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The Ocean Lifeguard Intervention Continuum: A Cognitive Aid for Surf Lifeguard Education

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Cover Page Footnote

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Abstract

Ocean lifeguards are constantly engaged in beach risk analysis, required to efficiently evaluate a variety of environmental and other factors quickly in order to triage and prioritize who needs help. Teaching these skills is a challenge for introductory training programs. We sought to improve new lifeguards' understanding of the interaction of various risk components in the beach environment and aid decision-making related to when a lifeguard should intervene in a situation. We developed a two-part cognitive aid for introductory ocean lifeguard education depicting individual and interacting elements of a beach goer's risk of drowning or injury and the process by which that risk increases with associated lifeguard interventions on a continuum from low risk and no distress to drowning. This new cognitive aid represented an advancement in the presentation of complex material in introductory training programs for those involved in aquatic rescue.

Keywords: drowning, drowning prevention, risk, education, emergencies, rescue

Background

Drowning is a major global health problem claiming approximately 372,000 lives annually (WHO, 2014). Trained lifeguards are one of the layers of protection to reduce the occurrence of drowning at open water recreational swim sites (Ramos et al., 2015). Some evidence for lifeguard effectiveness already exists, (Branche et al., 2001) and expert consensus supports the role lifeguards play in recognizing and preventing aquatic injuries and accidents (Quan et al., 2012). The purpose of this article is to present a new cognitive aid for use in training new surf lifeguards how to analyze various components of risk and subsequently make intervention-related decisions.

Open water lifeguards are required to be adept in beach risk analysis, engaged in a two-part process which includes vigilant observation of a swim area and complex decisions about multifaceted environments (Harrell & Boisvert, 2003; Smith, 2016). Lifeguard surveillance is a difficult task (Lanagan-Leitzel et al., 2015) and the routine decision-making process lifeguards undertake during rescue activities involves an enormous mental burden (Szpilman et al., 2018). Lifeguards in the surf environment must consider a myriad of environmental variables and hazards (Short, 1999; Short & Hogan, 1994) that require hundreds of mental mini-calculations per day (Page et al., 2011). This complexity presents a unique challenge for lifeguard instructors teaching new, mostly young, lifeguards how to most efficiently do their job.

Our department, California State Parks (CSP), employs approximately 1,000 open water lifeguards and trains over 200 new open water lifeguards every

year. We recently conducted a training needs analysis for our introductory lifeguard training program (Koon et al., 2020) and found that in their first season new lifeguards who successfully passed our training course had significant difficulty with both aspects of the two-part process previously described. New lifeguards struggled with i.) recognizing people in distress in the ocean, and ii.) decision-making related to when they should leave their observation post to intervene in a situation. These two topics were identified as major areas for improvement in our training program by both new lifeguards reflecting on their first season and by experienced senior-level field staff commenting on new lifeguard performance.

Recognition of a person in distress is the first step in interrupting the drowning process and thus is a critical lifeguard skill (Szpilman et al., 2014). Dr. Francesco Pia conducted seminal work in the 1970s on recognizing distressed swimmers by describing the “instinctive drowning response,” a concept which became a cornerstone for both pool and open water lifeguard training programs (Pia, 1974). That our lifeguards struggled with recognizing a person in distress and making a correct decision about when to intervene during their first season of employment was not surprising and not unique to our department.

Long standing lifeguard axiom and previous research has suggested these skills develop over time: lifeguards with more experience are more likely to detect a swimmer in distress than less experienced guards (Page et al., 2011). With experience, lifeguards evolve from a mentally burdensome and time-intensive analytical decision-making process to an intuitive, rapid, and more cognitively efficient decision-making process (Szpilman et al., 2018). Ideally, we have preferred to staff beaches with experienced lifeguards and a limited number of new, learning lifeguards. Unfortunately, market forces have required us to bring in excessive numbers of new lifeguards, further advancing the need to address this issue during training in the classroom. For training purposes, identifying educational tools and methods that help new lifeguards understand various elements of the decision-making process and speed up the transition from analytical to intuitive reasoning would be of great benefit.

The CSP ocean lifeguard training program previously addressed the topic of victim recognition in one classroom education block titled “Rescue Recognition” which included lecture slides on the instinctive drowning response, “dry land observation” clues, and “distressed swimmer indications” with pictures, videos, and descriptions from veteran instructors (Pia, 1974; USLA, 2017). This block was accompanied by supervised time (4-8 hours) in a lifeguard tower with a senior lifeguard. Motivated by the results from our training needs analysis that indicated this instruction was not meeting needs of lifeguards in the field, our core instructor staff convened a meeting in March 2018 to deconstruct and rebuild the strategy for

teaching this topic. Our main goal was to shift towards an andragogic methodology (Holton et al., 2001) improving the way we develop and train lifeguards in order for them to be more effective decision-makers earlier in their careers.

Developing a New Teaching Tool

First, our cadre recognized the title of the existing education block, “Rescue Recognition,” was a contradiction to a preventative lifeguarding ethos. Modern ocean lifeguards strive to mitigate the need for ocean rescues through preventative actions intended to halt a progression of events that may lead to higher risk situations, and research has determined lifeguards actually spend the majority of their time involved in preventative activities (Koon et al., 2018; Szpilman et al., 2018). To this end, we agreed that our introductory ocean lifeguard course should present a more nuanced approach to assessing various components of risk in order to identify situations requiring intervention several steps *before* a person is in distress and subsequently informing a decision on whether and when to intervene. While our existing instruction included dispersed instruction in preventative lifeguarding, the training needs analysis results established that a more intentional effort to present these concepts in an organized and systematic way was required.

We searched the literature for resources that would be helpful in teaching lifeguards about different components of the drowning process and identified language and concepts that could facilitate discussion on the continuum of lifeguard interventions. Both the 2014 Drowning Chain of Survival (Szpilman et al., 2014) and American Red Cross Circle of Drowning Prevention (Ramos et al., 2015) established “recognize a person in distress” as one of the first steps for lay persons to prevent drowning, and the 2016 Drowning Timeline included several additional components and definitions of the drowning process useful for professional rescuers (Szpilman et al., 2016).

The most comprehensive work specifically related to recognition and prevention education for ocean lifeguards is the SENTINEL system, first introduced by Doyle and Webber in 2007 (Figure 1) (Doyle & Webber, 2007). SENTINEL is an educational tool which was developed to improve drowning detection rates by lifeguards. The model aimed to ensure lifeguards provide the right response, to the right victim, in the right amount of time by assigning victims a numeric status code based on “threat to life” and included a focus on the tactical goal of interrupting the drowning process by providing buoyancy support (Webber, 2012).

Figure 1

The SENTINEL system for the management of drowning by Doyle and Webber (2007) is a triage matrix designed to provide the right response, to the right patient in the right amount of time. The color/status codes correlate to those used by emergency departments and ambulance services in New Zealand.

SENTINEL SYSTEM FOR RESPONSE TO DROWNING					
STATUS	ONE	TWO	THREE	FOUR	FIVE
Threat to Life	IMMEDIATE	CRITICAL	SERIOUS	MODERATE	LOW
Behaviour Displayed	Submerged or Unconscious	Instinctive Drowning Response	Distress	Early Distress	No Distress (Hazard Present)
Response Required	Urgent Rescue (multi-level) Buoyancy Support + / - in-water BLS Call for Ambulance	Urgent Rescue Buoyancy Support Rescue Assets on standby	Immediate Rescue Buoyancy Support (if required)	Routine or Immediate Rescue	Preventative Action or Routine Rescue
Patient Assessment	Unresponsive and not breathing normally	Large amount of foam in mouth or nose; breathing inadequate or decreased LOC	Large amount of foam in mouth or nose; breathing adequate	Small amount of foam in mouth or nose; lung sounds abnormal	Cough, with no foam in mouth or nose; lung sounds normal
Treatment	Start CPR Bag/mask with high-flow oxygen Attach AED	High-flow oxygen Monitor breathing Vital signs Recovery position	High-flow oxygen Vital signs Recovery position	Oxygen Warm and calm the victim Recovery position	Rest, warm and calm the victim Oxygen not normally required
STATUS FIVE PATIENTS WITH NO OTHER MEDICAL PROBLEMS OR INJURIES CAN BE DISCHARGED INTO THE CARE OF A RESPONSIBLE ADULT. CALL AN AMBULANCE FOR ALL OTHER PATIENTS					

Our goal was to develop an education tool depicting physical environmental hazards, person-related factors, and available lifeguard resources contributing to risk of drowning or injury for an individual on the beach, and to visually represent that risk in relation to a spectrum of lifeguard actions in order to aid decision-making related to when a lifeguard should intervene. We developed a two-part cognitive aid informed by the Drowning Timeline and the SENTINEL system. Part one shows the intersection of contributing factors to a beach goer's risk of drowning or injury (Figure 2). Part two shows the process by which that risk increases on a continuum from low risk and no distress to drowning; along with the associated lifeguard actions at each stage (Figure 3). Specific components of beach goers' risk (part one) are described in Table 1; components of the Lifeguard Intervention Continuum (part two) are described in Table 2.

Figure 2

Components of beach risk for lifeguard decision-making

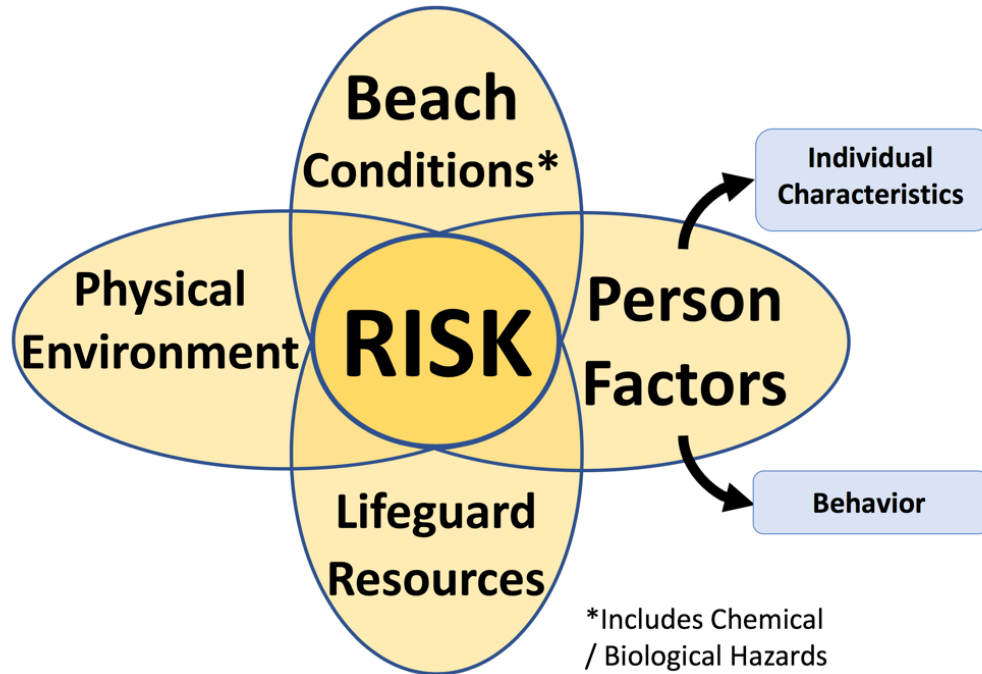


Table 1*Descriptions and Examples of Risk Components for Lifeguard Decision-Making*

Risk Component	Description for Lifeguard Education	Examples
Beach Conditions	<p>The state of weather and ocean variables that have the potential to change throughout the day.</p> <p><i>Teaching tool:</i> “These are variables you can <i>usually</i> look up on the internet before your day at work, be sure to look at both real time measurements and forecasts for later in the day.”</p>	<ul style="list-style-type: none"> ● Tides ● Waves/ surf <ul style="list-style-type: none"> ○ Height, period, direction ○ Plunging, spilling, surging ○ Shore break ● Wind (direction, speed) ● Rip currents ● Water temperature ● Littoral/ lateral currents ● Weather - Fog/ rain/ lightning Chemical and Biological Hazards ● Marine life ● Red tide ● Elevated bacteria levels/ spill
Physical Environment	<p>Aspects of the surrounding patrol area that primarily remain constant throughout the day including elements of beach geography and topography.</p> <p><i>Teaching tool:</i> “These are variables that you will generally need a map or picture of the area to find out if they are present.”</p>	<ul style="list-style-type: none"> ● Rocks/ jetties/groin ● Piers ● Sand Bars/ reef ● River/ harbor inlet ● In-shore hole (varying water depth) ● Beach type ● Sand vs cobbles ● Beach access (parking lot or trail to beach may mean increased population)

<p>Person Factors – Individual Characteristics</p>	<p>Demographic characteristics or knowledge level that may be associated with greater risk of drowning or injury. <i>Teaching tool:</i> “These characteristics are features of the person that they ‘bring’ to the beach. You, the lifeguard, cannot change these characteristics by contacting them - you cannot walk up to someone and change their age or suddenly cause them to gain ocean experience.”</p>	<ul style="list-style-type: none"> ● Age extremes ● Weight extremes ● Non-swimmer ● Lack of ocean experience/unfamiliar with beach environment <p>Visual clues for low ocean experience*</p> <ul style="list-style-type: none"> ▪ Obvious tourist ▪ Pale/extremely white complexion or visible sun burn ▪ Swimming attire ▪ Incorrect equipment for the activity (no wetsuit in cold water, no fins with body board, snorkeling at a surf beach) ▪ General health/fitness/obesity
<p>Person Factors - Behavior</p>	<p>Behavior, actions, or activities that may be dangerous or lead to a dangerous situation. <i>Teaching tool:</i> “These are dangerous activities and actions taken by beach patrons that that you, the lifeguard, can generally stop or warn them about.”</p>	<ul style="list-style-type: none"> ● Intoxication (Driscoll, et al., 2004) ● Cliff/pier jumpers ● Peer pressure ● Ball or other flotation in deep water ● Dangerous water entry ● Lack of PFD ● Walking too close to water on steep beach with large shore break ● Climbing or walking on rocks or tide pools ● Swimming near submerged rocks or objects ● Taking pictures in dangerous locations (includes “Selfies”) (Bansal et al., 2018)

<p>Lifeguard Resources</p>	<p>The availability and type of rescue resources available in your patrol environment that influence lifeguard response time and capacity for early intervention.</p> <p><i>Teaching tool:</i> Compare and contrast lifeguard resources of a solo patrol shift in a remote environment with responsibility for multiple beaches and a tower lifeguard shift on a fully staffed beach with responsibility for 100 meters of water and sandy beach. What about in the last 30 minutes of a beach shift?</p>	<p>Considerations for availability and type of rescue resources:</p> <ul style="list-style-type: none"> • Equipment (boat, Rescue Water Craft, rescue board, vehicle) • Lifeguard training status on equipment • Emergency response time • Full staff vs solo patrol • Size and type of area of responsibility • Time of day (lifeguards ending shift soon?) <p>Remote environment solo patrol: Tolerance for risk on the Intervention Continuum will be much lower, lifeguard should talk to nearly every beach patron about conditions before driving on to the next beach.</p> <p>Tower shift on fully staffed beach: Ability to observe and analyze many factors involved in beach risk, requires judgement about when to intervene in a situation.</p>
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* We present “visual clues” for potential lack of ocean experience not as inherent indicators of knowledge, but as factors that suggest unfamiliarity with the beach environment. We include a nuanced discussion in our training program on the role of culture and the plausibility that these clues could be incorrect in certain situations.

Figure 3
Lifeguard Intervention Continuum

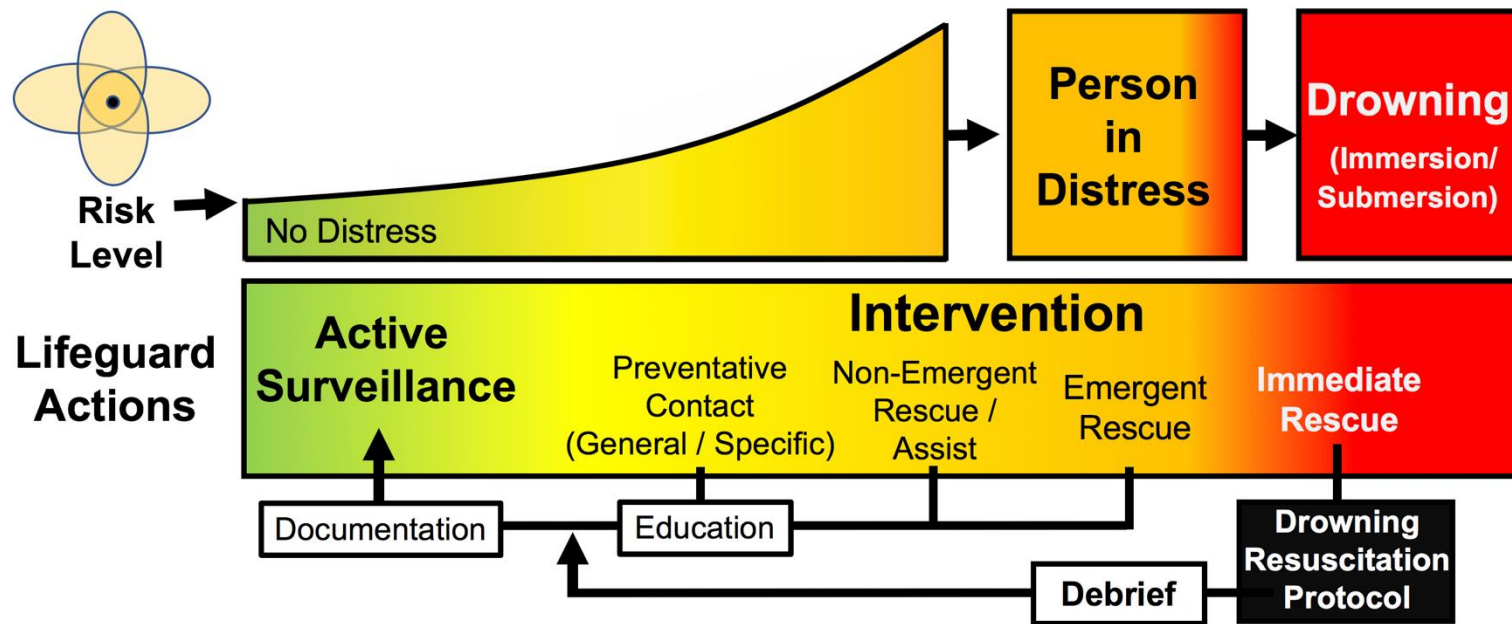


Table2*Description and Examples of Lifeguard Intervention Continuum*

Lifeguard Action	Description	Swimmer / Victim Status	Lifeguard Education Teaching Points and Examples
Active Surveillance	A state of alert, attentive supervision of patrol or observation area	Low risk, hazards present	<ul style="list-style-type: none"> • Scanning Techniques • Vigilance • Inattentional blindness • Distractions • Fixation Errors (De Keyser & Woods, 1990) • Communication between lifeguards
Preventative Contact	<p><u>General Prevention</u> Provision of broad safety information about current hazards and recommendations for safe recreation.</p> <p><u>Specific Prevention</u> Early, verbal contact regarding a specific situation with instructions to mitigate risk.</p>	<p>Person/persons not currently in an elevated risk situation.</p> <p>Person/person(s) currently in a situation that is likely to lead to adverse consequence</p>	<p><i>General preventative contact example: Contacting a family who just arrived at the beach with information on present hazards and recommendation on a safe place to swim.</i></p> <p><i>Specific preventative contact example: Contacting a beach patron who is unknowingly drifting into a rip current, providing instructions to stand up, walk to shore, and swim in front of the lifeguard tower.</i></p>
Non-Emergent Rescue/Assist	Routine response requiring physical assistance to a swimmer who may soon have or is starting	<ul style="list-style-type: none"> ○ Positively buoyant, may show early signs of distress ○ Extended time period interacting with beach 	<ul style="list-style-type: none"> • May or may not call for help • Not adequately coping with hazards (e.g. not swimming out of a rip, ducking under waves, managing shore break)

	to have difficulty in the water.	hazard (rip current, large surf)	<ul style="list-style-type: none"> • Overreliance or incorrect use of flotation device
Emergent Rescue	Urgent response to an imminent threat to life; provision of flotation support and physical assistance	<ul style="list-style-type: none"> ○ Showing signs of distress or swim failure ○ Loss of flotation ○ Panicking ○ May be asymptomatic 	<ul style="list-style-type: none"> • Facing shore with intention to return, making little to no progress • Increasing swim angle (horizontal to vertical body position in the water) (Tipton et al., 1999) • Swim stroke that is low, short, fast or inadequate (Tipton et al., 1999) • Waves breaking over back of victim's head • Victim acting erratically • Hair over forehead in face • Signs indicating exhaustion (floating on back) • Bystander/surfer helping victim
Immediate Rescue	Immediate, multi-system response to an immediate threat to life; provision of flotation support and physical assistance, preparation for possible resuscitation upon return to safe environment (shore/boat)	Instinctive drowning response followed by immersions/submersion	<ul style="list-style-type: none"> • Apparently unconscious/ floating face down • Instinctive Drowning Response (Pia, 1974) • Victim not calling for help • Instinctual arm movements at the side of the body • Vertical body position with head/nose up • Time a critical factor: instinctive drowning response duration is 20-60 seconds before immersion/ submersion (Pia, 1974)

Discussion

For part one, instruction on “Risk,” we broke beach hazards into two components: “Beach Conditions” and the “Physical Environment.” Some of these hazards may fall into both categories depending on location or season. We decided to categorize based on generalized understanding of our service area. We included chemical and biological hazards with “Beach Conditions” as these hazards are generally limited in time (as opposed to constant) in our service area. For example, the presence of sharks (marine life hazard) or unsafe water quality (biological or chemical hazard) have only a temporary effect on the *majority* of our beaches. Notable exceptions might include our service area near the U.S.-Mexican border where polluted water is common, a beach near a lagoon where sting ray incidents occur frequently, or Northern California areas where great white sharks breed.

“Person Factors” are taught in terms of individual characteristics, where we discuss visual clues for inexperienced beach visitors, and dangerous behavior which a lifeguard should identify and attempt to stop. In our instruction on risk, we also include an important discussion on the influence of “Lifeguard Resources” as a mitigating factor to risk. We ask new lifeguards to think through how availability of rescue tools, varying staffing levels, and size and type of area of responsibility might affect a beach goer’s risk, and in turn a lifeguard’s decision on when to intervene in a situation.

Any one of these risk components individually could be cause enough for a lifeguard to leave the tower and go contact a beach goer with a preventative message, such as a day with extremely large waves or a remote beach with limited lifeguard coverage. It is far more common that multiple components of risk combine and interact to create a situation with an increased threat. For example, a novice surfer (person factor), or waves less than one meter (beach conditions), or an outcropping of rocks (physical environment) would not by themselves, cause a lifeguard to have a heightened level of concern; but together (novice surfer in small waves close to rocks) would create a situation that may require lifeguard intervention.

A beach patron’s risk level will increase and decrease all day long as they recreate and interact with the surrounding environment. As such, the continuum from not being in distress to being in distress and eventually to submerging may go quickly or slowly and is often a fluid process. With this new visual representation, we teach new lifeguards to recognize when risk exceeds an appropriate limit that they determine which in turn should require that lifeguard leaving his/her post and intervening in the situation.

We teach new lifeguards to establish low, but appropriate risk thresholds to intervene at the earliest possible point resulting in a more preventative lifeguard ethos and culture. Interestingly, previous work from the United Kingdom recommended that inexperienced lifeguards be trained in *less* active intervention strategies in order to detect more hazards and avoid situations where they react to one perceived, but minor risk threat when another, more serious incident occurs without them noticing (Smith, 2016). Structural and organizational differences in our two lifeguard operations may allow our department to encourage new lifeguards to engage in more active preventative interventions. Specifically, our department organizes lifeguards under a surveillance structure known as the “Perimeter Defense System” which ensures that multiple people are watching the same water area, even when a lifeguard is away from their post (Huntington Beach Fire Department, 2018; Weisser, 2008). Regardless, during our instruction on “Lifeguard Resources” we challenge trainees to consider what sort of help they may have, if any, and who else will watch their water if they leave their post.

In the CSP lifeguard training program, instructors present this visual aid to new lifeguards as a framework to ease the analytical burden of decision-making until they can develop intuitive responses based on their experience. We show lifeguard trainees representative cases of each element of risk to influence their intuitive reasoning (Kahneman & Egan, 2011). Encouraged by Szpilman’s call to develop “rescue scripts,” (Szpilman et al., 2018) we present hypothetical beach situations with pictures, videos, and verbal descriptions, then ask trainees to determine where on the Intervention Continuum a particular beach patron might be, and if they should intervene. We discuss, then interchange one or two risk components to demonstrate how a small change might alter the total risk for a particular individual and change a lifeguard’s decision to intervene.

Although we designed the Ocean Lifeguard Intervention Continuum specifically for open water lifesaving, there may be cross over implications for development of similar tools aimed at assessing and addressing risk in other fields of emergency management which require decision-making based on a variable matrix of risk components. We plan on designing and carrying out an evaluation of this tool in future training sessions but were compelled to share our department’s initial advancement in pedagogic strategy for open water surf lifeguards. We presented this cognitive aid and described our teaching methods on this topic with the hope that other lifeguard department training programs or fire departments and Emergency Medical Service agencies involved in water rescue may benefit from this work. Out of a desire for continual improvement of our profession and elevation of the discourse related to the Ocean Lifeguard Intervention Continuum, we welcome future advancements and research on this topic.

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