

Surf2Heal an Investigation into the Impact of Outdoor Activity on the Social Behaviours of those with Autism Spectrum Disorder

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Abstract

Aim: Autism Spectrum Disorder is a highly prevalent, complex, neurobehavioral condition. Those with autism have impaired social interactions, reduced communication skills, difficulties in language development, and rigid, repetitive behavior. The volume and variety of resources available to those with ASD in Ireland is lacking, particularly given the considerable population with ASD. Surf2Heal is a voluntary camp providing those with ASD the opportunity to participate in ocean-based activities. This study was carried out with the aim of comparing the social behaviours of those with ASD before and after a surf camp tailored specifically towards those with ASD.

Methods: The parents' participants in the camps across the country filled out two copies of the Social Responsiveness Scale-2 questionnaire [SRS-2]. The first was based on participants behaviour prior to the camp, and the second based on participants behaviour immediately following the camp. Results were compared using paired t-tests to ascertain if there was an impact on social behaviours, examining overall impact and five treatment variables. The variables examined were Awareness, Cognition, Communication, Motivation, and, Restricted Interests and Repetitive Behaviours.

Results: Statistical analysis was done at the significance level of $p < 0.05$ of scores obtained before and after the surf camp. Of the 27 participants, 96.4% demonstrated an overall improvement. Results showed a statistically significant improvement in the Total score and in all variables measured. Within each variable between 55.6%-92.6% of participants demonstrated improvements following analysis of the results. Analysis also demonstrated that all variables had a moderate to very large effect size.

Conclusions: The study indicated that the surf intervention had a positive effect on the social behavior of those with ASD in all examined variables. These results highlight how valuable further development of resources such as Surf2Heal are in management of ASD, advocating for further research and investment in this area.

Introduction

Autism Spectrum Disorder [ASD] is a complex, neurodevelopmental condition characterised by impairments in social interaction and communication, as well as restricted, repetitive, and stereotyped patterns of behaviour [1]. The population of those living with a diagnosis of ASD in Ireland is significant, with a minimum prevalence rate of 1% in National Schools and 52% in Special Education Schools [2].

ASD is a lifelong diagnosis and certain resources can greatly improve the quality of life for both patient and carer alike. In 2018 the Irish Government published a report reviewing the services available for individuals with ASD. It describes the need for increased availability and implementation of evidence-based practices. The report strongly highlighted the critical need for service users and their families to be provided with assessments and interventions that have been shown to be effective [3]. Quite simply, the quantity of resources available in Ireland does not match the population living with ASD.

Movement is the basic attribute of life, and when properly prescribed, is an inexpensive and universal medication with minimal side effects [4]. The extensive range of benefits associated with exercise has been extensively documented. Exercise has a vital role in influencing people's life from many aspects; it can help improve physical condition, self-esteem, social skill, and behaviour [5]. However, there is relatively little information regarding physical activity in individuals with ASD [6]. Researchers have begun to examine the effects of exercise on a plethora of outcomes for individuals with ASD, such as motor skills, social skills, stereotypical behaviours, self-stimulating behaviours, and physical fitness. At present, it is understood that certain social

activity-oriented interventions and treatments can help children with ASD change their behaviours and function better in their normal environment [5].

Surf Therapy (ST) is "the evidence-based, clinically guided, and safely delivered use of surfing and play in and around waterways as a therapeutic vehicle in the prevention and treatment of social, behavioural, health, economic, and other challenges" [7]. Past research shows that physical exercise positively effects emotional wellness and reduces behavioural problems in children with typical development. Considering the effectiveness of physical exercise in improving emotional and behavioural functioning in this group, it is likely that children with ASD could benefit also from it [8]. Surf2Heal is based on this premise.

Surf2Heal is a surf camp specifically for those with ASD. It is a voluntary organisation first established in 2008 based on Garrets town Beach, County Cork. The camp was set up after a mother noticed the

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profoundly positive effect the ocean had on her son who has ASD. Since then, it has grown annually. Various versions of Surf2Heal now exist, both across County Cork and on numerous beaches around Ireland. Surf2Heal offers children with ASD a space in which they can have a social and sensory experience in an environment designed to put them at ease. They are given the freedom to connect with themselves. Many parents of those who have participated in camps such as these in the past advocate for their wider adoption, with many claiming them to have compellingly positive impacts on their children’s social behaviours. This study was inspired by this with an intention to examine if this impact exists. These testimonies served as the inspiration for this study, to examine whether the data would line up with such promising anecdotal evidence.

Aims and Objectives

This study was carried out with the primary aim of comparing the social behaviours of those with ASD before and after participating in a surf camp tailored specifically for those with ASD.

The objectives were as follows

- To examine the impact surf camps have on the overall social qualities of those with ASD.
- To analyse the camp’s effect with regards to specific social behaviours including awareness, communication, cognition, motivation, and restricted interests and repetitive behaviours.

Methods

Study design

This was a cohort study assessing the impact of the Surf2Heal summer camp on the social qualities of young people with ASD. The study was based on Surf camps specifically tailored for those with ASD on beaches around Ireland. The parents of those participating in the study were required to complete the Social Responsiveness Scale-2 form based on their child’s behaviour prior to participation in the camp. The same form was then filled out again after the camp. Results from before and after were compared to assess the camp’s effect on the participants social behaviours. Data was collected between August 2020 and August 2021 by the student investigator who worked in a voluntary capacity (as an instructor and lifeguard) at the camp during the period of this study.

Inclusion criteria	Exclusion criteria
Those who participated in a surf camp specifically tailored for those with ASD. Those aged between 8-24 with a diagnosis of ASD.	Participants who failed to complete the full camp.

Participants

Participants (n=27) aged between 8 and 24 years old with a diagnosis of ASD were recruited from surfing summer camps run throughout Ireland. Camp organizers acted as gatekeepers. They informed parents of the camp participants of the study via email and social media platforms. See Appendix 1 for a copy of the information sheet circulated to participants by camp organizers. The option of either filling out an online SRS-2 form (sent via email), or in handwritten form was offered. All those who participated in weeklong camps were invited to partake in the study. It was highlighted that refusal to take part in the study would have no negative impact on the participants experience of the camp nor deny them of any advantages the camp offers. There was an option of withdrawing from the study at any point.

Study measures

The Social Responsiveness Scale-2 form was utilised in this study. The SRS-2 scale identifies the presence and severity of social impairment within the autism spectrum [9]. Originally developed by Constantino and Todd, 2003, revised by Constantino and Gruber in 2012, the SRS-2 scale reveals social deficits associated with autism, and specifies where these symptoms fall on the spectrum by assessing a variety of subscales of social behaviour [10].

The Social Responsiveness Scale is a 65-item questionnaire that measures the severity of ASD in natural social settings [11]. The respondents rate the items in an ordinal-scaled method from 1 (not true) to 4 (almost always true). It typically takes between 10 and 15 minutes to complete and may be completed by parents, teachers, or caregivers who know the participant. Both online and handwritten versions were utilized in this study. See Appendix 2 for examples of questions included in the SRS-2 form.

Raw scores obtained were then computed to give a total score and seven treatment subscales. These were as follows

- Social Awareness
- Social Cognition
- Social Communication
- Social Motivation
- Restricted Interests and Repetitive Behaviours
- DSM-V compatible subscales; Social communication and interaction
- DSM-V compatible subscales; Restricted interested and repetitive behaviour

According to the SRS manual, social awareness is operationally defined as the “ability to pick up on social cues”, social motivation is defined as “the extent to which a respondent is generally motivated to engage in social-interpersonal behaviour”, and social cognition is defined as “expressive social communication” [12].

The total score computed through the SRS-2 form describes the severity of autism present in the participant, denoted as T (total) score.

T-scores of 76 or higher are considered severe, suggesting that an individual has clinically significant deficits in social functioning that interfere in their ability to interact with others. Scores falling between 66 and 75 are considered moderate, signalling some clinically significant social deficits. The mild range includes T-scores of 60 to 65, indicating mild-to-moderate deficiencies in social behaviour. T-scores of 59 and below indicate an individual probably does not have social difficulties indicative of ASD [13] (Table 1).

Study ethics

This study was granted ethical approval by the Social Research Ethics Committee (SREC) of University College Cork in April 2020.

Table 1: T-score interpretation.

T-score interpretation	
≥ 76	Severe
66 - 75	Moderate
60 - 65	Mild
≤ 59	Normal

All data was stored in a locked office on a password protected computer in anonymized form. Data was confidentially stored in encrypted shared files on the UCC provided shared drive and access was only available to those conducting the research. On completion of the project, data will be retained for a minimum of ten years and then destroyed.

Data analysis

The SRS-2 overall and subscale scores were entered into Microsoft Excel and SPSS was used to analyse the data. Paired sample t-tests were conducted to assess the effect of Surf2Heal on the following subscales included in the SRS-2 form:

- Social Awareness
- Social Cognition
- Social Communication
- Social Motivation
- Restricted Interest and Repetitive Behaviour
- DSM-V compatible subscale; Social communication and interaction
- DSM-V compatible subscale; Restricted interested and repetitive behaviour

The results obtained from surveys taken before and after the camp was compared in order to assess any changes. When examining the difference in results, paired t-tests were conducted to assess statistical significance. Statistical significance was designated at the level of $p < 0.05$. Cohen's d was also calculated to demonstrate effect size of the surf camps (Table 2).

Results

Population demographics

A total of 27 participants who attended Surf2Heal camps in 2020/2021 took part in this study. They ranged in age from of 8 to 24 years old, with a mean age of 14.3 years. Demographics of participants are outlined in (Table 3).

Table 2: Interpretation of effect size.

Cohen's d	Effect size
0.01	Very small
0.2	Small
0.5	Moderate
0.8	Large
1.2	Very large
2	Huge

Table 3: Population demographics.

Participants	
Gender	
Male	74%
Female	26%
Age	
08-Nov	33%
Dec-15	30%
16-19	22%
20-24	15%
Survey completed by	
Mother	81%
Father	19%

Total score (T-score)

When comparing T-scores from before and after Surf2Heal, 96.4% of participants demonstrated improvements overall with the remaining 3.7% demonstrating no change in overall score (Figure 1). No disimprovement was in overall score was demonstrated by any of the participants. The mean improvement was 7.2 with a standard deviation of 6.62 (Figure 2). Among participants who demonstrated an improvement, 38.5% of these changed severity classification to a less severe classification following the camp.

A paired sample t-test was then conducted to test the hypothesis that there was an improvement in the average overall score of participants before and after the Surf2Heal intervention. The test was statistically significant ($t(26) = 5.67, p < 0.001$) and had a large to very large effect size (Cohen's $d = 0.61$).

Therefore, we can reject the null hypothesis and conclude that Surf2Heal had a statistically significant positive effect on the overall social behaviours of participants with ASD.

Social awareness

When examining the effects of Surf2Heal on Social Awareness 59.3% of participants demonstrated an improvement in their awareness following the camp. No change was demonstrated by 25.9% of participants and a disimprovement was demonstrated by 14.8% (Figure 1). There was a mean change of 4.6 across all participants with a standard deviation of 7.57 (Figure 2).

A paired sample t-test was conducted to test the hypothesis that there was an improvement in the average social awareness before and after the Surf2Heal intervention. The test was statistically significant ($t(26) = 2.175, p = 0.0038$) and had a moderate to large effect size (Cohen's $d = 0.61$).

Therefore, we can reject the null hypothesis and conclude that Surf2Heal had a statistically significant positive effect on the social awareness of participants with ASD.

Social cognition

When comparing the scores from before and after Surf2Heal, 55.6% of participants demonstrated an improvement in social Cognition with a mean improvement of 4.15 with a standard deviation of 7.37 (Figure 2). Social cognition had the lowest reported incidence of improvement after the camp. After the camp 11.1% demonstrated no change and 4% demonstrated a disimprovement (Figure 1).

A paired sample t-test was performed to test the hypothesis that there was an improvement in the average social cognition before and

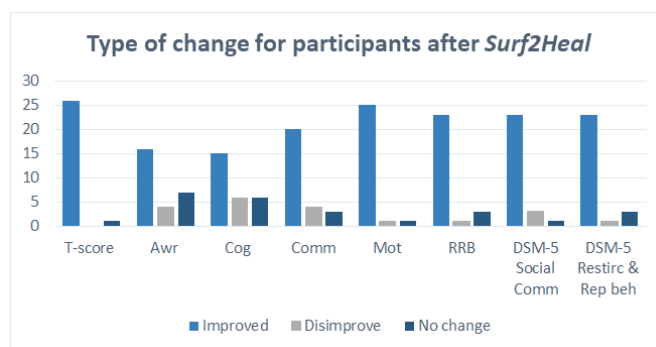


Figure 1: Type of change for participants after Surf2Heal.

after the Surf2Heal intervention. The test was statistically significant ($t(26)=2.92, p = 0.007$) and had a moderate effect size (Cohen's $d = 0.56$).

Therefore, we can reject the null hypothesis and conclude that Surf2Heal had a statistically significant positive effect on the social cognition of participants with ASD.

Social motivation

92.6% of participants in Surf2Heal demonstrated an improvement in Social Motivation after the camp. This variable had the highest incidence of improvement reported. There was a mean change of 10.6 with a standard deviation of 6.79 [Figure 2]. No change was demonstrated by 3.7% of participants, and a disimprovement was demonstrated by 3.7% of participants [Figure 1].

A paired sample t-test was performed to test the hypothesis that there was an improvement in the average social motivation before and after the Surf2Heal intervention. The test was statistically significant ($t(26)=5.625, p < 0.001$) and had a large to very large effect size (Cohen's $d = 1.08$).

Therefore, we can reject the null hypothesis and conclude that Surf2Heal had a statistically significant positive effect on the social motivation of participants with ASD.

Restricted interests and repetitive behaviours

When examining the effect Surf2Heal had on RRB of the participants 85.2% of those involved demonstrated an improvement following the camp. No change was demonstrated by 11.1% with 3.7% demonstrating a disimprovement (Figure 1). There was a mean improvement of 8 with a standard deviation of 6.79 [Figure 2].

A paired sample t-test was performed to test the hypothesis that there was an improvement in the average RRB before and after the Surf2Heal intervention. The test was statistically significant ($t(26)=6.12, p < 0.001$) and had a very large effect size (Cohen's $d = 1.18$).

Therefore, we can reject the null hypothesis and conclude that Surf2Heal had a statistically significant positive effect on the RRB of participants with ASD.

DSM-V compatible subscales; social communication and interaction

On examination of the DSM-V compatibility subscale social communication and interaction 85.2% of participants demonstrated an improvement after the camp. There was a mean improvement of 6.74 with a standard deviation of 6.92 [Figure 2]. Of the remaining participants, 3.7% demonstrated no change and 11.1% demonstrated a

disimprovement [Figure 1].

A paired sample t-test was performed to test the hypothesis that there was an improvement in the average social communication and interaction before and after the Surf2Heal intervention. The test was statistically significant ($t(26)=5.06, p < 0.001$) and had a large effect size (Cohen's $d = 0.97$).

Therefore, we can reject the null hypothesis and conclude that Surf2Heal had a statistically significant positive effect on the social communication and interaction of participants with ASD.

DSM-V compatible subscales; restricted interests and repetitive behaviours

When examining the DSM-V compatibility subscale of RRB, there was an improvement demonstrated by 85.2% of participants. The mean improvement was 8 with a standard deviation of 6.79 [Figure 2]. Of the remaining participants 11.1% demonstrated no change with only 3.7% demonstrating a disimprovement following the camp [Figure 1].

A paired sample t-test was performed to test the hypothesis that there was an improvement in the average restricted interests and repetitive behaviours before and after the Surf2Heal intervention. The test was statistically significant ($t(26)=6.12, p < 0.001$) and had a very large effect size (Cohen's $d = 1.17$).

Therefore, we can reject the null hypothesis and conclude that Surf2Heal had a statistically significant positive effect on the RRB of participants with ASD.

Feedback was not requested when SRS-2 forms were distributed. However, parents of some participants included testimonies describing the positive effects they observed that these surf camps had on their children. Appendix 3 contains anonymised feedback from parents. This feedback displays the practical significance and positive implications immediately observed following these surf camps (Table 4).

Discussion

The nature of ASD presents a challenge not only to those with this disability, but also to teachers and parents fostering the development of social behaviours. The importance of social relationships for this population is increasingly being acknowledged [6]. A key component of socialization is the ability to communicate. Communication is the medium (both verbal and nonverbal) that provides access to social interactions [14]. Stereotyped behaviour is one of the core defects of autistic patients, which is a series of repetitive, aimless, and meaningless behaviours [15]. Vigorous intensity exercises such as jogging, roller-skating, hydrotherapy exercises, and exergames have been used in

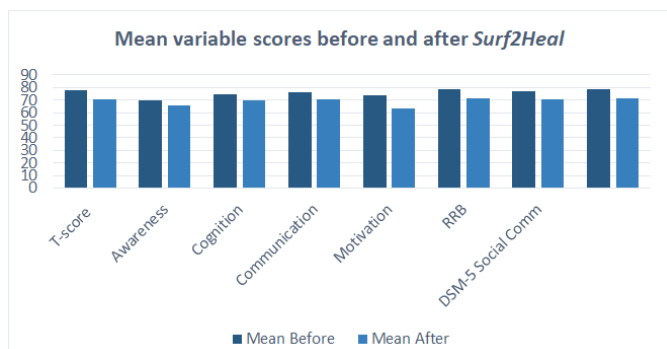


Figure 2: Mean variable scores before and after Surf2Heal.

Table 4: Mean and SD before and after intervention.

	BEFORE		AFTER	
	M	SD	M	SD
Total Score	78.14	9.94	70.92	10.46
Social Awareness	70.04	12.99	65.41	11.77
Social Cognition	74.3	10.71	70.15	9.66
Social Communication	75.96	9.15	70.85	9.76
Social Motivation	73.63	11.62	63	13.7
Restricted interests and Repetitive Behaviours	79.07	12.15	71.07	12.26
DSM-V Social communication and interaction	76.96	10.38	70.22	10.13
DSM-V Restricted interests and Repetitive behaviour	79.07	12.15	71.07	12.26

the past to reduce the frequency of stereotypical behaviours [16]. Blue-space may be defined as outdoor bodies of water with the potential of promoting health [17]. Within academia there is growing interdisciplinary interest in (and recognition of the benefits) provided by specific water environments, or blue-space [18]. Contact with blue-spaces improves health outcomes through mitigation (noise abatement), instoration (physical activity), and restoration (stress reduction) pathways [17-19], resulting in improved mood, self-esteem, social interactions, and a decrease in mortality [20]. Surf therapy, a form of blue-space, is defined as a method of intervention that combines surf instruction/surfing, and structured individual or group activities to promote psychological, physical, and psychosocial wellbeing. Recognising the value of nature and place as influencers of well-being presents an opportunity for health-care systems to seek meaningful, cost-effective services.

Surf2Heal is a combination of the benefits of blue-space, with the advantages of activity based interventions aimed at those with ASD. The present study examined the effect of surf camps specifically tailored for those with ASD had on the participant's social qualities. The main findings showed that participants demonstrated statistically significant improvements in overall behaviours, and within all the specific variables measured. The most notable variables to improve were Social Motivation, RRB and Social Communication. Participants also demonstrated improvements in Social Cognition, Social Awareness, and Social Interaction. The results presented in this study indicate that surfing could be an effective therapeutic choice for those with ASD to reduce the social burdens of their condition.

The findings in this study are in accordance with previous studies which examined the effect of physical activity on the social qualities of those with ASD. These include Bass et al. (2009), which looked at the effects of horseback riding on the social functioning of those with ASD [12]; Zhao et al. (2018), which examined the effects of structured physical activity programmes on those with ASD and Pan et al. (2010), which investigated to effects of water exercise swimming programmes on social behaviours in those with ASD [6].

While it is not yet known precisely why ASD is positively impacted by such interventions, studies have speculated potential explanations. One possible explanation for the effectiveness of physical activity centred programs on social interaction is the fact that physical activity is regarded as the natural setting for promoting positive social interactions for children with ASD. The reduction of stereotyped behaviour in autistic patients may be explained by the fact that the stimulation obtained via the physical activities of autistic patients has a similar internal mechanism of action as the stimulation produced by stereotyped behaviour, which can bring comfortable sensory stimulation and adjustments [15]. Bass et al. (2009) described the multisensory nature of horseback riding as an experience that may have been a very stimulating event, and the act of riding the horse may have been perceived as a rewarding stimulus that accounted for higher levels of motivation and social engagement [12]. This may be comparable to surfing, the multisensory nature of being in the ocean, and the act of riding a wave possibly accounting for the significant improvement in Social Motivation shown in this study.

There are strengths to this study that warrant acknowledgement. The SRS-2 scale is a validated measurement used in other similar studies [12]. The use of a validated and standardized measurement adds credibility to results obtained in this study. The SRS-2 scale is also an appropriate choice of measurement to maximize ease of completion amongst parents of participants. Parenting a child with ASD is a

stressful and challenging experience. This measurement tool is highly accessible with online versions available and contains easy to follow instructions. It may be completed at a pace and in a location which is most convenient to the respondent, taking from 10 to 15 minutes to complete. Secondly, there are strengths related to the methodology and population used in this study. A highly systematic approach was utilized which allows for ease of reproducibility in the future. Strengths can be noted in both the population's broad age-range and demographics. ASD is diagnosed more often in boys than in girls, with a sex ratio of 3: 1. This ratio is reflected in the population of this study and therefore can be seen as an accurate representation of general population. Finally, more than one surf camp tailored towards those with ASD was involved in this study, which highlights that the camp is repeatable in various locations based on a similar design.

Limitations of this study most notably relate to the scope for potential parental misreporting. From the outset parents of participants were strong advocates for Surf2Heal to be made more readily available to their children. Bruni et al. (2014) reviewed the SRS-2 scale, stating the utility of the SRS-2 depends on the accuracy of the rater. Thus, results could be affected by many factors including preconceived notions, motivation for certain results, contextual variables, and halo effects [10]. Parent's vocal acknowledgement of Surf2Heal's benefits prior to commencement of this study may translate as subjective bias when completing the SRS-2 scale.

Additionally, this study took place during the COVID-19 global health pandemic. This presented a significant obstacle when carrying out data collection. Due to governmental restrictions concerning the amount of people who could gather, camp sizes were reduced with some camps being cancelled entirely. This contributed to a difficulty in gathering a larger population leading to reduced sample size.

The clinical implications of this study are striking. The results shown are a pertinent learning opportunity for healthcare workers engaging with ASD. Insight is given into the considerable benefits surf camps have on those with ASD. This is a compelling argument for the expansion and investment in interventions such as these in the future. The 2018 HSE review of services available to individuals with ASD demonstrated the need for increased availability of services for those with ASD [3]. Surf2Heal and other similar camps is an are a cost effective, attainable intervention and therefore a suitable proposition as part of a solution to the lack of resources available to those with ASD.

This study establishes multiple key areas which would benefit from future research. Firstly, a comprehensive assessment of the longevity of positive results, as seen in this study, would offer further guidance to future implementation of surf interventions. Scope for future studies exists in examining whether increasing the length of camp, or more intense versions of a surf intervention may demonstrate greater improvements in social functioning among a population with ASD. Investment in further research is needed to understand the general significance of blue-space for public health and the potential for embedding blue-space within existing health promotion services. Finally, as those with ASD may also experience motor deficits as compared to typically developing children, future studies should be performed to examine the effect surf camps examined in this study have on motor deficits.

Conclusion

This is the first study of its kind to evaluate and quantify the effect of surf camps specifically tailored towards those with ASD have

on social behaviours. Results of this study are promising, showing that surf camps such as these have positive effects on overall social behaviours, and on various subscales examined; Social Awareness, Social Cognition, Social Communication, Social Motivation and RRB. ASD is a complex, multifaceted condition. While no cure exists, it is paramount that healthcare professionals provide the best possible management plans to aid those living with the condition. Results of this study show that camps such as those examined can markedly reduce the burden and impact of challenging social behaviours seen in ASD. There is growing interest in promoting blue-space for health and well-being [20]. This study is a step towards understanding the benefits of blue-space activities, in particular surfing, have on those with ASD.

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Author Declaration

I hereby declare that the material included in this paper is my original work. It has not been previously published or submitted for publication elsewhere. Signed: Sorcha Ní Bhrúdair 06/12/2023

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