

5-1-2011

## The Influence of Simulated Drowning Audits on Lifeguard Surveillance and Swimmer Risk-Taking at Public Swimming Pools

David C. Schwebel

*University of Alabama - Birmingham*, [schwebel@uab.edu](mailto:schwebel@uab.edu)

Heather N. Jones

*Auburn University*

Erika Holder

*University of Alabama - Birmingham*

Francesca Marciani

*The Ohio State University*

Follow this and additional works at: <https://scholarworks.bgsu.edu/ijare>

---

### Recommended Citation

Schwebel, David C.; Jones, Heather N.; Holder, Erika; and Marciani, Francesca (2011) "The Influence of Simulated Drowning Audits on Lifeguard Surveillance and Swimmer Risk-Taking at Public Swimming Pools," *International Journal of Aquatic Research and Education*: Vol. 5 : No. 2 , Article 8.

DOI: 10.25035/ijare.05.02.08

Available at: <https://scholarworks.bgsu.edu/ijare/vol5/iss2/8>

This Research Article is brought to you for free and open access by the Journals at ScholarWorks@BGSU. It has been accepted for inclusion in International Journal of Aquatic Research and Education by an authorized editor of ScholarWorks@BGSU.

# The Influence of Simulated Drowning Audits on Lifeguard Surveillance and Swimmer Risk-Taking at Public Pools

**David C. Schwebel, Heather N. Jones, Erika Holder,  
and Francesca Marciani**

An alarming number of injuries and drowning events occur at lifeguarded swimming pools. One strategy used in the aquatics industry to improve swimming safety is simulated drowning lifeguard audits. During audits, supervisors arrive unannounced and ask on-duty lifeguard(s) to rescue a dummy. This study tested whether audits effectively improve lifeguard surveillance and reduce swimmer risk-taking behaviors. A pre-post design examined lifeguard surveillance and swimmer risk-taking prior to, three days after, and a month after conducting unannounced lifeguard audits at 14 public swimming pools. Lifeguard surveillance and swimmer risk-taking were assessed via behavioral observation. Following the audits, lifeguards were less distracted and swimmers took fewer risks. Simulated drowning lifeguard audits appear to offer a useful strategy to improve lifeguard surveillance and decrease swimmer risk-taking at public swimming pools.

Drowning is the second leading cause of unintentional injury death for American children ages 1–14 (AAP Committee on Injury, 2010; National Center for Injury Prevention and Control, 2010). Pediatric drowning events occur in a range of environments (AAP Committee on Injury, 2010). For young children, the greatest risk is standing water (e.g., buckets, tubs) inside homes. Among older children, unsecured or unsupervised natural and manmade water environments represent the greatest risk. Perhaps most surprising from an epidemiological perspective, however, is that drowning and other injury events occur with some frequency in locations monitored by professional lifeguards. The United States Lifesaving Association documented 72 deaths at lifeguarded U.S. beaches and pools in the past five years; other undocumented deaths may occur (United States Lifesaving Association, 2010).

One reason drowning events may occur in lifeguarded areas is because the cognitive-perceptual task of lifeguarding is difficult. Lifeguarding requires monitoring of repetitive behavior (patrons swimming) for very rare events (drowning events) over long periods of time, a task that laboratory-based cognitive and perceptual research suggests is difficult for humans to perform well (Duncan & Humphreys,

---

David Schwebel and Erika Holder are with the Psychology Department at the University of Alabama at Birmingham Birmingham, AL. Heather Jones is now at Auburn University in Auburn, AL. Francesca Marciani is now with The Ohio State University in Columbus.

1989; Wolfe, 1998; Wolfe, Horowitz, & Kenner, 2005). Few research studies have considered ways of improving human capacity to detect drowning events.

In one previous study, lifeguards were exposed to a brief training session consisting of lessons designed to increase the lifeguards' perception of susceptibility to drowning events at their pool, to educate the lifeguards about the potential severity of a drowning event, and to help the lifeguards overcome perceived barriers to effectively scanning the swimming area (Schwebel, Lindsay, & Simpson, 2007). The training improved lifeguard surveillance and also decreased risk-taking (e.g., aggressive play, diving into shallow water, jumping into water near other swimmers, running on deck) by swimmers at the pool.

An alternative strategy, now popular in the industry, is the use of simulated drowning lifeguard audits. During these audits, which are required to meet insurance liability requirements at thousands of swimming facilities worldwide, a supervisor arrives unannounced to the swimming facility and informs the lifeguard(s) on duty that a simulated drowning audit will occur (Ellis & Associates, 2000). At that point, either a life-size three-dimensional dummy (which floats on the water surface) or a two-dimensional shadow-dummy (which drops to the bottom of the water, the more typical drowning scenario) is dropped into the water. The lifeguard(s) on duty role-play, as if a true emergency was transpiring. Their performance is monitored and critiqued by supervisors.

Consistent with health-related behavior change theory, simulated drowning audits are designed to elevate lifeguards' vigilance and their personal perception that they are vulnerable to drowning and injury events occurring in the pool they are monitoring (Ellis & Associates, 2000). Importantly, they are designed to ensure the whole aquatics facility — not just the lifeguards who are directly audited— functions safely. It is impractical to conduct regular audits on all lifeguards working at a facility because it would be too disruptive to the swimming environment and to the paying patrons of the facility. Instead, pool managers use audits to influence cognition and behavior of all lifeguards at the facility by publicizing audit results in lifeguard meetings or through written postings (Ellis & Associates, 2000). Facility-wide change also occurs informally because audits are often emotionally arousing to lifeguards and therefore elicit discussion among lifeguard peer groups. Altogether, the intended effect of a lifeguard audit on a swimming facility is an intervention that has the potential to raise awareness of vulnerability and susceptibility to emergency situations among all lifeguards at the facility and ultimately to increase patrons' safety in the facility. This objective is highly consistent with health behavior change theories such as the Health Belief Model (Rosenstock, 1974). This hypothesized effect has not been tested in careful empirical study, however. The present study used a pre-post design to study whether simulated drowning lifeguard audits are an effective strategy to improve lifeguard surveillance and reduce swimmer risk-taking at 14 public swimming pools.

## Method

### Settings and Samples

Data were collected at 14 swimming pools operated by the Birmingham, Alabama YMCA. The pools varied in terms of shape and size, geographic location, and swimmer demographics. Some were small pools serving neighborhood areas.

Some were in suburban areas and served the broad membership of the YMCA. One was at a youth summer camp and one was an indoor pool serving mostly adult swimmers exercising. Several were originally designed for lap-swimming at health clubs but had been converted to permit both recreational and exercise use. Almost all pools were used for providing swimming instruction, both for children learning to swim and for adults participating in water aerobics courses. Some pools served primarily Caucasian patrons while other pools served racially integrated or mostly African American populations. On average, 5.81 children ( $SD = 5.30$ ; range = 0.14 – 24.00) and 1.25 adults ( $SD = 0.92$ ; range = 0.00 – 4.04) were swimming in the pools during our observational data collection periods. An additional 11.16 individuals ( $SD = 8.40$ ; range = 0.27 – 29.27), on average, were on the pool deck and therefore were also under the supervision of the lifeguards.

All pools were staffed by American Red Cross-trained lifeguards. Specific demographic information was not collected, but most lifeguards were young adults working seasonally, during the summer. Representative of the communities served by the facilities, they were approximately 50% female and approximately 60% Caucasian, 35% African American, and 5% of other races/ethnicities. All research was reviewed and approved by the institutional review board at our university to provide permission for altering standard informed consent procedures.

## Protocol

The research protocol was implemented in three phases, with the intervention occurring between phases I and II. During phase I, preaudit observational data were collected to evaluate lifeguard surveillance and swimmer risk taking. The observational system used to collect these data is detailed below. An average of 4.61 days ( $SD = 3.21$ ) after phase I pre-audit data were collected, the intervention, consisting of simulated drowning audits (detailed below), were conducted by YMCA staff. Phase II was scheduled three days after the audit ( $M = 3.36$  days,  $SD = 1.70$ ) and consisted of a second set of observational data collection. Finally, phase III was scheduled one month after the audit ( $M = 26.58$  days,  $SD = 4.94$ ). It consisted of a third set of observations. Phases II and III were conducted twice at each pool, to increase data available for analysis. Because preintervention data (phase I) would have been biased during the second set of data collection, phase I preaudit data were used as comparison data for both sets of postintervention and follow-up data at each pool. In other words, phase I data were collected just once at each pool, and phases II and III data were collected twice. Observations were taken at randomly-selected times and days and therefore encompassed all activities (including classes and free-swim periods) occurring at the pools.

## Details of the Intervention: Simulated Drowning Audits

The simulated drowning audits were conducted consistent with standard industry protocol and as required by many major insurance and liability carriers for aquatics facilities in the United States. An upper-level aquatics supervisor arrived at the swimming facility unannounced and dropped a dummy (on random basis, either a floating dummy or a sinking shadow-dummy) into the pool. He or she then informed the lifeguard(s) on duty that they should rescue the dummy as if it were a real emergency. The lifeguard(s) cleared the swimming pool of swimmers, entered

the water to use proper rescue techniques to “save” the dummy, and performed appropriate medical resuscitation procedures on the pool deck. Aquatics supervisors observed and scored the efficiency and accuracy of the simulated rescue. Immediate feedback was provided to the lifeguard on duty, and results of the audit were posted prominently in a location where all lifeguards, including those not on duty at the time of the audit, could see and learn from them. Anecdotally, it was clear that audits created attention among all lifeguards at the facility, including those not on duty at the time and that the results of the audits became a common topic of conversation among lifeguards for a few days afterwards.

### Coding System and Interrater Reliability

Coding was completed by trained undergraduates dressed in swimming attire, who blended in to the environment and completed their observations unobtrusively, usually without lifeguards or swimmers aware of their purpose. Coding was conducted via a rotation system whereby coders recorded swimmer’s risky behaviors for a three-minute segment in objectively defined sections of the pool and then coded behavior of each on-duty lifeguard successively for 3-minute segments in a clockwise manner around the pool. Sections of the pool were defined prior to coding based on logical boundaries and markers (e.g., rope lines or change in pool depth). The number of sections was determined by the pool’s size, but was most typically two. The ends of temporal segments were indicated to coders through vibrating wristwatches. To prevent coder fatigue, coding was conducted for three-hour segments, and was suspended for 10 minutes per hour, coinciding with lifeguard breaks. Intercoder reliability (or interrater objectivity) was established prior to active data collection by having coders simultaneously code the same behaviors in the same pool segments for four-hour segments (or 80 observations, which was deemed sufficient to demonstrate inter-coder reliability). Reliability was high (average intercorrelations for continuous measures = 0.94; kappa for all categorical measures = 1.00).

### Measures

Four outcome measures were derived from the coded observations. *Lifeguard looking behavior* was coded at the start of each three-minute segment used to measure lifeguard behavior. When the coder’s wristwatch vibrated, she immediately looked at the lifeguard and determined whether or not the lifeguard’s gaze was focused on his or her assigned area in the pool. Behavior was rated dichotomously, as looking toward the assigned area of the pool (1) or not (0). *Lifeguard scans* were coded based on Harrell’s (1999) criteria as movement of gaze from one section of the assigned pool/deck area to another. Coders counted movements by watching for shifting of the head from one angle to another. The measure was reduced to average scans per minute for analysis.

*Lifeguard warnings* included a count of any instance when the lifeguard made verbal or whistle warnings to swimmers, instructing them to behave in a safer manner. Repeated warnings about the same single violation (e.g., a whistle followed by a yell) were counted as a single instance. *Swimmer risky behaviors* was computed as the sum of occurrences of five 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 shallow 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. Measures of both lifeguard warnings and swimmer risky behaviors were averaged per hour and then divided by average number of people at the pool to adjust for greater likelihood of occurrence with more people present.

## Data Analysis Plan

Data analysis proceeded in two steps. First, descriptive data on the four dependent variables (lifeguard looking, lifeguard scans, lifeguard warnings, swimmer risky behaviors) were examined at each of the three time points (preintervention, post-intervention, follow-up). Second, nonparametric Friedman tests were computed to examine change over time. Nonparametric tests were selected due to the small sample size ( $N = 14$  swimming pools, each surveyed twice) and nonnormal distribution of the dependent variables. Wilcoxon signed-ranks tests were used to calculate bivariate post-hoc comparisons following significant results from the Friedman test.

## Results

Table 1 presents descriptive data on the four dependent variables (lifeguard looking, lifeguard scans, lifeguard warnings, swimmer risky behaviors) at the three time points (preintervention, postintervention, follow-up). As shown, lifeguards tended to look toward their assigned areas more frequently following the audits. Their scanning behavior did not change appreciably over time. Warnings from lifeguards tended to decrease following the simulated drowning audits, and risky behaviors by swimmers decreased substantially following the audits.

**Table 1 Descriptive Data and Friedman Test Results**

Measure	Pre Intervention M(SD)	Post Intervention M (SD)	Follow-Up M (SD)	$\chi^2$ ( <i>df</i> = 2)
Lifeguard Behaviors				
Looking (0 = no, 1 = yes)	0.84 (0.18) <sup>a,b</sup>	0.93 (0.08) <sup>a</sup>	0.95 (0.13) <sup>b</sup>	8.53**
Scans (per minute)	7.40 (2.41)	7.49 (2.63)	7.44 (2.54)	0.56
Swimmer Behaviors (number per hour, adjusted for people at pool)				
Warnings from lifeguard	0.76 (1.17)	0.42 (0.53)	0.44 (0.54)	5.30
Risky behaviors	2.61 (3.86) <sup>c</sup>	1.36 (1.56)	1.41 (2.72) <sup>c</sup>	10.63**

<sup>abc</sup> Statistically significant difference between groups, based on post-hoc tests using Wilcoxon Signed Ranks Test.  $p < .01$  for looking and  $p < .05$  for risky behaviors.

\*\*  $p < .01$ .

Changes over time were investigated using the Friedman test. Significant findings emerged for lifeguard looking,  $\chi^2(2) = 8.53, p < .01$ , and swimmers' risky behaviors,  $\chi^2(2) = 10.63, p < .01$ . The change in lifeguard warnings over time,  $\chi^2(2) = 5.30, p = 0.07$ , was not statistically significant at  $\alpha \leq .05$ . Change in lifeguard scans also was not statistically significant:  $\chi^2(2) = 0.56, ns$ .

Wilcoxon signed-ranks tests were used to calculate bivariate post-hoc comparisons following significant results from the Friedman test. For lifeguard looking, Wilcoxon results suggested significant differences between preaudit and postaudit lifeguard looking ( $z = 2.63, p < .01$ ) and between preaudit and follow-up lifeguard looking ( $z = 2.96, p < .01$ ). Wilcoxon comparisons of swimmers' risk-taking behavior at pre-audit and post-audit assessments did not yield a significant difference, but the difference between pre-audit and the follow-up assessment was statistically significant ( $z = -2.45, p < .05$ ).

## Discussion

Results suggest exposing lifeguards to a simulated drowning lifeguard audit may be an effective strategy to improve lifeguard surveillance and reduce swimmer risk-taking. We found a reduction in lifeguard distraction from the assigned area of the pool a few days after the audit and that reduction was maintained almost a month later. We also found a reduction in risky behaviors by swimmers following the audits. Surprisingly, the audits did not result in any change in lifeguard scanning behavior; lifeguards scanned the pool at a similar rate before and after the audits occurred.

One result that may appear unexpected is the lack of statistically significant change in lifeguard warnings following implementation of the lifeguard audits. One might expect that more alert lifeguards would issue more warnings concerning safety than would less alert lifeguards. However, the null finding is consistent with our results that risky behaviors decreased and also with previous research in both laboratory (Schwebel & Bounds, 2003) and pedestrian (Barton & Schwebel, 2007) settings that suggests children may behave more safely when they are aware they are being monitored more carefully by adults. Thus, it may be that lifeguard warnings did not increase dramatically because swimmers began to behave more safely, in recognition that they were being watched more carefully. There may also have been a learning effect. Perhaps lifeguard warnings increased initially, children responded to the increased quantity of warnings, and then warning decreased as children behaved more safely. We do not feel the result is an anomaly, however. It parallels findings from a previous lifeguard intervention (Schwebel et al., 2007) as well as a pattern observed in a playground safety intervention (Schwebel, Summerlin, Bounds, & Morrongiello, 2006), where teachers issued fewer warnings to children about risky behaviors following implementation of an intervention.

Also somewhat unexpected was the finding that lifeguard scanning behavior did not change as a result of the intervention. In fact, scanning rates remained quite consistent throughout our research observations. One plausible explanation for this result, in need of empirical evaluation in the future, is that lifeguard scanning is an inadequate measure of lifeguard performance. Researchers in the distracted automobile driving literature have reported that drivers distracted by telephone conversations appear to scan the driving environment at a rate similar to the rate

(Strayer, Cooper, & Drews, 2004). In other words, it may not be visual scanning that yields safe behavior alone, but rather cognitive processing of the perceived environment that yields safety. The same may be true in the lifeguarding context: lifeguards can visually scan while distracted, but the cognitive processing of the environment perceived while scanning forms a more important, and perhaps more vulnerable, aspect of safe lifeguarding. Future research should investigate this possibility.

## **Mechanisms Behind Behavior Change**

These findings contribute to the growing body of knowledge suggesting that some, but not all, lifeguard behaviors can be improved through behavioral intervention strategies. Lifeguard audits are likely to change some lifeguard behaviors for at least two reasons. First, they directly influence individual lifeguards who are audited. It is often not practical for swimming facilities to conduct regular audits on all lifeguards because they disrupt the swimming environment greatly (i.e., during a simulated rescue, all patrons are asked to leave the swimming pool), but those lifeguards who are exposed to the audit experience valuable role-playing of emergency procedures and immediate constructive feedback from supervisors concerning their role-played actions. Role-playing exercises have proven successful for humans to negotiate a wide range of complex behavioral responses, particularly when the response might be conducted under stressful or emergency circumstances (e.g., in psychotherapy, Moreno, 1953; in complex business situations, Comer & Vega, 2006; and in medical education, Ziv, Wolpe, Small, & Glick, 2003).

Second, and perhaps more critical because they have the potential to influence all lifeguards at the facility, lifeguard audits are designed to increase lifeguards' perceived vulnerability and susceptibility to drowning events at swimming facilities. This objective of audits, highly consistent with the goals of health-behavior change theory (e.g., Rosenstock, 1974), is accomplished both through public posting or discussion of audit results and via informal communications among lifeguards. Thus, even though only individual lifeguards undergo the audit, all lifeguards are exposed to information about the audits designed to invoke cognitive and behavior change of perceived susceptibility and vulnerability to emergency situations and therefore improved surveillance of the pool.

Changing health-related behaviors, especially when the task is cognitively demanding like the task of lifeguarding, is difficult (Sleet & Gielen, 2007). Our results suggest conducting simulated drowning audits with lifeguards is one strategy that may contribute to improved surveillance of swimming facilities by all lifeguards working there.

## **Limitations and Future Directions**

Like all research, this study suffered from limitations. Perhaps most prominently, it used a pre-post design with swimming pool rather than lifeguard as the unit of measurement. This research design resulted in poor statistical power and lack of experimental control, but was chosen for two reasons. First, lifeguard audits are designed to change behavior by all lifeguards at the facility (Ellis & Associates, 2000), so we felt it necessary to evaluate the efficacy of audits facility-wide rather



than focusing on just the lifeguards who experienced an audit. Second, in any local area, there are a limited number of facilities where lifeguard interventions can be conducted. Making statistical inferences from half that number via a case-control design seemed more risky than the pre-post design we employed.

Another methodological limitation was our reliance on lifeguard surveillance and swimmer risk-taking as outcome measures. Fatal and nonfatal drowning are rare events, so it was infeasible to use them as outcome measures. Another alternative was to assess the hypothesized mediator between the audit intervention and its result of reduced injury risk, lifeguard perception of vulnerability and susceptibility to emergency events, as an outcome measure. However, we chose to focus on the more general objective — higher quality surveillance of the pool and reduced risk-taking by swimmers — in an attempt to tap the desired outcome of the intervention rather than its mediating influence. Finally, we relied on nonparametric statistical strategies to analyze our data. Data transformations were unsuccessful in resolving nonnormality of the data, and the sample size was quite small. In most cases, nonparametric strategies are less powerful than parametric alternatives (Maxwell & Delaney, 2004), so our interpretation of results is biased in the conservative direction, resulting in a greater risk of Type II errors, which means we might not have been able to detect statistical differences if they were indeed present. We believe the results validly represent behavior change that occurred.

## Conclusion

In summary, this study examined the influence of simulated drowning lifeguard audits on lifeguard surveillance and swimmer risk taking. Results from our pre-post research design suggest lifeguards were less distracted following the audits and that swimmers took somewhat fewer risks following the audits. These results suggest simulated drowning audits may be one effective strategy to reduce injuries, including fatal and nonfatal drownings, at lifeguarded swimming facilities.

## Acknowledgments

Special thanks to Jennifer Dick, Head of Aquatics at the YMCA-Birmingham, for her dedicated support of this research. Thanks also to Jeff Kepler at Vestavia YMCA and all YMCA aquatics personnel, and to Carl Brezausek for statistical consultation. This study was funded by the UAB School of Social and Behavioral Sciences and Department of Psychology.

## References

- AAP Committee on Injury, Violence, and Poison Prevention. (2010). Policy statement – prevention of drowning. *Pediatrics*, *126*, 178-185.
- Barton, B.K., & Schwebel, D.C. (2007). The roles of age, gender, inhibitory control, and parental supervision in children's pedestrian safety. *Journal of Pediatric Psychology*, *32*, 517-526.
- Comer, D.R., & Vega, G. (2006). Unsavory problems at Tasty's: A role-play about whistleblowing. *Journal of Management Education*, *30*, 251-269.
- Duncan, J., & Humphreys, G.W. (1989). Visual search and stimulus similarity. *Psychological Review*, *96*, 433-458.

- Ellis & Associates. (2000). *National pool and waterpark lifeguard training* (2nd ed.). Sudbury, MA: Jones and Bartlett Publishers.
- Harrell, W.A. (1999). Lifeguards' vigilance: Effects of child-adult ratio and lifeguard positioning on scanning by lifeguards. *Psychological Reports, 84*, 193-197.
- Maxwell, S.E., & Delaney, H.D. (2004). *Designing experiments and analyzing data: A model comparison perspective* (2nd ed.). Mahwah, NJ: Erlbaum.
- Moreno, J.L. (1953). *Who shall survive? Foundations of sociometry, group psychotherapy, and sociodrama* (2nd ed.). New York: Beacon House Press.
- National Center for Injury Prevention and Control (NCIPC). (2010). *WISQARS™ (Web-based Injury Statistics Query and Reporting System)*. Retrieved July 1, 2010, from <http://www.cdc.gov/ncipc/wisqars/>.
- Rosenstock, I.M. (1974). The health belief model and preventive health behavior. *Health Education Monographs, 2*, 354-386.
- Schwebel, D.C., & Bounds, M.L. (2003). The role of parents and temperament on children's estimation of physical ability: Links to unintentional injury prevention. *Journal of Pediatric Psychology, 28*, 505-516.
- Schwebel, D.C., Lindsay, S., & Simpson, J. (2007). Brief report: A brief intervention to improve lifeguard surveillance at a public swimming pool. *Journal of Pediatric Psychology, 32*, 862-868.
- Schwebel, D.C., Summerlin, A.L., Bounds, M.L., & Morrongiello, B.A. (2006). The Stamp-in-Safety program: A behavioral intervention to reduce behaviors that can lead to unintentional playground injury in a preschool setting. *Journal of Pediatric Psychology, 31*, 152-162.
- Sleet, D.A., & Gielen, A.C. (2007). Behavioral interventions for injury and violence prevention. In L.S. Doll, S.E. Bonzo, D.A. Sleet, & J.A. Mercy (Eds.), *Handbook of injury and violence prevention* (pp. 397-410). New York: Springer.
- Strayer, D.L., Cooper, J.M., & Drews, F.A. (2004). What do drivers fail to see when conversing on a cell phone? *Proceedings of the Human Factors and Ergonomics Society – 48<sup>th</sup> Annual meeting*. 2213-2217.
- United States Lifesaving Association. (2010). *2006-2010 National Lifesaving Statistics*. Retrieved November 23, 2010 from, <http://www.usla.org/Statistics/current.asp?Statistics=5>.
- 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.
- Ziv, A., Wolpe, P.R., Small, S.D., & Glick, S. (2003). Simulation-based medication education: An ethical imperative. *Academic Medicine, 78*, 783-788.