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Abstract

The purpose of this mixed methods pre-/post-pilot intervention study was to assess parental psychological health and child challenging behaviors before and after a swimming program for children with autism. Participants were 10 parent–child dyads. Child's challenging behaviors were lower in the post testing (Cohen's d = 0.07–0.45). Mean scores were improved for parent perception of general health (Cohen's d = 0.22). Three themes emerged from the post swim program focus group: (a) Parent

satisfaction with instructors with sub themes (i) firmness (ii) creativity, and (iii) promotion of social interaction and sharing, (b) improved child sleeping, and (c) family dynamics with sub themes (i) siblings wanted to swim and (ii) parents' fear of drowning. Preliminary results point to improved child behaviors and parent perception of general health. Future studies can focus on expanding the swim program to include all family members.

Keywords

swimming program, autism spectrum disorders, caregivers

Children with autism spectrum disorder (ASD) display persistent deficits in social communication and social interaction across multiple contexts and have restricted, repetitive patterns of behavior, interests, or activities that cause clinically significant impairment in social or occupational functioning (American Psychiatric Association [APA], 2013). The prevalence of ASD is 1 in 54 individuals (Maenner et al., 2020). Approximately 50% of children with ASD have challenging behaviors such as self-injury, for example, biting, banging their head or body parts, and hair pulling (Richards et al., 2012). Furthermore, an estimated two thirds of children with ASD have sleep problems that contribute to challenging behaviors (Abel et al., 2018; Souders et al., 2017). Child challenging behaviors have a powerful impact on the caregivers' perception of their well-being (Johnson et al., 2011) which in turn can affect their health and the health of their caregivers (Almansour et al., 2013; Karst & Van Hecke, 2012; Strang et al., 2012).

Exercise for Children with Autism

While exercise is known to improve the health of children with ASD and their caregivers, many children with ASD do not regularly exercise and are at higher risk of obesity than typically developing children (Curtin et al., 2014). Medications for challenging behaviors and sleep disorders increase the child with ASD's risk of obesity (Polfuss et al., 2016). Children with ASD who do exercise generally prefer to do individual non-team-based exercise such as swimming but lack opportunities to learn how to swim (Polfuss et al., 2016). While children with ASD in aquatic therapy programs get exercise that improves their cardio-respiratory health, muscle strength, and endurance, it is challenging for children with ASD to learn in typical swim programs that are offered in large groups (Alaniz et al., 2017). Furthermore, drowning is the number one cause of death for children with ASD (Guan & Li, 2017). Children with ASD are known to wander away from their caregivers and are drawn to water, putting them at an even higher risk of drowning if they do not know how to swim (Rice et al., 2016).

In light of the physical and mental health risks for children with ASD and their caregivers, assessing the impact of swim programs for children with ASD on child challenging behaviors is vital for family health. Previous studies on swim interventions for children with ASD looked at improvement in emotional response, adaptation to change, daily living skills, adaptive behaviors, and emotional functioning in a sample of 26 children with ASD aged between 6 and 12 years (Caputo et al., 2018). Previous studies also looked at increased physical and social interactions with typically developing peers and siblings during the peer-/sibling-assisted conditions in a sample of 21 children aged between 7 and 12 years (Chu & Pan, 2012). Previous studies also assessed improvement by at least one level on the Swimming Classification Scale in a sample of 12 children between 6 and 12 years (Fragala-Pinkham et al., 2011). Furthermore, the study conducted by Alaniz and colleagues (Alaniz et al., 2017) showed an

improvement in swim and water safety skills over time after 8 hours of group therapy including breath control, propulsion, and changing positions while swimming in a sample of seven children with ASD aged between 3 and 7 years (Alaniz et al., 2017). Also, another study showed that children with ASD enjoyed swimming significantly more (fifth most enjoyed activity) than typically developing children (thirtieth most enjoyed; Eversole et al., 2016). To date, previous studies have not assessed parental psychological health and child behaviors before and after a private swimming program for children with ASD as proposed in this study.

Theoretical Framework

The Individual and Family Self-Management Theory (IFSMT; Ryan & Sawin, 2009) provided the theoretical framework for this study. The IFSMT involves the assessment of risks and complexities as well as the strengths of the family in preparing to manage the child's condition as they participate in a swim program. Based on the IFSMT, knowledge and beliefs, self-regulation, and social facilitation are the key processes in this study (Ryan & Sawin, 2009). Parents need the knowledge and skills about water safety to manage the child's health at home and a positive belief in their own self-efficacy to be safe around water with their child. In the context of swimming, self-regulation refers to family preparation for swimming. Social facilitation refers to the availability of family, friends, and swim instructors who are accessible for emotional and social support. These processes ultimately impact the overall ease or difficulty experienced during the swim program. The content of the swim program water safety class and the mental health resources, along with private instruction addressed each of these processes.

Purpose

Thus, the purpose of this mixed methods pilot study was to assess parental psychological health and child behaviors before and after a private swimming program for children aged between 5.5 and 11 years with ASD. There were the two research questions:

1. Do caregivers perceive fewer challenging child behaviors after their child participates in a swimming program for children with ASD?
2. Is there improvement in caregiver psychological well-being, positive thinking, and state anxiety after their child participates in a swimming program for children with ASD?

Methods

Design

This study was an interventional, longitudinal, pilot, mixed methods, feasibility study. We provided a 12-session private swim lesson program. The outcomes were measured at baseline and at the completion of the swim program.

Sample

The sample included 10 children with ASD and their primary caregivers. The program was offered in May through June 2019. The inclusion criteria for the study included English-speaking children with a diagnosis of ASD, and between the ages of 5.5 and 11 years. Another inclusion criterion was the availability of a primary caregiver to be present with the child in the pool area during the entire

swimming program. Exclusion criteria for children were seizure disorder, IQ < 70, and ostomies or other physical disabilities. Caregiver inclusion criteria were English-speaking, primary caregiving parent of the child with ASD. Funding limited the sample size to 10 participants.

The recruitment of the participants was by convenience sampling via emails from a registry of names of parents at the University Interdisciplinary Autism Consortium who agreed to be contacted for research studies. Additional assistance for recruitment was received from executive director at the local autism society who distributed IRB approved flyers at a parent conference and on a private autism society social media site for caregivers of children with ASD. The first 10 caregivers who contacted the principal investigator (PI), who met inclusion criteria and who agreed to be in the study were invited to the swim safety session at the University where the PI explained the purpose of the study, risks and benefits, incentives, and the procedure for the swim program.

Measures

Demographic questionnaire

The demographic questionnaire included questions for parents and children. Data were collected on parent gender, age, marital status, race, level of education, income, and child gender and age. Questions about swimming exposure prior to the study included asking the parent if the child had ever been in a pool, put their face in the water, used a life jacket or other floating device, and if they were able tread water, or propel themselves forward in the pool.

Children's challenging behaviors

Children's challenging behaviors from the parent perspective were measured by the Nisonger Child Behavior Rating Form (Nisonger CBRF). The parent version of Nisonger CBRF was used in this study to identify the problem behaviors and the social adaptive behaviors in children with ASD from caregivers' perspectives (Aman et al., 1996). The Nisonger CBRF consists of 76 items that measure two domains: The social and problem behaviors. The first domain, the social behavior domain, consists of 10 items and is scored on a 4-point Likert scale ranging from not true to always true. The social behavior domain includes two subscales: compliant/calm (six items) and adaptive/social (four items). The second domain, the problem behavior domain, is 66 items and includes: (a) disruptive behavior disorder subscales: conduct problems (sixteen items) and insecure/anxious (fifteen items) and (b) ADHD subscales: hyperactive (nine items), self-injury/stereotypic (seven items), self-isolated/ritualistic (eight items), and overly sensitive (five items), scored on a 0–3 Likert scale from 0, did not occur or not a problem, to 3, occurred a lot or was a severe problem (Lecavalier et al., 2004). The Nisonger CBRF is a reliable measure as indicated by Cronbach's alphas for the social behavior domain and the problem behavior domain subscales, which were 0.87 and 0.94, respectively in a sample of 117 caregivers of persons with ASD (Bekhet, 2016).

Parent positive thinking

Positive thinking was measured by the Positive Thinking Skills Scale (PTSS; Bekhet & Zauszniewski, 2013). The PTSS is an eight-item questionnaire that assesses eight positive thinking skills on a 4-point Likert scale. Scores may range from 0 to 24 with higher scores indicating caregivers' use of more positive thinking skills. The PTSS is a reliable scale as indicated by Cronbach's alpha of 0.90 in a sample of 109 of caregivers with persons with ASD (Bekhet & Zauszniewski, 2013). Construct validity is also supported by significant correlations in the expected directions with measures of resourcefulness,

depression, and general well-being (rs = 0.63,–0.45, and .40 respectively; Bekhet & Zauszniewski, 2013).

Parent psychological well-being

Psychological well-being was assessed by the Psychological General Well-being Index (PGWBI) questionnaire (Dupuy, 1984). The PGWBI consists of 22 items that reflect 6 non-overlapping health-related quality of life domains namely: anxiety (five items), depressed mood (three items), positive well-being (four items), self-control (three items), general health (three items), and vitality (four items). Each domain is rated on a 6-point Likert scale ranging from 0 to 5. A summary score is a maximum of 110 points and can be calculated by summing up the scores of all domains; the higher the score, the higher the well-being. The scale is reliable as shown by a Cronbach's alpha of correlations between 0.90 and 0.94 (Moholdt et al., 2011).

Parent state anxiety

The State-Trait Anxiety Inventory (STAI) Form X-1 was used to measure caregivers' state anxiety (Spielberger & Gorsuch, 1983). It consists of 20 items rated on a 4-point Likert Scale, with higher scores representing higher levels of anxiety. The scale is reliable as indicated by Cronbach's alpha that ranges from 0.86 to 0.95 (Spielberger & Gorsuch, 1983). Test-retest coefficients range from 0.69 to 0.89 (Spielberger, 1989). STAI is a good predictor of caregivers' stress overtime (Elliott et al., 2001).

Data Collection Procedure

Study approval was obtained from the University Institutional Review Board. Participants who agreed to be in the study were invited to the swim safety session at the University where the PI explained the purpose of the study, risks and benefits, incentives, and the procedure for the swim program. Next, the caregivers signed the informed consent and filled out the demographic questionnaire and baseline study questionnaires. A focus group was also hosted for the 10 caregivers of the children with ASD following the 12- session swimming program intervention. The focus group was held four days after the last swim lesson on the University campus. Caregivers also completed the post-swim program surveys at that time. Detailed field notes on the child progress were collected by the research assistant during the swim sessions.

Incentives were provided at the following three time points during the swim program to thank participants for their time: (1) a thirty-five dollar gift card after the completion of the pre-swim surveys, (2) a sixty dollar gift card halfway through the swim lessons, and (3) a sixty dollar gift card after the completion of lessons and the post-program focus group and post-program surveys.

Swimming Program Intervention

The swim program intervention consisted of two parts. The first part was an in-person class that was 60 minutes long and was held on the University campus to teach caregivers about precautions for safety around water. The second part included 12 sessions in the pool over the time span of three weeks, with five lessons in the first week, five lessons in the second week, and two lessons in the third week. Each day of the program, 10 children received a 30-minute long private swim lesson. The program started at noon and lasted until 3:30 p.m., from Monday through Friday. Two lanes of the pool were used at a time to accommodate two children for 30 minutes. There was a main swim

instructor and two other instructors working with the children. The main instructor oversaw the instruction in both lanes and provided directions to the other instructors as needed. Thus, there was a one-to-one instructor for each child. During these lessons, instruction was provided on a one-to-one basis with each child having their own swimming instructor in their own lane of the pool. All three instructors were lifeguards. An additional lifeguard, a research assistant, and the PI were present during the swimming program. A caregiving parent was present at the side of the pool during every lesson.

The 12 swim sessions in the pool were tailored to meet the needs of each child. They were adapted from the Aquatic Skills checklist (Alaniz et al., 2017) and from the instructor's experience teaching at the YMCA as an American Red Cross adaptive swim instructor. First, in order to acclimate the child to the water, the instructor used cups to slowly pour water on the child's arms and legs while the child sat on the side of the pool at the start of the swim lesson. Second, because the children needed to master swim skills in an order, they were taught the skills in the following sequence: (a) enter the pool independently, (b) navigate through the pool by holding the pool wall, (c) blow bubbles on the surface of the water, (d) put face under water and blows bubbles, (e) float with, and without, the foam swim noodles, (f) scoop hands and kick feet in the water, (g) blast-off from the side of the pool, (h) retrieve an item and return it to the instructor, (i) tread water and (j) swim the entire length of the pool using front or back crawl. The last 5 minutes of each swim lesson were reserved for swim play. Children could jump in the water from the side of the pool or play with pool toys during this time.

Data Analysis

Data analysis for the quantitative data was done with the program R (R Core Team, 2019). In this study sample (n = 10), with a significance level of .05, and 80% power, we reject the null hypotheses for effect sizes larger or equal than d = 0.99. Based on this, the results focused on describing the change over time, focusing on the interpretation of the effect sizes. The effect sizes presented are Cohen d (Cohen, 1977, 1992), overlapping coefficient (Reiser & Faraggi, 1999), and the probability of superiority (Ruscio, 2008). The effect sizes were estimated for all 16 scales of interest, the Nisonger CBRF (eight scales), PTSS (one scale), PGWBI (six scales), and STAI (one scale).

Additional qualitative data was collected using a single focus group with an interview guide. Three research team members were present for the focus group, which was recorded and transcribed verbatim into a Word document. During the focus group, caregivers answered questions about their satisfaction with the swimming program. Three researchers performed the content analysis for the focus group. Transcripts were read by each researcher and then coded individually, identifying the themes in each participant's response. Next, researchers met to determine themes across participants (Graneheim & Lundman, 2004).The credibility and trustworthiness of the findings were achieved by independent coding of the data by the researchers. The researchers met and arrived at common themes as an iterative process (Glaser, 1992; Struebert & Carpenter, 1999). Saturation was achieved with no redundancy or new themes from the caregivers' responses.

Results

The pre/post study was completed by 10 parent–child dyads (White [n = 4], Hispanic [n = 3], Black [n = 2], and Asian [n = 1]; see Table 1). Prior to the swim program, all 10 children were not at the same

swimming ability. Nine children had the experience of being in a pool before but only six put their face underwater. Further, six children had used a life jacket or other floating device and two children could tread water; but none of the 10 children could propel themselves forward in the pool. Based on the children's swimming ability before the swim program, the main instructor paired children with similar ability into the same time slots for their lessons.

Table 1. Demographics *N* = 10 Parent–Child Dyads.

Gender of child with ASD

Male 7 (70)

Female 3 (30)

Child age (years)

9 2 (20)

7 5 (50)

5.5–6 3 (30)

First time taking swim lessons

Yes 2 (20)

No 8 (80)

Parent race

Item	N(%)
Gender of child with ASD	
Male	7(70)
Female	3(30)
Child age (years)	
9	2(20)
7	5(50)
5.5-6	3(30)
First time taking swim lessons	
Yes	2(20)
No	8(80)
Parent race	
White (Non-Hispanic)	4 (40)
Hispanic	3 (30)
Asian/Pacific Islander	1 (10)
African American	2 (20)
Parent's level of education	
9th grade–11th grade	1 (10)
Some college	1 (10)

Associate degree	1 (10)
Bachelor's degree	4 (40)
Graduate degree	3 (30)
Family income	
$21,000–$40,000	4 (40)
$41,000–$60,000	2 (20)
$100,000 and above	4 (40)

The results for the research questions are presented in Table 2; first presented is the mean and standard deviation for both baseline and post treatment followed by effect sizes. The effect sizes presented are the Cohen d (and the respective 95% confidence interval), percentage of distribution overlap, and probability of superiority. In general, the mean scores were improved for parent anxiety (Cohen's d = 0.04, negligible effect size), psychological well-being (4 subscales Cohen's d = 0.1–0.2, small effect size), and parent positive thinking (Cohen's d = 0.1, small effect size; see Table 2).

Table 2. Nisonger Child Behavior Profile (NCBP), Parent Psychological Well-being Inventory (PGWBI), Positive Thinking Skills Survey (PTSS) and State Trait Anxiety Inventory (STAI) *N* = 10.

	Time 1		Time 2						
Variable	M	SD	M	SD	Cohen's d	Cohen's d lower ci	Cohen's d upper ci	Overlap	Superiority
NCBP									
Compliant/Calm	1.583	0.432	1.467	0.375	0.288	− 0.585	1.161	88.87	57.85
Adaptive Social	1.375	0.755	1.325	0.457	0.078	− 0.820	0.977	96.81	52.26
Conduct Problem	0.985	0.689	0.787	0.620	0.295	− 0.003	0.594	88.08	58.4
Insecure/Anxious	0.653	0.697	0.558	0.667	0.138	− 0.074	0.350	94.42	53.94
Hyperactive	1.844	0.631	1.631	0.523	0.362	− 0.1758	0.900	85.72	60.05
Self-injury Stereotypic	0.428	0.455	0.286	0.343	0.317	− 0.04	0.674	87.29	58.95
Self -isolated/Ritualistic	0.775	0.564	0.704	0.608	0.121	− 0.410	0.653	95.22	53.38
Overly Sensitive	1.525	0.652	1.24	0.610	0.450	− 0.027	0.927	82.2	62.48
PGWBI									
Anxiety	2.86	1.370	2.66	1.530	0.136	− 0.2340	0.505	94.42	53.94
Depressed mood	3.63	1.160	3.767	1.187	− 0.114	− 0.524	0.297	95.61	53.1
Positive well-being	2.867	1.214	3.025	1.133	− 0.132	− 0.350	0.086	94.82	53.66
Self-control	3.817	0.747	3.833	0.997	− 0.018	− 0.480	0.444	99.6	50.28
General health	3.567	0.649	3.433	0.589	0.215	− 0.657	1.087	91.24	56.18
Vitality	2.908	1.11	2.975	0.916	− 0.063	− 0.445	0.319	97.61	51.69
PTSS	1.948	0.790	2.025	0.626	− 0.107	− 0.875	0.661	95.61	53.1
STAI	2.015	0.675	1.985	0.808	0.039	− 0.0359	0.437	98.4	51.1

Note. Abbreviations:
cd lower ci: Cohens d lower confidence interval.
cd upper ci: Cohens d upper confidence interval.

Paired comparisons of parent perception of their child's challenging behaviors showed scores decreased over time for all 8 subscales of the Nisonger CBRF in the post testing (Cohen's d = 0.07–0.45, small to medium effect size). For the PGWBI, the scores decreased over time, except for vitality which increased. For both the STAI and PTSS scales, the scores decreased over time. These are the overall trends, but the magnitude and relevance should be considered in function of the measure of effect size.

With d (absolute value) ranging from 0.02 to 0.45, this would be qualified from negligible to small effect sizes (Cohen, 1992). We failed to reject the null hypothesis for all of them as none of the mean changes is equal or larger than d = |0.99|, effect size for which this study has 80% power. Next, we describe the results for the outcomes that presented effect sizes larger than d = 0.2, which is considered to be the standard guideline for a small effect size (Cohen, 1992). All other outcomes presented smaller effect sizes which would be considered to be negligible. From the 16 outcomes, 6 presented effect sizes |d| > 0.2. Five outcomes were from the Nisonger CBRF: "compliant/calm," less "hyperactive," fewer "self-injury/stereotypies," improved "overly sensitive," and fewer conduct problems. One outcome was from the PGWBI: "general health."

For the Nisonger CBPRF, compliant /calm, the baseline and post treatment are on average 0.29 standard deviations away from each other (d = 0.29, 95% CI = −0.58, 1.16) as the average scores decreased over time. This means that 88.87% of the distributions overlap and selecting a subject at random from the baseline will have a 57.87% chance of having a higher score than at post treatment. In the case of "hyperactive," the baseline and post treatment are in average 0.36 standard deviations away from each other (d = 0.36, 95% CI = –0.18, 0.89) as the average scores decreased over time, this means that 85.72% of the distributions overlap and selecting a subject at random from the baseline will have a 60.05% chance of having a higher score than at post treatment. For "self-injury/stereotypies," the baseline and post treatment are in average 0.32 standard deviations away from each other (d = 0.32, 95% CI = –0.04, 0.67) as the average scores decreased over time, this means that 85.29% of the distributions overlap and selecting a subject at random from the baseline will have a 58.95% chance of having a higher score than at post treatment. Finally, decreased scores for "overly sensitive" indicates that the baseline and post treatment are on average 0.45 standard deviations away from each other (d = 0.45, 95% CI = –0.03, 0.93) as the average scores decreased over time, this means that 82.2% of the distributions overlap and selecting a subject at random from the baseline will have a 62.48 chance of having a higher score than at post treatment. Finally for "conduct problems," the baseline and post treatment are on average 0.29 standard deviations away from each other (d = 0.29, 95% CI = –0.003, 0.59) as the average scores decreased over time, this means that 88.08% of the distributions overlap and selecting a subject at random from the baseline will have a 58.4 chance of having a higher score than at post treatment.

For the PGWBI, for general health, the baseline and post treatment are on average 0.22 standard deviations away from each other (d = 0.22, 95% CI = –0.66, 1.08) as the average scores decreased over time. This means that 91.24% of the distributions overlap and selecting a subject at random from the baseline will have a 56.18% chance of having a higher score than at post treatment.

Three themes emerged from the post swim program focus group: (a) Parent satisfaction with instructors with sub themes (i) firmness (ii) creativity, and (iii) promotion of social interaction and

sharing (b) Improved child sleeping, and (c) Family dynamics with sub themes (i) siblings wanted to swim and (ii) parents' fear of drowning. Supporting quotations for each theme are presented in Table 3. Caregivers were satisfied with their child's behaviors after the swim lessons but had concerns about the siblings not getting to swim and them not knowing how to swim.

Table 3. Post-swim Program Focus Group Themes and Representative Quotations.

Theme	Quotations
(1) Parent satisfaction with instructors	
(a) Firmness	"Sometimes I was like 'Oh, why isn't he working? Because, [child] needs that firmness too in the voice." "I think there's a way to have that firmness but still give them the support and the security in the water. Because I know a lot of them are afraid, and I think that's kind of sometimes where it gets, like, well, they seem scared, so I need to coddle. And it's like, no, you give them support and reassurance, but still you can do this, and you need to do this because. . ." "She loves jumping in the pool. . .she was rewarded. You swim you do this then you get to jump in again." So I think there's a firmness there and you're going to do this but I'm going to do this, you know, there's that give and take."
(b) Creativity	". . . .the level of creativity the instructors had with trying to get [child's name] to try different techniques and learn how to be safe in the water." ". . . you know from throwing the ducks out, to putting the rings under the water. . ."
(c) Promotion of social interaction and sharing.	". . .So kind of became not only learning to swim. With a little bit of a social interaction."
(2) Improved child sleeping	" I appreciated him being worn out because my son never takes naps, never." "I love this [swim lessons] he would knock out as soon as we got home, oh yes thank you."
(3) Family Dynamics	
(a) Siblings wanted to swim.	"When you have other siblings it's like okay well if you don't have anyone to watch them you know during the day or during that short time you know it's like uh well what do you do with them? You know because of course you can't take a two-year old in and say no you can't get in the swimming pool"
(b) Parents' fear of drowning.	"I think would be amazing [for parents to learn to swim] and it would help also the parents get that comfort level that there are people who care and have that patience to work with kids like ours."

Discussion

This pilot study is the first to assess the effect of a swimming program for 10 children with ASD aged between 5.5 and 11 years on the parental psychological well-being, anxiety, positive thinking, and child behaviors. Given the small sample size it was important to report these effect size findings as indicative of improvement in behaviors and parent general health after the swim program.

For the first research question, parents of children with ASD who participated in the swim program, perceived their child to have fewer challenging behaviors in the areas of "compliant/calm," less "hyperactive," fewer "self-injury/stereotypies," improved "overly sensitive," and fewer conduct problems. In addition, themes from the focus group inform these quantitative findings as the caregivers noted that their child was sleeping and behaving better after the swimming program. Specifically, parents noted that their child would take a nap after the swim lesson and sleep better than when they did not have swim lessons. Children with ASD are known to have sleep problems that contribute to challenging behaviors (Abel et al., 2018; Souders et al., 2017), so improved sleep could account for the perceived improvements in the six areas of the Nisonger CBRF. Future research needs to better assess sleep improvements after swim program using a valid and reliable tool.

For the second research question, parents of children with ASD who participated in the swim program, reported they perceived better general health. Past research also found that challenging behaviors impact the caregivers' perception of their well-being (Johnson et al., 2011) which in turn can affect their health and the health of their caregivers (Almansour et al., 2013; Karst & Van Hecke, 2012; Strang et al., 2012). Since swimming was associated with a reduction in challenging child behaviors, it is possible that the swimming intervention for children could be related to the parents' improvement in their perception of their own general health in this study. This, in fact, is similar to the findings from previous research that shows that challenging behaviors of children with ASD can impact their parents' psychological well-being and quality of life (Allik et al., 2006; Bekhet, 2016; Karst & Van Hecke, 2012).

The effect size $|d|$ was < 0.2. for the other psychological health measures, PTSS, and STAI anxiety. The themes from the focus group can also inform these quantitative findings. In general, while the parents were satisfied with the creativity of the instruction and the promotion of the social interaction and sharing, they wished the instructors would have been firmer with the children during the lessons. Caputo et al. (2018) found that children with ASD cling to the side of the pool and must be prompted and progressively reinforced to cling to the instructor and build a secure base before they can progress to exploring the pool retrieving water toys. Incorporation of expectations for parents about the stages of learning to swim that includes a period of getting to know the instructor, that is, forming a relationship that would help the child feel more comfortable letting go of the pool wall (Caputo et al., 2018). Research is needed in future swim programs with development and use of a social script book or iPad application that outlines the expected stages of learning how to swim could help parents be less upset about the lack of firmness for the instructor as they would understand that the instructor is building a relationship with the child.

The caregivers also expressed that the swim program compromised their family dynamics. There was no childcare or alternative activity for the siblings who wanted to swim and 8 of the 10 parents in the study did not know how to swim themselves and had a fear of drowning. The IFSMT (Ryan & Sawin,

2009) predicts that there are risks and complexities that compromise condition management of children. Based on the IFSMT, the lack of the siblings and the caregiver having access to the pool and swimming or activity could help explain the lack of greater improvement in psychological well-being of the caregiver in the present study. These finding inform the design of future swim programs in terms of a more structured approach to the swim instruction in a larger trial of private swim lessons.

This study has limitations and strengths. The sample size was small and there was no control group. Spanish-speaking children were not included and all the caregivers were mothers. We did not measure the level of autism severity or length of time of diagnosis. Future research should measure the level of autism according to DSM–5 by using the Autism Diagnostic Observation Survey and Intellectual Disability by IQ testing and length of time of diagnosis.

A strength of the study was the diversity of the participants with African American, Hispanic, Asian, and White caregivers taking part in the swim program. Future studies can focus on expanding the swim program to have a control group and swim lessons for parents and activities for other family members.

In conclusion, the results of this mixed methods pilot feasibility study showed promising evidence of improved child behaviors and parent perception of their general health after a swim program for children with ASD. Since ASD has lifelong physical and emotional consequences for child and caregiver, novel family well-being interventions are needed. Future research is needed to compare the effectiveness of a family-based swim program on child behaviors and parental well-being.

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