Wills et al., 1997), adult supervision has emerged as one of the most effective means to prevent unintentional injury. The same is true for swimming environments. In fact, largely in response to public inquiries and scientific concern, the Centers for Disease Control recently convened an expert panel to consider lifeguard effectiveness (Branche & Stewart, 2001). The expert panel offered some

All correspondence concerning this article should be addressed to David C. Schwebel, Department of Psychology, University of Alabama at Birmingham, 1300 University Blvd, CH 415, Birmingham AL 35294. E-mail: schwebel@uab.edu.

Journal of Pediatric Psychology 32(7) pp. 862–868, 2007
doi:10.1093/jpepsy/jsm019
Advance Access publication April 2, 2007

encouraging data: Lifeguards rescue more than 100,000 Americans each year from drowning, and probably prevent millions more drownings through verbal warnings and other interventions (Branche & Stewart, 2001). The experts also issued a grave warning: ''There is no doubt that trained, professional lifeguards have had a positive effect on drowning prevention in the United States [but] patron surveillance is key to preventing aquatic injury'' (Branche & Stewart, 2001, pp. 5, 9).

Much of lifeguarding behavior—especially surveillance, attention, and concentration—is inherently psychological in nature, but behavioral science has attended comparatively little to safe lifeguarding. The most prominent work is a series of studies by Harrell (1999, 2001, 2003, 2006), which suggests that scanning behavior decreases with a lower child:adult ratio, more children in the pool, and later in the day (Harrell, 1999), and that scanning is associated with fewer rule violations by swimmers (Harrell, 2001). Together, Harrell's research lays critical scientific groundwork highlighting the importance of scanning in effective lifeguard behavior and the need to consider interventions that might improve lifeguard scanning behavior. Harrell's work also coincides with the broader cognitive perception literature, which suggests visual search behavior is a challenging behavioral task (Duncan & Humphreys, 1989; Wolfe, 1998), especially when the target behavior is rare, as in perception of drownings.

When it comes to lifeguarding, then, how might injury scientists work to develop effective prevention strategies? A number of community-based campaigns have proven successful at reducing drowning risk (Bierens, 2006) and a large body of research suggests the efficacy of interventions to improve child safety in other domains (Damashek & Peterson, 2002; Gulotta & Finney, 2000), but we are unaware of any intervention studies focused particularly on improving lifeguard scanning behavior.

The present study was designed to improve lifeguard surveillance skills at an outdoor public swimming pool via a brief booster intervention delivered in the middle of the summer swimming season. The intervention was designed to reinforce lessons about concentration, attention, and surveillance that certified lifeguards are exposed to during initial certification training, and it was conducted with all lifeguards working at the pool. Theoretically, the intervention was based on the Health Belief Model and targeted three behavioral changes: (a) increase lifeguards' perception of susceptibility for drowning incidents at their pool, (b) re-educate lifeguards about the potential severity of drowning and near-drowning incidents in public swimming pools, and (c) help lifeguards overcome any perceived barriers about conducting high-quality surveillance over substantial time periods. Both before and after the intervention, observational data were collected at the swimming pool concerning surveillance, scanning, and attentional behavior by the lifeguards as well as risk-taking by patrons.

Methods

Setting and Sample

The study took place at an outdoor public swimming pool located in a Jewish Community Center (JCC). The pool was open to the public but required a membership for entry; the patrons were disproportionately (∼50%) Jewish and almost all (roughly 95%) Caucasian. The pool was physically designed in a ''U''-shape and covered approximately 6000 square feet. Between two and five lifeguards monitored the pool simultaneously from three tower-chairs and various deck stations, depending on the number of swimmers and various other factors.

Data-collection times were scheduled to coincide with the busiest times at the pool, when children attending JCC summer camps used the pool along with the public. On average, there were 60.81 people in the pool during observations ($SD = 16.44$; 92% children) and 20.97 more people on the pool's deck ($SD = 10.05$; 60% children).

Fourteen lifeguards worked at the pool on a rotating basis. They were a mean of 20.50 years old ($SD = 3.65$, range = 16–30), had a mean of 5.11 years of lifeguard experience ($SD = 3.59$, range = 2–15), and included eight women and six men. Thirteen of the 14 were Caucasian.

Protocol

The study was divided into two phases, preintervention and postintervention, that divided the summer swimming season roughly in half. Data collection was scheduled 4 days per week (three afternoons and one morning), and was canceled when the pool was closed due to inclement weather. In total, 34 days of observation were available (roughly 125 h of pool-observation, equivalent to over 10,000 h of individual patron-observation plus over 600 h of individual lifeguard-observation). Data were split into 20 days of observation preintervention and 14 days postintervention, with more preintervention data primarily due to poor weather patterns (frequent afternoon thunderstorms) in late summer. The average temperature during observations was 90.59° F ($SD = 4.73$) and coders rated 83% of days as sunny. All study protocols were reviewed and approved by the university's Institutional Review Board for Human Use.

Coding Strategy, Measures, and Inter-Coder Reliability

Two coders independently collected data. One coder rotated through three objectively defined sections of the pool, recording patron risk-taking, and then began coding each on-duty lifeguard in a counter-clockwise manner around the pool. At the end of that rotation, the number of children and adults in the pool and on the deck were recorded, and then the rotation began anew. The other coder followed the same pattern, but began with lifeguards and then switched to sections of the pool, creating a situation whereby the coders rarely overlapped. Rotations between pool sections and lifeguards occurred every 3 min, as indicated by a vibrating wristwatch. Coding was postponed for 10 min per h, coinciding with lifeguard breaks (during those 10 min, only individuals over age 18 were permitted to swim); weather conditions were recorded during break times.

The three nonoverlapping sections of the pool were as follows: the shallow area (where most young children swam and played; progressed from 3 to 3.5 feet deep); the ''side'' area (where many older children swam, played games, and threw balls; progressed from 3 feet, 4 inches to 4 feet, 2 inches deep); and the deep area (which included three diving boards and 12.5 feet deep water). Observation of each area encompassed the water and surrounding deck areas.

While observing pool areas, coders tallied incidents of five types of risky behaviors: (a) *pushing people under the water*, defined as one individual pushing another under water in an angry, aggressive, or malicious manner; (b) *dangerous diving*, defined as diving into the shallow end of the water head-first; (c) *aggressive acts*, defined as behavior including hitting another person with hands or toys, throwing objects angrily at other people, or pushing people; (d) *jumping into the water near someone else*, defined as jumping into the water within arms' reach of another person; and (e) *running on the deck*, defined as having both feet off of the ground simultaneously while running to jump into the water, get to the diving board, or get elsewhere.

Lifeguard observations occurred in a rotating counter-clockwise pattern, and included observation of all lifeguards on duty at that time. Three behaviors were coded: (a) *looking at the pool/deck*, which was scored at a single moment, immediately after the wristwatch vibrated, as a binary measure—whether the lifeguard was looking toward his or her appointed area of the pool and deck, or was looking elsewhere (e.g., at a conversant or at objects in his/her hands such as a whistle or drink); (b) *distractions*, defined as intervals when the lifeguards' visual attention was distracted away from the target area for 5 s or more (e.g., talking to patron or other lifeguard, eating or drinking, applying sunscreen, etc.); and (c) *scans*, defined based on Harrell's (1999) criteria as movement of lifeguards' gaze from one section of the assigned pool/deck area to another, and evidenced by the shifting of the head from one angle to another.

Intercoder reliability was established during the first week of the study, during which observations were conducted simultaneously but independently. Reliability was excellent (all rs > .80, and seven out of eight rs > .90 for continuous measures; $\kappa = 1.00$ for looking measure). There were no controls for potential observer drift over the course of the study.

Intervention Specifics

Halfway through the summer, the intervention was delivered in the form of a mandatory evening meeting for all lifeguards. The research team and swimming pool managers developed and presented the intervention jointly.

The intervention was based theoretically on the principles of the Health Belief Model, and had three primary purposes. First, we sought to increase the lifeguards' perception of susceptibility of drowning incidents by describing the data collected thus far during the preintervention phase, including information about the relatively high rate of risky patrons' behaviors at the swimming pool and the frequency of distracted lifeguards (Schwebel, Simpson, & Lindsay, in press). Second, we educated the lifeguards about the potential severity of drowning incidents by having the swimming pool director (their immediate supervisor) relay information about a fatal drowning incident that had occurred recently at a JCC swimming pool in another state. Third, we sought to help lifeguards overcome any barriers they perceived about scanning by reviewing American Red Cross recommendations about strategies for pool surveillance and introducing alternative scanning techniques they may have been unfamiliar with (e.g., scanning the pool sequentially in the shape of the alphabet letters, scanning figure eights, etc.; see Werts, 1996). Although much of the intervention was delivered in a serious, cautioning manner, the overall mood was encouraging, complimentary, and positive.

Results

The primary analysis was a series of independent samples t-tests comparing preintervention versus postintervention behavior on the part of patrons and lifeguards.

Table I. Descriptive Data and *t*-Test Comparisons, Pre- versus Postintervention

Measure	Pre-IV *M* (*SD*)	Post IV *M* (*SD*)	*t*
Patron behaviors			
Running	65.81 (19.26)	44.64 (14.23)	3.49**
Pushing under[a]	3.41 (3.38)	1.30 (2.71)	2.02*
Jumping near others[a]	19.63 (15.92)	5.19 (5.54)	3.75**
Diving into shallow water	0.04 (0.18)	0.11 (0.43)	−0.70
Aggression	2.48 (2.96)	1.20 (2.81)	1.27
Risky behavior composite	91.35 (25.58)	52.49 (17.13)	4.95**
Lifeguard behaviors			
Looking (1 = yes, 2 = no)	1.09 (0.12)	1.03 (0.05)	1.74+
Distraction	10.29 (3.59)	3.87 (3.04)	5.46**
Scanning	369.51 (64.40)	455.99 (84.75)	−3.38**
Lifeguard composite	0.41 (0.47)	−0.59 (0.46)	6.14**

IV = intervention. All measures are per hour, except the bivariate lifeguard looking measure and the standardized lifeguard composite. Two-tailed tests. $df = 32$.
[a]Levene's Test for Equality of Variances significant, so equal variances not assumed. $df = 31.31$ for pushing and 25.05 for jumping.
$+p < .10$, $^{*}p \leq .05$, $^{**}p < .01$.

Beforehand, we considered potential covariate effects of people in the pool, people on the deck, and weather. *t*-Tests comparing pre- versus postintervention measures yielded findings that were not statistically significant, suggesting temporal consistency of those measures.

Table I displays results testing the primary hypotheses. As shown, three of the five risky patron behavior measures were statistically significant. Dangerous diving was extremely rare throughout the study, and therefore had low variance and showed no significant change post-intervention. The change in the fifth variable, aggression, was in the predicted direction but failed to reach traditional significance levels.

There was also a significant change in two of the three lifeguard behaviors, distraction and scanning. The third, looking, showed a trend for change and also suffered from the problem of low variance (in almost all cases, even prior to the intervention, lifeguards were looking at the appropriate places). Note that experiment-wide Type I error rate was elevated due to the multiple comparisons conducted. With the Bonferroni correction applied, all statistically significant findings except the change in pushing people underwater are maintained.

As a final inferential test of postintervention change, we created aggregate measures of patron and lifeguard behaviors. The patron composite was created by summing all risky patron behaviors into a single measure of risky behavior; it changed significantly from the pre- to postintervention measurement [$t(32) = 4.96$, $p < .01$]. The lifeguard composite was created by standardizing and then averaging the three lifeguard measures, with number of scans reflected; it also changed significantly postintervention [$t(32) = 6.14$, $p < .01$].

Although inferential statistics offer strong quantitative support for the efficacy of the intervention with the lifeguards, they fail to provide detailed analysis of the process of change postintervention. Figures 1 and 2 illustrate the daily patterns of change in the two aggregate measures. Viewed graphically, it is clear that both risky patron behavior and lifeguard distraction/inattention decreased noticeably following the intervention, and that these decreases were maintained for the remainder of the summer swimming season.

Discussion

Drowning is among the leading causes of mortality for American children in middle childhood, and high-quality adult supervision is among the best defenses to prevent unintentional drowning. Results from this study suggest brief interventions targeting lifeguard behavior might be effective to improve safety at public swimming pools.

It is not surprising that lifeguards might lose attention at times during their work. In most American swimming areas, lifeguards tend to be relatively young employees who are paid a low salary to sit in hot weather, observe repetitive behavior for hours at a time, and maintain full attention with relatively infrequent breaks and rotations. Work by cognitive and perceptual psychologists supports the possibility that risky situations might be overlooked by lifeguards (Wolfe, Horowitz, & Kenner, 2005), and previous empirical work by injury scientists offers particular situations during which scanning behavior might decrease (Harrell, 2006). Given this convergence of evidence, identification of interventions—and in

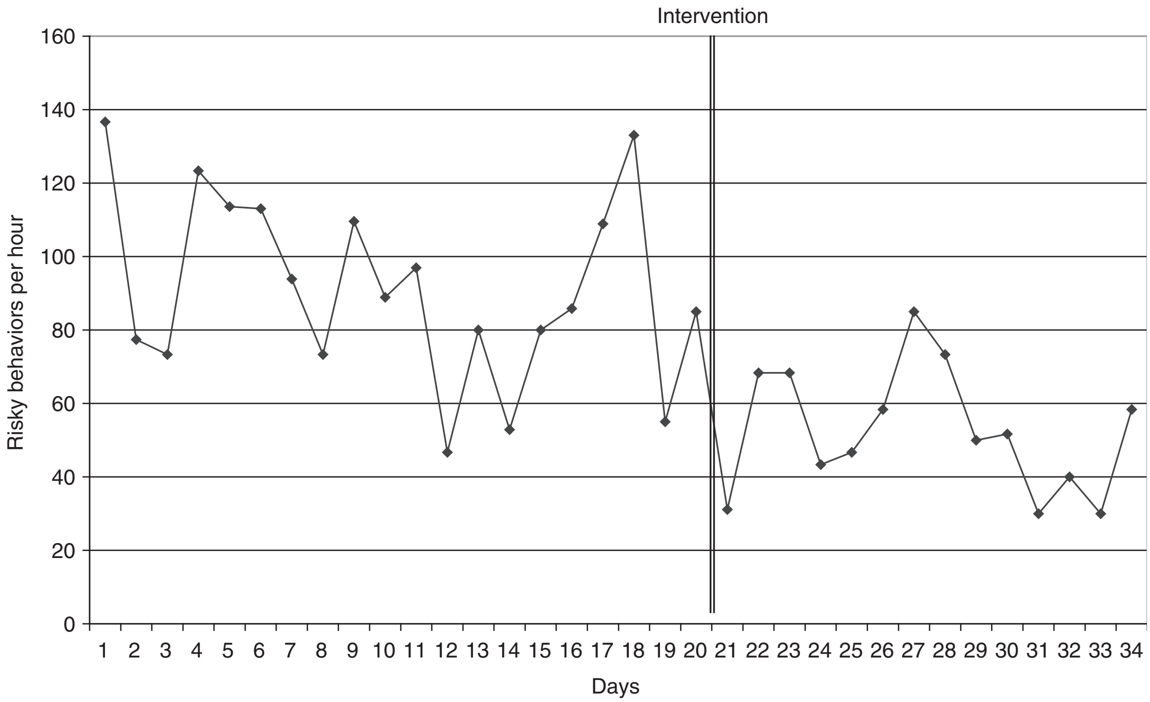

Figure 1. Change in patron risky behaviors over time.

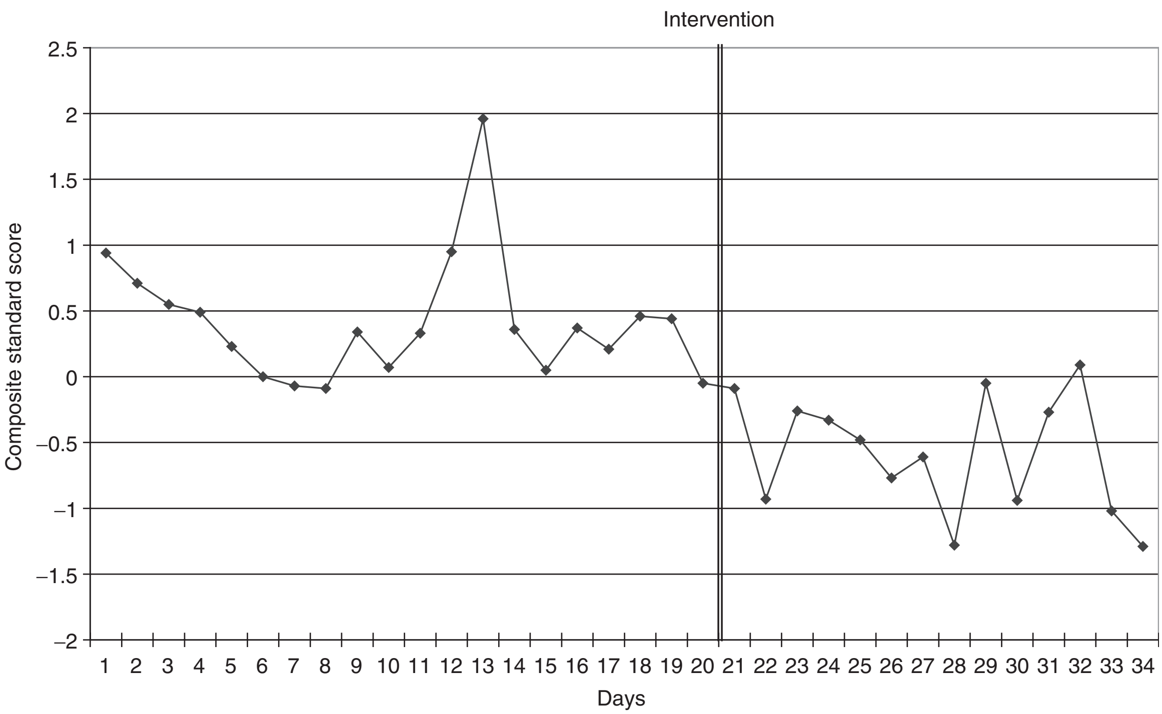

Figure 2. Change in lifeguard behaviors over time.

particular brief and inexpensive interventions—that might improve scanning behavior of lifeguards and ultimately reduce the risk of drowning incidents would be highly desirable.

Our study suggests periodic ‘‘booster’’ sessions with lifeguards might be effective. Guided by the Health Belief Model, our intervention targeted three issues in particular: (a) increasing lifeguards' perception of susceptibility for drowning incidents at their pool, (b) re-educating lifeguards about the potential severity of drowning and near-drowning incidents, and (c) overcoming perceived barriers among lifeguards about conducting high-quality surveillance. Delivered in about an hour using a positive but cautionary and serious tone, the intervention successfully reduced patron risk-taking and increased lifeguard attention and surveillance.

One of the more dramatic findings was that the intervention changed not only lifeguard behavior but also swimmers' behavior patterns. Since the intervention directly targeted lifeguards only, this change must have occurred indirectly. We can only hypothesize what the mechanism might have been, but one likely explanation is that swimming patrons sensed that lifeguards were watching the pool more carefully, and therefore obeyed rules better. This possibility is consistent with the results from Harrell (2001), who reported greater frequency of lifeguard scans was associated with fewer rules violations in an indoor swimming pool setting.

One significant concern about interventions such as the one we conducted is the fact that they do not always have lasting effects: There is an initial change in behavior that dwindles over time. Although we did not see such dwindling in the 4-week postintervention assessment period, it is quite possible that we would have witnessed a return to baseline over a longer duration. However, most swimming pools—including the one where our work was conducted—are seasonal. Thus, unlike many health situations where behavior change must be long-lasting or permanent, safe lifeguarding requires behavioral change for only a few months. One ''booster'' session may be sufficient to maintain preferred behavior patterns over the course of a season.

Limitations and Future Directions

Like all research, this study suffered from limitations. Some reflect the location of the study and the measures collected. Behavior was observed in just one swimming pool, with a homogenous population. Lifeguards were rather experienced and skilled, on average. We witnessed no drowning or near-drowning events during our study, and relied instead on risky patron behavior and lifeguard vigilance as proxies of drowning risk. It is clear that the behaviors we observed were somewhat dangerous, but equally clear that the probability any single instance of risky behavior would lead to an injury or a drowning incident is quite low.

From a research design perspective, our study was observational. Observational research offers methodological strengths, but also requires inferences. In this case, we do not know whether the intervention reminded or taught lifeguards new knowledge or techniques they were not already using. We also do not know the mechanism behind behavior changes we observed. Future research should include control groups and other methodological manipulations to understand better the processes through which interventions might change lifeguard behavior.

Two last concerns are noteworthy. First, there is some risk of bias in our results because lifeguards were aware of researchers' presence (researchers did wear ''pool attire'' and attempted to blend into the crowd, but for ethical reasons lifeguards were informed at the start of the season; patrons were unaware of the research). Second, statistical power was modest (power = .61 to detect a large effect size in a two-tailed independent samples t-test with $N = 34$).

What next? From an applied perspective, this study might inspire swimming pool directors to educate lifeguards throughout the season. Mid-summer booster sessions that are inexpensive to conduct may help maintain top-level lifeguarding skills throughout the season (Turner, Voglesong, & Wendling, 2003). From a research perspective, we hope this study will stimulate further work in the areas of lifeguard surveillance, drowning prevention in public swimming areas, and interventions directed toward supervisors of children in a range of potentially dangerous situations. Lifeguarding, supervision, and surveillance are largely psychological tasks, and continuing psychological research on these behavioral processes is essential for development of empirically supported, theoretically based interventions to prevent drowning and other unintentional injuries.

Acknowledgment

The second and third authors contributed equally to the research, and their authorship order was determined by coin toss. Thanks to Betty Masur, Bee Lewis, and Miriam Sokol of the JCC in Birmingham for their permission to work at the swimming pool and their patience with our requests and protocol. We thank Don Sanders, Assistant Director of the UAB Campus Recreation Center and Director of UAB Aquatics, for his insights and input. This study was funded by the UAB School of Social and Behavioral Sciences and Department of Psychology, and by the McNair Scholars Program.

Conflict of interest: None declared.

Received October 13, 2006; revisions received February 22, 2007; accepted March 1, 2007

References

American National Red Cross. (2001). *Lifeguard training*. Yardley, PA: StayWell.

Bierens, J. J. L. M. (Ed.) (2006). *Handbook on drowning: Prevention, rescue, treatment*. Heidelberg, Germany: Springer.

Branche, C. M., & Stewart, S. (Eds) (2001). *Lifeguard effectiveness: A report of the working group*. Atlanta: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.

Damashek, A., & Peterson, L. (2002). Unintentional injury prevention efforts for young children: Levels, methods, types and targets. *Journal of Developmental and Behavioral Pediatrics*, *23*, 443–455.

Duncan, J., & Humphreys, G. W. (1989). Visual search and stimulus similarity. *Psychological Review, 96*, 433–458.

Gulotta, C. S., & Finney, J. W. (2000). Intervention models for mothers and children at risk for injuries. *Clinical Child and Family Psychology Review*, *3*, 25–36.

Harrell, W. A. (1999). Lifeguards' vigilance: Effects of child-adult ratio and lifeguard positioning on scanning by lifeguards. *Psychological Reports*, *84*, 193–197.

Harrell, W. A. (2001). Does supervision by a lifeguard make a difference in rule violations? Effects of lifeguards' scanning. *Psychological Reports, 89*, 327–330.

Harrell, W. A. (2003). An information theory analysis of duration of lifeguards' scanning. *Perceptual and Motor Skills*, *97*, 129–134.

Harrell, W. A. (2006). The vigilance of beach patrols. In J. J. L. M. Bierens (Ed.), *Handbook on drowning: Prevention, rescue, treatment* (pp. 110–112). Heidelberg Germany: Springer.

Morrongiello, B. A. (2005). Caregiver supervision and child-injury risk: I. Issues in defining and measuring supervision; II. Findings and directions for future research. *Journal of Pediatric Psychology, 30*, 536–552.

National Center for Injury Prevention and Control [NCIPC]. (2007). *WISQARS^{TM} (Web-based Injury Statistics Query and Reporting System)*. Retrieved February 21, 2007, from http://www.cdc.gov/ncipc/wisqars/

Schwebel, D. C. (2006). Safety on the playground: Mechanisms through which adult supervision might prevent child playground injury. *Journal of Clinical Psychology in Medical Settings, 13*, 141–149.

Schwebel, D. C., Simpson, J., & Lindsay, S. (in press). Ecology of drowning risk at a public swimming pool. *Journal of Safety Research.*

Turner, H., Voglesong, H., & Wendling, R. (2003). An extra safe guard. *Parks and Recreation, 38*, 42–45.

United States Lifeguarding Association [USLA]. (2007). *Statistics*. Retrieved February 21, 2007, from http://www.usla.org/Statistics/public.asp

Werts, T. (1996). Scanning for the unexpected. *Parks and Recreation, 31*, 56–57.

Wills, K. E., Christoffel, K. K., Lavigne, J. V., Tanz, R. R., Schofer, J. L., Donovan, M., et al. (1997). Patterns and correlates of supervision in child pedestrian injury. *Journal of Pediatric Psychology*, *22*, 89–104.

Wolfe, J. M. (1998). Visual search. In H. Pashler (Ed.), *Attention* (pp. 13–73). Sussex UK: Psychology Press.

Wolfe, J. M., Horowitz, T. S., & Kenner, N. M. (2005). Rare items often missed in visual searches. *Nature, 435*, 439–440.