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The Benefits of Aquatic Occupational Therapy for Children on the Autism Spectrum

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Table of Contents

Abstract

The proposed study aims to identify the benefits of aquatic OT by examining the progress a child with ASD makes in motor skills, social, emotional, and physical development as well as evaluate the therapist's ability to provide therapy, compared to therapy provided on land. It is hypothesized that providing occupational therapy in an aquatic environment for children with autism will have equal to or greater benefits as occupational therapy provided on land. Twenty-one participants were recruited from occupational therapy clinics and programs around the United States to take a survey asking questions to learn more about specific changes observed in children with autism who are participating in aquatic therapy. This study displayed that there are advantages and benefits to aquatic occupational therapy due to therapists agreeing) that 15 out of 26 skills measured increased after aquatic occupational therapy and that there were limited published resources on aquatic occupational therapy for therapists to use to guide their practice.

Keywords: aquatic occupational therapy, autism spectrum disorder, water-based therapy

The Benefits of Occupational Therapy for Children on the Autism Spectrum

Occupational therapy is a growing field, with a great variety of clients with unique needs. Occupational therapists assist people who have been in an accident return to their daily lives and help individuals with a disability become independent, contributing members of the community. Autism Spectrum Disorder (ASD) diagnoses are also increasing due to greater awareness and childhood testing for the disorder (Benjamin et al., 2006). Autism is defined by the American Psychiatric Association guidelines as "a pervasive neurodevelopmental disorder characterized by impairments in social communication and restricted, repetitive patterns of behavior, interests or activities" (American Psychiatric Association, 2013, p.1). Functional social impairments typically seen with an autism diagnosis include lacking expressions, relational problems and isolation, and lack of social enjoyment (Vonder Hulls et al., 2006). Therefore, occupational therapists work with children on the autism spectrum to reduce the severity and frequency of these behaviors and help them develop age-appropriate life skills, self-sufficiency, independence, and motor skills.

There are a variety of therapeutic approaches for children with ASD that focus on a range of functional impairments, but more research is needed on the benefits of a specific approach - aquatic occupational therapy - as a resource for children with autism. In addition to all the benefits of participating in occupational therapy sessions on land, water creates unique circumstances that can be explored simultaneously while performing therapy activities. Water has the unique properties of density, hydrostatic pressure, buoyancy, viscosity, resistance, turbulence, and thermal conductivity, which can be used to decrease as well as increase the intensity of the therapy session (Becker, 2009). Skills learned and mastered in aquatic therapy sessions can be transferred to land fairly easily (Vonder Hulls et al., 2006). Being in the water

takes away some of the challenges that children with autism face when they are on land, by the moderation of sensory arousal, decreased pressure from gravity, and increase in safety, as well as providing additional learning opportunities (Fragala-Pinkham et al., 2011; Franken et al., 2013; Lawson et al., 2019).

In addition to developmental support, children with autism must acquire water safety skills and basic swimming abilities, which can be included during aquatic therapy sessions. Accidental drowning is the leading cause of death for children with autism (Lawson et al., 2019) and the fear of a child drowning can affect the whole family by limiting the child's participation in physical activity and social interaction. Occupational therapy focuses on treating the whole child, which includes their family, so learning water safety and swim skills would be an appropriate addition to therapy sessions.

Another problem that occurs in children with ASD is being at risk for obesity due to inactivity. "Children should engage in at least 60 min or more of age and developmentally appropriate physical activity on all or most days of the week" (Pan & Frey, 2006, p.2). Many children with autism do not participate in as much physical activity as their non-impaired peers because of challenges with social interactions and physical impairments that may make them move slower and experience more physical pain/discomfort (Fragala-Pinkham et al., 2011). Additionally, children with ASD often take medication that has weight gain as a side effect (Fragala-Pinkham et al., 2011).

Aquatic activities can relieve joint, muscle tension, and pain, as well as reduce excess body weight, making them more limber and mobile (Lee & Porretta, 2013). After stretching out and building their muscle strength using water as an aid, the skills can then be transferred to

land. By starting in the water children with ASD will be able to build up strength and create muscle memory of skills before moving to land with the additional weight of gravity.

There have been few research studies done on the specific benefits of aquatic occupational therapy and no known studies have specifically focused on children with ASD. It is imperative to explore the benefits of aquatic occupational therapy sessions for children with autism due to the potentially unique fit of water exercise with specific characteristics of ASD. Disability can greatly affect a person's physical and cognitive ability. Different disabilities have unique restrictions that influence a person's activity level. Therefore, there needs to be a study done specifically on how aquatic occupational therapy can benefit children with autism rather than generalizing the benefits to all disabilities (Pan & Frey, 2006).

Literature Review

Aquatic Therapy

Aquatic therapy differs from land therapy due to the physical properties of water and the effects of those properties on the body (Becker, 2009). The physical properties of water include density, hydrostatic pressure, buoyancy, viscosity, thermodynamics, turbulence, and resistance (Becker, 2009). “Although the human body is mostly water, the body’s density is slightly less than that of water and averages a specific gravity of .974, with men averaging higher density than women. Consequently, the human body displaces a volume of water weighing slightly more than the body, forcing the body upward by a force equal to the volume of the water displayed, as discovered by Archimedes” (Becker, 2009, p.860). Buoyancy displaces body weight that is typically on the joints (Becker, 2009). Due to the human body being less dense than water this decreases weight from the body (Becker, 2009). When children with autism have less weight on

their joints, bones, and muscles it increases their flexibility and decreases their pain (Lee & Porretta, 2013).

Hydrostatic pressure "is directly proportional to both the liquid density and to the immersion depth when the fluid is incompressible" (Becker, 2009, p.860). The pressure is equivalent to 22.4 mmHg per foot of water depth (Becker, 2009). In water, the pressure increases proprioception in children with autism. Increasing proprioception allows for improved coordination and spatial awareness. Viscosity "refers to the magnitude of internal friction specific to fluid during motion. When a person rehabilitating in water feels pain and stops moving, the force drops precipitously as water viscosity damps movement almost instantaneously. This allows enhanced control of strengthening activities within the envelope of patient comfort" (Becker, 2009, p.860).

The thermodynamics of water affects the temperature of the water which can be used as a tool during therapy sessions to increase the comfort of the patient or create optimal conditions for a specific skill (Becker, 2009). These properties of water influence the Dynamic Systems Theory by taking away inhibiting factors for children's movement allowing the therapist to modify goals then transfer the goal to land (Lee & Porretta, 2013). The Dynamic Systems Theory is the "movement patterns and development that occurs as a result of a self-organizational process, which is brought about by complex interactions between the environment, task, and learner" (Lee & Porretta, 2013, p.41). Occupational therapists set goals for children and then help them to learn and complete the complex interactions necessary to achieve that goal.

Sensory arousal. The unique properties of water, resistance, pressure, and temperature can cause sensory arousal in children with autism (Lawson et al., 2019). Children with autism

can oftentimes be overwhelmed by stimuli in their environment making it difficult for them to concentrate on the task at hand (Vonder Hulls et al., 2006). “The four sensory patterns that arise from individual differences in neurological thresholds that can vary in stimulation and self regulation strategies include: low registration, seekers, avoiders, and sensors” (Lawson et al., 2017, p.29). Using factors to mitigate sensory arousal during therapy is known as sensory integration (SI) therapy. “SI therapy increases or decreases arousal level in order to achieve a more optimal, moderate level… more moderate arousal level improves the child’s ability to interpret and use sensory input” (Vonder Hulls et al., 2006, p.15). Children with autism use sensory processing to self-regulate environmental stimulation, therefore the constant stimulation from water can help them more easily focus on the task at hand during their therapy session rather than on other stimuli (Dunn & Tomchek, 2007).

Motor skills. During therapy sessions, occupational therapists work with children on developing fine and gross motor skills. “Motor abilities are also related to social and emotional functioning, daily living skills, and playing and interacting with others” (Caputo et al., 2018, p.1945). Working on fine, small, controlled movements, and gross, large movements, in the water creates more of a challenge due to the additional balance needed (Lee & Porretta, 2013). Therapists also work on building muscle strength so that children can perform daily tasks effectively (Vonder Hulls et al., 2006). The aquatic environment provides a safe environment for this by reducing the risk of injury from falls or overloading muscles (Franken et al., 2013).

Social skills. Additionally, occupational therapists work on social skills with children with autism. In past studies, aquatic programs have been beneficial to imaginative play, social games, reciprocal conversation, making friends, and turn-taking (Pan & Frey, 2006). Oftentimes swim programs can be done in group sessions which aids these social interactions and the

development of social skills (Caputo et al., 2018). The therapist or instructor can be there to instruct, prime, and intervene in students' interactions.

Life skills. Aquatic occupational therapy sessions provide unique, indirect opportunities to practice daily living skills which will benefit the child (Benjamin et al., 2006). The occupational therapy session taking place in the pool presents children with the chance to practice getting dressed and undressed each session to put on their swimsuit and take it back off (Benjamin et al., 2006). Changing to get into the pool is necessary for the session and is a great time to practice functional skills. Hygiene is also a skill that can be practiced after getting done with an aquatic therapy session (Benjamin et al., 2006). Therapists can work with children on skills in the water but leave time for the logical next process of getting redressed and ready at the end of the session. These skills could be worked on without having the in-water session but getting in the water provides the need to practice these skills.

Other benefits. Another indirect benefit of aquatic occupational therapy in children with autism is that it is typically a preferred activity among that group (Lawson et al., 2019). This means that children will continue wanting to swim as a leisure activity or potentially for exercise once they are introduced to the water and comfortable. “Some children with ASD have physical impairments including decreased trunk strength, coordination and gross motor skills which limit their ability to participate in physical activities with peers” (Fragala-Pinkham et al., 2011, p.231). Swimming is an activity that they can do to interact with peers, practice social skills, and make friends (Fragala-Pinkham et al., 2011). Children with autism also struggle with obesity so swimming is a great option that they enjoy keeping children physically active and healthy (Fragala-Pinkham et al., 2011). According to a study done by Vonder Hulls et al., aquatic therapy led to a “substantial increase in tolerating touch, tolerating crowded or loud areas,

performing swimming skills, demonstrating water safety and paying attention" as well (2006, p.19). These skills were not directly being worked on during therapy sessions but were incorporated due to the environment in which the therapy tool place (Vonder Hulls et al., 2006). By learning water safety and swim skills during therapy sessions parents can feel more comfortable taking their child to aquatic environments. It is hard for parents to find places that their autistic children enjoy and that the whole family can enjoy so this is beneficial to families (Lawson et al., 2019).

Current Study

More research is needed on the benefits of aquatic occupational therapy, particularly for children on the autism spectrum who have specific developmental, psychosocial, and physical needs that may be uniquely fitting for water-based therapy. The proposed study aims to identify the benefits by examining the progress a child with ASD makes in motor skills, social, emotional, and physical development as well as evaluate the therapist's ability to provide therapy, compared to therapy provided on land. It is hypothesized that providing occupational therapy in an aquatic environment for children with autism will have equal to or greater benefits as occupational therapy provided on land.

Method

Sample

Twenty-one participants were recruited from occupational therapy clinics and programs around the United States. Occupational therapists at each site, who practice aquatic therapy of children with autism (or have in the past), were provided information about the study and survey via email, creating a volunteer convenience sample. In addition to these sites, the survey was posted on Facebook to reach occupational therapists who are currently practicing or have

practiced aquatic OT for children with autism. Data from two participants could not be used due to not meeting the requirements of being a licensed occupational therapist and having provided aquatic occupational therapy to children between 4-18 years old with ASD. Thus, the data for this study is based on responses from 19 participants who met the requirements of being a licensed occupational therapist and having provided aquatic occupational therapy to children between 4-18 years old with ASD.

Measures

The survey consists of 41 questions in total; ten questions gathering demographic information, 26 multiple choice questions on the observed fluctuation of occupational therapy and autism-related skills and functions, and 5 open-ended questions (see appendix).

Demographics. Participants self-reported their age, gender, race, occupation, length of time working in occupation, education level, any specialized training or licensures, and client base.

Life Skills. A series of skills were listed related to fine and gross motor skills, social-emotional skills, life skills, and other skills (e.g., swimming ability) and therapists reported whether they saw "substantial decrease," "slight decrease," "no change," "slight increase," "substantial increase," or "not applicable/not observed" among children with autism participating in aquatic OT. A similar measure has been used in the past in *Clinicians' Perception of Benefits of Aquatic Therapy for Young Children with Autism: A Preliminary Study* by Hulls, Walker & Powell, 2006).

Benefits/Challenges of Aquatic OT. The third section of the survey included open-ended questions allowing the therapists to list any skills that the survey may not have covered,

that they have observed changes in, or that are more easily accomplished or more challenging to accomplish in an aquatic environment.

Procedure

The survey consists of three sections- demographic questions, a skills assessment, and a series of open-ended questions- to learn more about specific changes observed in children with autism who are participating in aquatic therapy. Demographic and skill items will be explored using descriptive statistics in SPSS. Using Braun and Clarke's approach to thematic analysis (2006), the researcher (with reliability coder), will read and code open-response items from each survey to identify recurring patterns of benefits with aquatic occupational therapy.

Results

Demographics

The majority of the sample reported their gender as female (84.21%), 10.53% reported male, and 5.26% (1 participant) classified themselves as both. The racial/ethnic breakdown of the sample is as follows: 89.47% Caucasian, 5.26% African American, and 5.26% multiple race/ethnicity (i.e., reported Black, White, and Hispanic). Majority of participants were between the ages of 31-35 (20 & Under, 15.79%; 26-30, 15.79%; 31-35, 21.05%; 36-40, 21.05%; 41-45, 5.26%; 51-55, 5.26%; 56-60, 10.53%; 66-70, 5.26%). The most common range of experience practicing OT was 6-10 years. The majority of the sample had obtained a master's degree (73.68%) with 21.05% having a doctoral degree and 68.42% of the sample reporting no special training.

Change in Skills Following Aquatic OT

Skills which 50 percent or more of the sample had observed and agreed had a "slight increase" or "significant increase" following aquatic OT included the following: efficient

transitions between activities, social interactions, communication, confidence, social competence, comfort in the water, swimming ability, concentration/focus, interest in leisure swimming, muscle strength, balance, tolerating touch, tolerating crowded areas, imaginative, and ability to transfer skills learned in the aquatic environment to land (yellow and red highlighted skills in Table 2 in Appendix). The only skill which 50 percent or more of the sample had observed and agreed had a "slight decrease" or "significant decrease" following aquatic OT was distractibility. Skills which 80% or more of the sample had observed and agreed seeing a "slight increase" or "significant increase" were social interaction, communication, confidence, comfort in the water, concentration/focus, and interest in leisure swimming (Red highlighted skills in Table 2 in Appendix).

Open-Ended Aquatic OT Questions

Unique benefits of aquatic OT. The most referenced resource or situation aquatic therapy provided that could not be found on land is the sensory input that is provided to the entire body while in the water, 11 references were made to this in participant responses. Other resources or situations referenced frequently in responses were more engagement, 6 references; balance activities, 4 references; gravity, 2 references; and dressing skills, 2 references (See Table 3 in Appendix).

Limitations of aquatic OT. The most referenced resource that was unavailable in aquatic therapy provided that otherwise would have been available on land is the ability to work on fine motor skills, 6 references were made to this in participant responses. Other resources or situations referenced frequently in responses were published resources, 3 references; independent play, 2 references; materials, 2 references; peers, 1 reference; and feeding goals, 1 reference (See Table 4 in Appendix).

Other skills from aquatic OT. The most referenced skill that was not asked about in the survey but that participants saw an increase or decrease in due to aquatic OT is arousal levels, which was referenced 3 times in responses. Other resources or situations referenced frequently in responses were increase in risk-taking/safety awareness, 2 references; provides an environment for working on dressing, 2 references; immediate impacts of aquatic OT, 1 reference; and coordination and endurance, 1 reference (See Table 5 in Appendix).

Aquatic-only OT skills. The most referenced skill that can be worked on in an aquatic setting but not on land is sensory processing and integration with 7 references in participant responses. Other skills referenced frequently in responses were building strength, 4 references; coordination/body awareness, 3 references; swimming skills, 3 references; balance, 2 references; and calming environment, 1 reference (See Table 6 in Appendix).

Other comments. When given the opportunity to comment on any other aspects of aquatic therapy, participants referenced transitions the most (3 references) as another aspect of aquatic OT that they had found to be beneficial or detrimental that they thought it was important for the researcher to know. Other aspects of aquatic OT referenced frequently in responses were versatility of aquatic OT and environment, 2 references; the importance of safety, 2 references; visibility in the water, 2 references; and hypertensive input, 2 references (See Table 7 in Appendix).

Discussion

This descriptive study examined 19 occupational therapists' experiences providing OT in an aquatic environment to children ages 4-18 years on the autism spectrum. The study found that there are many benefits as well as a few challenges unique to aquatic OT when working with

children with ASD. Additionally, the study revealed extra precautions that need to be taken during aquatic OT and how occupational therapists could be more effective in using aquatic OT.

In this study the researcher aimed to answer how the rate of progress in motor skills, social, emotional and physical development was impacted by aquatic therapy. The occupational therapists in this study reported an increase in gross motor skills and physical development such as in balance, muscle strength, and swimming ability. An increase in social development was reported by occupational therapists through an increase in children's social interactions, communication, and tolerating crowded areas. An increase in emotional development was observed by therapists through an increase in their client's confidence, concentration, and imagination. Although there were benefits seen in all the areas of development and motor skills, it was noted six times that fine motor skills are difficult to work on and make progression in an aquatic environment. In addition, feeding goals (2 mentions) and goals with peers (1 mention) were also difficult to work on in an aquatic environment. Looking at the number of benefits seen in aquatic therapy aiding children in reaching their goals and progressing in comparison to the downfalls and challenges aquatic therapy presents, the benefits outnumber the negatives, supporting progression be made more effectively in an aquatic environment than on land for developmental skills and gross motor skills.

This study also aimed to identify how easy and effective it was for occupational therapists to provide therapy in water compared to land. Therapists noted that almost all of the skills they worked on and performed on land could also be done in the water, but the therapist had to be creative. A few skills and scenarios therapists noted that needed extra attention while in an aquatic environment were the need to be prepared for transitions between activities (3 mentions), the safety component (2 mentions), and independent play periods (1 mention). This

supports that if the occupational therapist makes a detailed plan for an aquatic therapy session, taking into consideration transitions, safety precautions and equipment needed, then aquatic therapy is equally if not more conventional and effective as land therapy.

Unique Properties of Aquatic Therapy

The unique properties of water and circumstances it creates, seen in prior studies, was confirmed in this study. Becker (2009) discussed how water incorporates density, hydrostatic pressure, buoyancy, viscosity, resistance, turbulence, and thermal conductivity into OT which can be used to decrease as well as increase the intensity of the therapy session (2009). In the present study, therapists stated that gravity was a resource that could not be found on land that granted children greater physical freedom and ease of motion. These water properties take away some of the challenges that children with autism face when they are on land, by the moderation of sensory arousal, decreased pressure from gravity, and increase in safety, as well as providing additional learning opportunities (Fragala-Pinkham et al., 2011; Franken et al., 2013; Lawson et al., 2019). Therapists in the present study further supported these previous finding, with the exception of increased safety. Sensory arousal and input to the body is the most prominent resource that therapists say an aquatic environment provides which land does not, with 11 mentions in the study. Gravity again was mentioned twice in this study and the decrease of gravity allowing the client to move more freely. Additional learning opportunities such as working on dressing (2 mentions) and swimming skills (3 mentions) were addressed by therapists in this study. The study done by Fragala-Pinkham et al. states that safety is increased in an aquatic environment, but this study found that was more of a challenge and concern in aquatic therapy than it is in land therapy (Fragala-Pinkham et al., 2011; Franken et al., 2013;

Lawson et al., 2019). Therapists in the present study expressed concerns, due to safety, about clients being able to be independent in the water.

The Lawson et al. study looked at the importance of children with autism acquiring water safety skills and basic swimming abilities (Lawson et al., 2019). Current study therapists agreed that through providing aquatic occupational therapy an increase children's swimming skills (47.77%), comfort in the water (83.34%), and learning water safety (1 mention). This study supports the importance of teaching these skills and it is an indirect benefit of aquatic therapy.

Future Direction

This study provides a base for the need for future studies and the need for additional materials and resources on aquatic occupational therapy. This study displayed that there are advantages and benefits to aquatic occupational therapy due to therapists agreeing (50% of more of response) that 15 out of 26 skills measured increased after aquatic occupational therapy. The study also found that there were limited published resources on aquatic occupational therapy for therapists to use to guide their practice. This study included 19 aquatic occupational therapists who work with children on the autism spectrum. Additional research is needed with a larger sample of therapists in order to determine if aquatic OT significantly benefits children. It is critical that researchers recruit a sufficient number of therapists (and, ideally, children) to determine statistically significant improvements so that evidence-based best practices are available for therapists to use. Once the research and materials become available on this novel therapeutic practice, new and existing OT's can be educated on the benefits and implement aquatic OT into sessions when appropriate.

Conclusion

This study was done to determine if there were additional benefits during aquatic occupational therapy compared to a typical occupational therapy session on land for clients ages 4 to 18 years on the autism spectrum. This study is significant as there is limited research on aquatic OT and no studies specifically focused on the effect aquatic OT has on the pediatric, autistic population. This study can serve as a baseline or pilot study for the potential benefits of aquatic occupational therapy and aid in justifying future research. This study found that there are benefits in an aquatic environment for children ages 4 to 18 years on the autism spectrum that cannot be found on land; thus, emphasizing a need for further research and awareness of these benefits.

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APPENDIX

Survey Questions

Demographics

1. Are you a licensed occupational therapist? (Yes, No)
2. Are you currently practicing, or have you practiced aquatic occupational therapy? (Yes, No)
3. Have you provided aquatic occupational therapy to a child between the ages of 4-18 years old with a primary diagnosis of ASD? (Yes, No)
    a. If yes, how long did you provide aquatic-based OT to the child? (_____)
4. Gender? (Female, Male, Other _____)
5. Race? (Caucasian, Latino, African American, multiple, Asian, other_____)
6. Age?_____
7. Occupation?_____
8. Length of time working in occupation (years) _____
9. Education level? (high school, bachelors, masters, doctorate, other_____)
10. Any specialties training or license? (Yes, No)
    a. If yes, title of specialty or license: _____

Skills Assessment

1. Please choose the answer which best fits your observations of the skill listed from when you provided aquatic occupational therapy to children age 4-18 with a primary diagnosis of ASD. Responses for each: “substantial decrease,” “slight decrease,” “no change,” “slight increase,” “substantial increase,” or “not applicable/not observed”
    a. Transitions between activities

b. Social interactions
c. Communication
d. Confidence
e. Antisocial behavior (hostile/irritable, antisocial/aggressive, defiant/disruptive)
f. Social Competence (peer relations, self-management/compliance, academic behavior)
g. Comfort in the water
h. Swimming skills
i. Weight
j. Flexibility
k. Pain/discomfort in bones while performing therapy
l. Pain/discomfort in muscles while performing therapy
m. Pain/discomfort in joints while performing therapy
n. Concentration/focus
o. Distractibility
p. Object-control
q. Interest in leisure swimming
r. Muscle strength
s. Balance
t. Tolerating touch
u. Tolerating crowded areas
v. Imaginative play
w. Sharing/turn-taking

x. Interest in making friends

y. Sensory arousal (increased, less manageable than when on land, or decreased to a more functional level)

z. Ability to transfer skills learned in the aquatic environment to land (increase, easy to do or decrease, had to relearn completely on land)

Open-Ended

1. Did an aquatic environment provide any resources or situations that otherwise could not be found on land?
2. Did an aquatic environment take away any resources that otherwise would be used on land?
3. Are there any skills not listed above that you saw an increase or decrease in the child's ability due to aquatic occupational therapy?
4. Are there any skills that can be worked on in an aquatic setting that could not be done on land?
5. Anything else you think is beneficial to note?

Table 1

Demographics

Variable		**Percent**	**Number of Participants**
Gender			
	Female	84.21%	16
	Male	10.53%	2
	Other	5.26%	1 (identifies as both)
Race			
	Caucasian	89.47%	17
	African American	5.26%	1

	Other	5.26%	1 (identifies as Black, White, Hispanic)
Age			
	20 & Under	15.79%	3
	21-25	0%	0
	26-30	15.79%	3
	31-35	21.05%	4
	36-40	21.05%	4
	41-45	5.26%	1
	46-50	0%	0
	51-55	5.26%	1
	56-60	10.53%	2
	61-65	0%	0
	66-70	5.26%	1
Occupation			
	Occupational Therapist	89.47%	17
	Aquatic Specialist	5.26%	1
	Professor	5.26%	1
Time in OT (in years)			
	1 or less	0%	0
	2-5	31.58%	6
	6-10	31.58%	6
	11-15	10.53%	2
	16-20	5.26%	1
	21-25	0%	0
	26-30	5.26%	1
	31 or over	15.79%	3
Highest Level of Education			
	Master’s degree	73.68%	14
	Doctoral Degree	21.05%	4

	Other	5.26%	1
Specialty Training/Licenses			
	No	68.42%	13
	Yes	31.58%	6

Table 2

Aquatic OT Questions

Skill	Substantial Decrease	Slight Decrease	Not Applicable/ Not Observed	Slight Increase	Substantial Increase	No Change
Efficient Transitions Between Activities	0.00% (0)	0.00% (0)	16.67% (3)	50.00% (9)	22.22% (4)	16.67% (3)
Social Interactions	0.00% (0)	0.00% (0)	5.56% (1)	44.44% (8)	38.89% (7)	11.11% (2)
Communication	0.00% (0)	0.00% (0)	5.56% (1)	55.56% (10)	33.33% (6)	5.56% (1)
Confidence	0.00% (0)	0.00% (0)	0.00% (0)	38.89% (7)	44.44% (8)	16.67% (3)
Antisocial behavior (hostile/irritable/antisocial/aggressive)	5.56% (1)	38.89% (7)	11.11% (2)	22.22% (4)	11.11% (2)	11.11% (2)
Social Competence (per relations, self-management/compliance, academic behavior)	0.00% (0)	11.11% (2)	5.56% (1)	61.11% (11)	5.56% (1)	16.67% (3)
Comfort in Water	0.00% (0)	0.00% (0)	11.11% (2)	5.56% (1)	77.78% (14)	5.56% (1)
Swimming skills	0.00% (0)	0.00% (0)	11.11% (2)	44.44% (8)	33.33% (6)	11.11% (2)
Body Weight	0.00% (0)	5.56% (1)	27.78% (5)	5.56% (1)	0.00% (0)	61.11% (11)
Flexibility	0.00% (0)	0.00% (0)	22.22% (4)	33.33% (6)	5.56% (1)	38.89% (7)
Pain/discomfort in Bones while Performing Therapy	0.00% (0)	16.67% (3)	61.11% (11)	0.00% (0)	0.00% (0)	22.22% (4)

Pain/discomfort in Muscles while Performing Therapy	0.00% (0)	16.67% (3)	50.00% (9)	11.11% (2)	0.00% (0)	22.22% (4)
Pain/discomfort in Joints while performing therapy	0.00% (0)	22.22% (4)	61.11% (11)	22.22% (4)	22.22% (4)	16.67% (3)
Concentration/Focus	0.00% (0)	0.00% (0)	5.56% (1)	61.11% (11)	27.78% (5)	5.56% (1)
Distractibility	5.56% (1)	66.67% (12)	5.56% (1)	0.00% (0)	5.56% (1)	16.67% (3)
Object-Control	0.00% (0)	11.11% (2)	22.22% (4)	33.33% (6)	5.56% (1)	27.78% (5)
Interest in Leisure Swimming	0.00% (0)	0.00% (0)	11.11% (2)	38.89% (7)	44.44% (8)	5.56% (1)
Muscle Strength	0.00% (0)	0.00% (0)	16.67% (3)	55.56% (10)	22.22% (4)	5.56% (1)
Balance	0.00% (0)	0.00% (0)	11.11% (2)	55.56% (10)	22.22% (4)	11.11% (2)
Tolerating Touch	0.00% (0)	0.00% (0)	16.67% (3)	38.89% (7)	38.89% (7)	5.56% (1)
Tolerating Crowded Areas	0.00% (0)	0.00% (0)	27.78% (5)	33.33% (6)	16.67% (3)	22.22% (4)
Imaginative	0.00% (0)	0.00% (0)	27.78% (5)	55.56% (10)	0.00% (0)	16.67% (3)
Sharing/Turn Taking	0.00% (0)	0.00% (0)	27.78% (5)	27.78% (5)	11.11% (2)	33.33% (6)
Interest in Making Friends	0.00% (0)	0.00% (0)	27.78% (5)	22.22% (4)	11.11% (2)	38.89% (7)
Sensory Arousal	11.11% (2)	50.00% (9)	11.11% (2)	11.11% (2)	16.67% (3)	0.00% (0)
Ability to Transfer Skills Learned in Aquatic Environment to Land	0.00% (0)	0.00% (0)	5.56% (1)	55.56% (10)	16.67% (3)	22.22% (4)

Table 3

Open-Ended Aquatic OT- Question 1 (What resources or situations did aquatic therapy provide that otherwise could not be found on land?)

Sensory input to entire body (n=11)	
"Proprioceptive input to the entire body at once[.]"	"Deep proprioceptive input constantly[.]"

"Whole body intensive proprioceptive input for increased praxis. More easily work on ADLs like bathing/showering. Easy to facilitate a calm environment and calm/alert the sensory system."	"Great means to offer needed sensory input as the pool offers deep pressure input, proprioceptive input and vestibular input all in one."
"Proprioceptive input with full body non-invasive deep pressure cannot be better obtained- many patients enjoy getting into the tub when disorganized or overwhelmed[.]"	"Tolerance to the proprioceptive and tactile input in the water."
"The kids I saw had a lot of sensory aversions which impacted their feeding performance. Many kids were very tactilely sensitive, demonstrated gravitational insecurities/vestibular sensitivities, and had low muscle tone/low strength. The pool environment provides a safe environment to reduce these sensitivities for avoidant kids. Aquatic therapy was also great for kids who were very sensory seeking as it provided a lot of vestibular, proprioceptive, tactile, and auditory input which was very calming and helped these kids focus better than on land."	
More Engagement and Motivation (n=6)	
"More motivation and engagement in activities for this that loved water."	"Occupation based environment leads to more motivation and greater outcomes as almost every kid loves the water."
"Increases motivation of movement and endurance activities, balance activities, bilateral coordination activities."	"Increased motivation with activities, increased sensory regulation, and increased transitions between activities."
Balance Activities (n=4)	
"It was also usually easier on the therapist and the client to safely perform balance and strengthening exercises since the water took out the gravity element."	"Easier to work on things in the water than on land (balance, motor planning, oral-motor, sensory)[.]"
"Aquatic therapy challenges core strength, endurance, and balance much more than on land. It also provides sensory input constantly throughout the session, which can be difficult on land."	
Gravity (n=2)	
"A gravity-eliminated environment that allowed the client to move more freely and easily without increased energy expenditure. It was also usually easier on the therapist and the client to safely perform balance and strengthening exercises since the water took out the gravity element."	

Dressing skills (n=2)	
"With aquatic therapy we also gain the integrated ADL component to work on dressing skills prior to and after the session."	"More easily work on ADLs like bathing/showering."

Table 4

Open-Ended Aquatic OT- Question 2 (Please describe any resources that were unavailable through aquatic therapy that otherwise would have been available on land?)

Ability to Work on Fine Motor Skills (n=6)	
"The ability to incorporate tasks such as handwriting, fine motor skills."	"Fine motor, visual motor, academic and manual dexterity tasks are more difficulty to target."
"Aquatic toys and games for FM skills, many options for gross motor but limited in waterproof FM and cognitive toys. "	"Cutting is very hard in the pool and you had to be very creative with writing and incorporating fine motor goals. As a therapist you have to use the pool to your advantage and see how you could best use the pool to target different sensory systems."
Published Resources (n=3)	
"Not much resources on PEDIATRIC aquatic therapy and OT in general."	"There is really limited documented research on the sensory and motor benefits of aquatics. Also, the benefits of co-treatment in these sessions."
"Concrete sensory strategies to demonstrate for parents (ones to be used at home)."	
Independent Play (n=2)	
"Independent/self-directed work/play is a little more risky in the pool as the therapist often cannot be too far away for safety reasons."	
Materials (n=2)	
"Obstacle course materials, materials to work on ADLs."	
Peers (n=1)	
"Peer interactions, allowed to participate in activities independently to improve independence"	
Feeding Goals (n=1)	
"Any feeding goals were not able to be addressed[.]"	

Table 5

Open-Ended Aquatic OT- Question 3 (Are there other skills not asked about in this survey that you saw increase or decrease in the child's ability due to aquatic occupational therapy?)

Arousal Levels (n=3)	
"I think the child's arousal levels after spending time in the water were significantly different than just land based therapy."	"A lot of kids with Autism are difficult to engage in activities due to decreased motivation and most of my kids absolutely loved the pool and were easier to motivate during aquatic therapy."
Increase in Risk Taking/Safety Awareness (n=2)	
"Safety awareness."	"Risk taking/safety awareness"
Provides Environment for Working on Dressing (n=2)	
"Aquatic therapy provides a natural environment (locker room) to work on ADLS: changing into swim suit, using toilet before, shower after swim, drying body and getting dressed afterwards. These ADLs are a big factor of why I recommend Aquatic Therapy to children with ASD- it provides are great motivator and natural reason to work on dressing and ADLs."	"Dressing/ADLs before and after therapy."
Immediate Impacts (n=1)	
"There are immediate impacts and then longer term impacts. In my experience, I saw more immediate impacts, but skills learned in the pool allowed for more engagement and exposure."	
Coordination & Endurance (n=1)	
"Overall coordination and endurance."	

Table 6

Open-Ended Aquatic OT- Question 4 (What skills can be worked on in an aquatic setting that could not be done on land?)

Sensory Processing Integration (n=7)

“Sensory processing integration involving both proprioceptive and vestibular sensory input is much easier to work on in the water as it provides proprioceptive input just by being in the water itself.”	“Resistance against water provides great prop input and strength building.”
“I feel like all skills can be worked on in both settings, but with the weight, sensory and gravity issues our ASD clients can perform better.”	**“**Tolerance to the tactile and proprioceptive inputs of water.”
Strength (n=4)	
“Range of motion and strength due to natural gravity”	**“**Core strengthening by rolling in water or staying afloat on back.”
“Core strength/stability is continuously worked on in the aquatic environment due to turbulence and changes in water resistance.”	
Coordination/Body Awareness (n=3)	
“Breathing/head motions timing and coordination for swimming”	“Also working on kinesthetic awareness and body awareness.”
Swimming Skills (n=3)	
“Breathing/head motions timing and coordination for swimming”	“Swimming”
Balance (n=2)	
“Balance can be worked on either space, but fear of falling is significantly decreased in water.”	“Targeting all the sensory systems, different types of balance, vestibular (especially for kids who do not like to have their hair washed due to gravitational insecurities).”
Calming (n=1)	
“Going under water often provides a "calm zone" for some of the kids that I work with, offering the deep pressure input as well as the decreased auditory input when going under water.”	

Table 7

Open-Ended Aquatic OT- Question 5 (What else have you found to be beneficial (or detrimental) with aquatic therapy that we should know about?)

Transitions (n=3)

"Need to be prepared on ways to work on transitioning out of the water (i.e. picture schedules, using a routine with the same task at the end, etc.) as most kids will not want to get out."	"Difficult to schedule around-current location we have a pool on site but my previous employer we had to schedule all kids at the end of the day so we could immediately go home after due to being wet."
Versatility (n=2)	
"Almost any skill that can be worked on on land can be worked on in aquatic therapy in some way"	"I would say on the detrimental side there isn't the variety of equipment/ games."
Safety (n=2)	
"It is challenging to work in a pool without a zero depth or under 3 feet deep. Care has to be taken for safety and for dependence on adults. it is challenging to allow independent exploration, which directly affects the ability to control breathing. Adaptions can be done using small docks, mats and even the pool walls."	"Pool/aquatic safety is something you can also work on with kids with ASD that is super important."
Visibility (n=2)	
"Having and underwater camera was helpful to have the patient see their feet and where they were."	"It can sometimes be difficult to demonstrate in the pool as the water affects visibility. If I need a child to see exactly what I am doing with my body, it is sometimes beneficial to break down the skill and teach them on land before expecting success in the pool."
Hypertensive Input (n=2)	
"People with sensory sensitivities may have a mixed response to being in a busy pool."	"the constant input from the water is super beneficial for a lot of kids on the spectrum. I would say on the detrimental side there isn't the variety of equipment/ games. Or the input may be too much is hypersensitive."
Balance & Coordination (n=2)	
"It is very beneficial for core strengthening, balance, motor planning, and endurance."	"Great for building balance and coordination."
Independence (n=1)	
"Care has to be taken for safety and for dependence on adults. It is challenging to allow independent exploration, which directly affects the ability to control breathing."	