Assessment and treatment of high-risk challenging behavior of adolescents with autism in an aquatic setting

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Aquatic-based activities produce positive skill and health benefits for individuals with Autism Spectrum Disorder (ASD); however, aquatic contexts, such as the pool, introduce the risk of injury and drowning. This risk is heightened when individuals with ASD engage in challenging behavior in the pool context. The purpose of the study was to evaluate the effects of differential reinforcement without extinction for 2 participants diagnosed with ASD who engaged in challenging behavior when asked to transition from the pool. The treatment successfully decreased participants’ transition latencies and challenging behavior during transitions from the pool for up to 2 months following treatment. Lifeguard staff rated the procedures as highly acceptable and helpful, and noted high degrees of satisfaction with improvements for each participant’s behavior.

Key words: compliance, high-risk challenging behavior, pool, transition refusal

Exercising is a class of socially significant behavior that leads to health benefits for individuals with and without Autism Spectrum Disorder (ASD). However, a commonly cited factor that contributes to obesity in children with ASD is decreased opportunities to engage in exercise (Curtin, Bandini, Perrin, Tybor, & Must, 2005; Rosser Sandt & Frey, 2005). Physical limitations may inhibit individuals with ASD from participating in exercise. These physical limitations often include poor gait, posture, lack of coordination, and rhythm (Provost, Lopez, & Heimerl, 2007), and the lack of fundamental motor skills (Berkeley, Zittel, Pitney, & Nichols, 2007). These difficulties may place individuals with ASD at risk for lower levels of physical activity and insufficient opportunities to participate in recreation and leisure programs (Frey, Buchanan, & Rosser Sandt, 2005; Pan & Frey, 2006). A potential low impact form of physical exercise for individuals with ASD is swimming.

Research suggests individuals with ASD generally enjoy aquatic environments, including the pool (Fragala-Pinkham, Haley, & O’Neil, 2011; Rogers, Hemmeter, & Wolery, 2010). In addition to being a preferred activity, previous research indicates that aquatic-based activities produce many positive skills and health benefits for individuals with ASD. Benefits associated with swimming include increases in basic swimming skills (Rogers et al., 2010; Yilmaz, Konukman, Birkan, & Yanardag, 2010), advantages in health and motor related fitness (Yilmaz, Yanardag, Birkan, & Bumin, 2004), increased movement skills (Prupas, Harvey, & Benjamin, 2006), and gains in movement competence (Attwood, 1997).

Despite the aforementioned benefits to swimming, children with ASD are often restricted from accessing aquatic areas due to safety concerns (Lee & Porretta, 2013). Shavelle, Strauss, and Pickett (2001) completed a longitudinal study to determine causes of death that were most common with individuals with ASD compared to typically developing
individuals. Their sample included 13,111 individuals diagnosed with ASD in the state of California between the years of 1983 and 1997. Their findings suggested that individuals with ASD were 3.9 times more likely to die due to drownings compared to a typically developing population. Sibert et al. (2002) reported that children with ASD in the United Kingdom were also at a heightened risk for drowning, and that broad-based initiatives to reduce drowning in the general population may not be sufficient to prevent drowning in children with ASD. For example, since children with ASD often lack verbal behavior skills, they may not understand instructions related to pool safety. In addition, if an individual is noncompliant when asked to transition out of the water, physical support from another person may be needed to facilitate the transition. If the individual is not relaxed, is resistant, or emits problem behavior during the transition, this may increase the likelihood of physical injury and could result in drowning.

The presentation of a demand to transition from a rich to a lean schedule of reinforcement may result in problem behavior for individuals with ASD (Jessel, Hanley, & Ghaemmaghami, 2016a). Jessel et al. (2016a) completed a translational study that extended the basic framing of transitions to behaviors and contexts of social significance. In a two-part study, Jessel et al. evaluated the effects of a treatment for the problem of dawdling by three boys diagnosed with ASD when asked to transition from rich-to-lean schedules. Using a quadrant procedure, they found that dawdling was most commonly observed when the participants were asked to transition to lean contexts. Likewise, when children with ASD are asked to transition away from a highly reinforcing, but inherently dangerous environment, like the pool, to a less reinforcing environment, like the locker room, transition noncompliance may occur, and this may lead to fatigue, injury, or even death (Shavelle et al., 2001). Thus, while swimming and aquatic activities produce copious benefits for individuals with ASD, caregivers must take steps to prevent and reduce transition noncompliance in order to maximize safety surrounding the pool environment.

Ensuring safe outcomes is an important consideration when facilitating compliance in other routines and settings besides pool transitions. Dowdy, Tincani, Nipe, and Weiss (2018) safely and successfully increased compliance with nail cutting for two adolescents diagnosed with ASD. Treatment included delivering a preferred edible item following each successful nail cut. Escape extinction was not a component of the treatment procedures in order to reduce the likelihood of unwanted dangerous side effects, such as the participant moving their hand rapidly during an attempted nail cut that could result in injury.

The purpose of the present study was to safely assess problem behavior in a pool environment, and subsequently evaluate the effects of differential reinforcement without extinction to reduce problem behavior. In addition, the experimenters evaluated lifeguards’ satisfaction with the assessment and treatment process using a social validity questionnaire.

METHOD

Participants, Setting, and Materials

The first author, a behavior analyst clinician, was presented with the case of two adolescent males who engaged in repeated dangerous problem behavior when asked to transition out of the pool. Both males resided at a residential treatment facility where the study took place. Sage was a 17-year-old young man diagnosed with ASD, attention deficit hyperactivity disorder (ADHD), Marfan’s syndrome, DiGeorge syndrome, and a profound intellectual disability. Sage was nonvocal and communicated via the speech-generating device, Proloquo2Go™ installed on his iPad®. Sage complied with
most academic instructions that involved listener responding during daily routines. Based upon the American Red Cross (2009) swimming and water safety criteria, Sage could successfully back float, but had difficulty with the front float and jellyfish float. Sage was able to tread water, but had difficulty with sculling, or arms moving up and down without kicking. Nathan was a 10-year-old male diagnosed with ASD, intellectual disability, attention deficit hyperactivity disorder (ADHD), intermittent explosive disorder, and pica. Nathan was non-vocal and communicated via the Picture Exchange Communication System (PECS; Frost & Bondy, 2002). Nathan could follow one-step directions, such as, “walk with me,” “take a seat,” and “pick up the puzzle.” Nathan was required to wear pool floaties when he went swimming. With the pool floaties on, Nathan was able to float and tread water. The teachers, residential supervisors, and lifeguard staff reported that each participant engaged in dangerous problem behavior when asked to transition out of the pool.

All sessions occurred at the residential treatment facility in which both participants lived. Sessions took place in the area of an Olympic-sized, indoor pool. All sessions occurred during designated pool times during either education hours (37% of sessions for Sage, 46% of sessions for Nathan) or residential hours (63% of sessions for Sage, 54% of sessions for Nathan). In both the educational and residential settings, daily schedules consisted of 30-min blocks, which included but were not limited to, math, reading, job sampling, chores, exercise, leisure time, and pool time. All sessions were completed during both participants’ designated pool times, during which a therapist accompanied each participant to the pool; a lifeguard was also present. Materials for all sessions consisted of music playing through a small speaker and a preferred edible item for Sage. For Nathan, a small portion (1 oz) of preferred ice cream was kept in a cooler.

Response Measurement and Interobserver Agreement

Observers collected data on two responses: latency of transitions and frequency of transition refusal behavior. Latency of transitions was defined as the time period between when the therapist gave the initial demand to leave the pool (e.g., “It is time to leave the pool.”) and when the participant began putting on his first article of clothing in the locker room. The terminal behavior, putting on the first article of clothing in the locker room, was selected because both participants were reported to sometimes dry themselves next to the pool, or to exit the pool to the pool deck, and then dart back to the pool and jump in. Both participants were unlikely to dart back to the pool after they exited to the locker room and placed on their first article of clothing. Transition latency data were recorded in seconds. Transition refusal behavior consisted of any instance or attempt to push away, hit with an open or closed fist, push, pull or grab the therapist. The experimenters converted the frequency of transition refusal behavior to responses per minute by dividing the number of responses per session by session duration.

Observers collected data on laptop computers using BDatapro™ (Bullock, Fisher, & Hagopian, 2017) for both the assessment and treatment. The experimenters calculated interobserver agreement (IOA) for transition latency using exact interval agreement. Sessions were divided into successive 10-s intervals. An agreement was scored if both observers recorded the same duration (rounded to the nearest 1 s) of the target response in the interval. Next, agreements were divided by agreements plus disagreements and multiplied by 100. Similarly, the experimenters calculated reliability for transition refusal behavior by dividing the sessions into 10-s intervals and scored an agreement for each interval if both observers recorded the same number of responses for transition refusal behavior. The total agreements and disagreements for a session was calculated by
number of agreements divided by the number of agreements plus the number of disagreements multiplied by 100.

An independent secondary observer collected data on both target behaviors for 60% of sessions during the functional assessment and at least 56% of sessions during treatment. The mean IOA of transition latency for Sage and Nathan was 97.3% (range = 91.8-100%) and 94.5% (range = 89.7-100%), respectively. The mean IOA of transition refusal behavior for Sage and Nathan was 96.4% (range = 90.3-100%) and 95.5% (range = 90.4-100%), respectively.

**Design and Procedures**

**Functional assessment.** Procedures for the functional assessment included a three-part process (i.e., interview, observation, functional analysis) and were based on the interview-informed synthesized contingency analysis (IISCA) by Jessel, Hanley, and Ghaemmaghami (2016b). First, 20 questions from the open-ended questionnaire found in the appendix of Hanley (2012) were used by the first author to conduct an informal, open-ended interview with two lifeguard staff familiar with both participants. The first author asked questions about challenging behavior, the circumstances in which challenging behavior occurred, and the lifeguards’ general response to challenging behavior. The results of the informal interview suggested that transition refusal behavior occurred when lifeguard staff delivered the demand to leave the pool or interrupted an activity in the pool. Results also suggested that transition refusal behavior was maintained by positive reinforcement in the form of continued access to the pool and negative reinforcement in the form of avoiding the demand.

Following the interview, the first author conducted a 20-min observation with each participant in which he was in the pool and then was asked to leave the pool area by lifeguard staff. Data were collected on the number of instances each participant emitted transition refusal behavior, and the latency to entering the locker room and putting on the first article of clothing. Both participants were observed to engage in all behavior topographies described in the transition refusal definition when the demand to transition away from the pool was placed.

Next, the experimenters conducted the IISCA in a multielement design. Each session was 5 min and occurred in the pool setting. The test and control conditions were procedurally matched and included all the same stimuli. The only differences between control and test conditions was the delivery of reinforcement (i.e., the synthesized reinforcement contingency) in the test conditions. In the control condition, the therapist presented the participant with continuous, noncontingent pool access. The therapist also refrained from presenting any establishing operations in the form of antecedent stimuli that were identified during the interview to occasion transition refusal behavior. Transition refusal behavior did not result in any environmental changes. In the test condition, the therapist placed the demand to leave the pool, followed by a three-step least-to-most prompting procedure (i.e., vocal, model, light physical touch) with 5 s between prompts. If transition refusal occurred, the therapist removed the demand to leave the pool and provided uninterrupted access to the pool for 30 s.

**Differential reinforcement without extinction evaluation.** Based upon the results of the functional assessment, the experimenters concluded that both participants’ challenging behaviors were maintained by continued access to the pool and escape from the demand to leave the pool. The dangerous nature of the setting precluded the use of extinction during treatment due to the possibility of increased challenging behavior during extinction bursts (Lerman, Iwata, & Wallace, 1999). Consequently, the treatment did not involve use of extinction (see Bishop et al., 2013; Dowdy et al., 2018). Sessions were 10 min or until the participant put
on his first article of clothing in the locker room.

Prior to the treatment evaluation and based on interviewing each participant’s teacher and residential supervisor, preferred stimuli were identified. Based upon these interviews, the experimenters completed a multiple-stimulus-without-replacement preference assessment (MSWO; DeLeon & Iwata, 1996) to identify highly preferred items to use in the intervention portion of the treatment analysis. The highest preferred items for Sage consisted of music playing on a small speaker and gummy bears. The highest preferred items for Nathan were plastic beads and Lemon Heads. During the differential reinforcement without extinction portion of the treatment analysis for Nathan, he appeared to satiate on the plastic beads and lemon heads; an additional MSWO preference assessment was completed, which suggested that chocolate ice cream was most preferred. Following the updated MSWO preference assessment, chocolate ice-cream was stored in a small clear cooler and used during intervention sessions for Nathan; previous items were removed.

Baseline. At the beginning of each baseline session, the therapist gave the instruction for the participant to leave the pool area, followed by the three-step prompting procedure if the participant did not independently exit the pool and walk into the locker room. Contingent upon transition refusal behavior each participant was provided with 30 s of continued access to the pool. Once 30 s was over, the instruction to leave the pool was repeated.

Differential reinforcement without extinction. At the onset of each intervention session, the therapist delivered a demand to leave the pool coupled with a contingency-specifying rule: “It is time to leave the pool area, once you leave the pool and begin to get dressed you can have these items.” The therapist held up the preferred items identified in the MSWO assessment to make the reinforcers more salient to the participant. Following presentation of the demand and contingency-specifying rule, as in baseline, the therapist used the three-step prompting procedure if the participant did not independently exit the pool and walk into the locker room. If transition refusal behavior occurred, the participant was provided with 30 s of continued access to the pool, after which the demand and prompting procedure were repeated. As previously described, extinction was not utilized during treatment. If the participants exited the pool, walked into the locker room, and put on the first article of clothing without emitting transition refusal behavior, the therapist handed him the preferred item and the session ended. If transition refusal occurred, access to the preferred item was not delivered once the participant put on his first article of clothing. The therapist was instructed to deliver reinforcement if the session lasted longer than 10 min, but the participants met the specified contingency; however, at no point during the treatment evaluation did this happen.

Maintenance. Maintenance probes were completed and data were collected at 1 and 2 months following the last treatment session for both participants. Maintenance probes were implemented by the therapist in exactly the same manner as intervention.

Procedural fidelity. Trained observers collected procedural fidelity data using “yes/no” checklists for the treatment assessment for Sage and Nathan. Procedural fidelity data were collected on 68% of Sage’s baseline sessions and 65% of his treatment sessions and on 59% of Nathan’s baseline sessions and 66% of his treatment sessions. The steps on the baseline procedural fidelity checklist were (a) participant and therapist are in the pool area; (b) therapist informs student it is time to leave the pool area; (c) three-step prompting with 5 s between prompts is implemented; (d) transition refusal behavior results in 30 s of escape from demand and pool access; and (e) session ends when the
first article of clothing is on or after 10 min following the initial request to leave area; (f) therapist has identified preferred items in visual proximity at onset and throughout the treatment session; (g) therapist says, “It is time to leave the pool area, once you leave the pool and begin to get dressed you can have these items” (treatment session); (h) once the participant enters the locker room and places on the first article of clothing, preferred item(s) are presented in the absence of the targeted problem behavior. Procedural fidelity was calculated by dividing “yes” responses by the sum of “yes” and “no” responses and then multiplying by 100. Mean procedural fidelity for Sage’s baseline was 97% (range = 93-100%) and 98% (range = 95-100%) for his treatment sessions. Mean procedural fidelity data for Nathan’s baseline was 96% (range, 92-100%) and 97% (range, 92-100%) for his treatment.

Social Validity

Before assessment and treatment began, the first author reviewed assessment and treatment components of the study with the two pool lifeguards who worked with the participants. Both lifeguards received basic training in ABA upon hire and had a background working with children who displayed challenging behavior. The assessment review included a description of the rationale for why the synthesized test condition was selected for the assessment along with a general description of the test and control conditions for the assessment and baseline and treatment phases for the intervention. Both lifeguards were present during all treatment sessions. At the end of treatment, the social validity questionnaire was completed by the lifeguards. The experimenter was present during the social validity assessment and asked the questions. The lifeguards were presented with a printout to rate the reviewed questions. For each question asked, a 1-5 scale was presented with 5 being highly acceptable, satisfying, and helpful and 1 being not acceptable, satisfying, and helpful. The lifeguards were interviewed because they were the most likely staff to cue participants to transition out of the pool when pool time ended once the treatment analysis was completed. These questions were based upon a modified version of Treatment Acceptability Rating Form – Revised (Reimers & Wacker, 1988).

RESULTS

The results of the IISCAs for Sage and Nathan are presented in Figure 1. Three synthesized test conditions and two control conditions were completed for both participants. High rates of transition refusal behavior were observed during the test condition for both Sage ($M = 1.2$ responses per minute (RPM)),

![Figure 1. Results of Interview-Informed Synthesized Contingency Analysis (IISCA) during pool activities for Sage (top) and Nathan (bottom).](image-url)
range 1.0-1.4) and Nathan ($M = 1.5\,\text{RPM}$, range 1.5-1.6). In addition, transition refusal behavior did not occur in any control sessions. This suggested that problem behavior for both participants was sensitive to escape from instructions and access to the pool.

Figure 2 shows the rate of transition refusal behavior and transition latency during the treatment evaluation for Sage (top panel) and Nathan (bottom panel). Transition refusal behavior remained elevated during baseline for Sage ($M = 1.5\,\text{RPM}$, range, 1.3-1.7) and Nathan ($M = 1.6\,\text{RPM}$, range 1.3-1.8) and the participants did not complete any transitions within a session (represented as a latency of 600 s). Transition refusal behavior immediately decreased when the treatment was introduced for Sage ($M = 0.01\,\text{RPM}$, range 0-0.1) and Nathan ($M = 0.2\,\text{RPM}$, range 0-1.3) and was eliminated by the final treatment phase. Sage’s mean transition latency reduced to 126.3 s (range, 83.3 s - 206.1 s) and Nathan’s mean transition latency reduced to 229.2 s (range, 66.8 s – 600 s). During the last phase of treatment, no transition refusal behavior was exhibited for both participants and transition latencies remained low at the 1 and 2 months follow-up visits.

Both lifeguards scored the social validity of the functional assessment and treatment procedures highly. Both lifeguards indicated that they clearly understood the treatment (4 and 5), were accepting of assessment and treatment (4 and 5), would be willing to carry out the

Figure 2. Treatment data for Sage (top panel) and Nathan (bottom panel). TRB = transitional refusal behavior (primary y-axis). Dressing refers to the latency to dressing (secondary y-axis). Maintenance treatment probes are represented by 1 m (one month) and 2 m (two months). DRA = Differential Reinforcement of Appropriate behavior.
assessments and treatment (4 and 5), felt the treatment would be very likely to make permanent improvements in both participants’ assessment (5 and 5), and found it unlikely that there might be disadvantages to the treatment (4 and 5).

**DISCUSSION**

The purpose of the study was to evaluate an assessment and intervention procedure for reducing dangerous transition refusal behavior in the pool context. Information yielded from the assessment based on the IISCA identified the function of the participants’ transition refusal behavior. Additionally, this information was useful in developing a successful intervention to reduce the problem behavior for both participants. Lifeguards were highly satisfied with the assessment and intervention procedures, and treatment gains maintained for 2 months following treatment.

The assessment procedures used to identify the function of participants’ transition refusal behavior, based on the IISCA, presented two key advantages given the nature of participants’ behavior and the study setting. First, the IISCA is designed to identify synthesized contingencies, or contingencies that involve control of multiple variables on problem behavior. The preliminary interview results suggested that the contingencies for participants’ transition refusal behavior was likely synthesized, in that they involved a combination of establishing operations and delivery of positive reinforcement (i.e., continued pool access) and negative reinforcement (i.e., escape the demand to leave the pool). Thus, the IISCA procedures were well suited for the participants’ challenging behavior, which was multiply maintained. Second, the brief, in vivo control and test condition portions of the assessment offered an efficient and practical option for identifying the function of challenging behavior in a dangerous setting, specifically the pool where an injury to the staff or client along with drowning was a potential risk.

Our study departed from previous investigations of the IISCA in that we did not teach a functional communication response as an alternative to challenging behavior (cf. Jessel, Ingvarsson, Metras, Kirk, & Whipple, 2018a; Jessel, Ingvarsson, Metras, Whipple, et al., 2018b). However, the IISCA still allowed the experimenters to identify maintaining, functional reinforcers for both participants’ transition refusal behavior. The experimenters’ decision to refrain from teaching a functional communication response was due to the risks associated with extinction bursts that might accompany functional communication training in the pool (e.g., Lerman & Iwata, 1995), which could have resulted in drowning. For example, increased levels of challenging behavior during extinction bursts in the pool could increase participants’ fatigue and decrease their ability to swim, which would, in turn, increase their likelihood of drowning. Additionally, both individuals communicated using augmentative and alternative communication devices that were difficult to bring into the pool (i.e., PECS, iPad). These results confirm those of previous research in supporting the efficacy of reinforcement-based treatment when extinction is contraindicated due to safety concerns associated with extinction bursts (Bishop et al., 2013; Dowdy et al., 2018).

Additionally, although lifeguard staff provided substantially high ratings of assessment and treatment acceptability for both individuals, a limitation of our study and an area of future exploration is the need to assess the role of stakeholders (e.g., lifeguards) who fully participate as therapists in assessment and treatment from the beginning to the end of the process. Nevertheless, similar to previous studies that employed the IISCA and function-based treatment (e.g., Jessel, Ingvarsson, Metras, Kirk, et al., 2018), we found that ecological validity was high, with lifeguards
providing strongly favorable responses to the social validity survey and continued implementation of the treatment procedures for up to 2 months following initial intervention. Additionally, the assessment procedures indicated that participants’ transition refusal behavior was reinforced by a combination of continued access to the pool and avoidance of the demand to leave the pool. However, in some cases, transition refusal behavior in the pool context resulted in multiple consequences, for example, social attention provided by lifeguards who engaged the participant when they refused to leave the pool. Thus, future research should explore functional assessment and intervention procedures with challenging behavior in the pool environment where other reinforcement contingencies are at play.

REFERENCES


