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Factors Associated with Improvement of Autistic Spectrum Children on Different Behavior Therapy Programs

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ABSTARCT:

Background: Choice of effective behavior therapy program(s) for autistic spectrum children (ASD) patients have been a concern for therapists, speech and language specialists, and psychiatrists. Failure of teaching program or combination of programs might lead to family frustration, unnecessary cost and high level of drop off from therapy.

Objectives: to determine factors associated with improvement on different teaching and behavioral programs used for autistic children in Palestine and to quantify improvement.

Methods: This retrospective cohort study involved 60 ASD children at Muhmamd Ben Al Maktoom Centre at Hebron City, West Bank. We followed them back in time for the last 6 months of 2021. We used Gilliam scale to determine degree of the condition. Subject of this study were exposed to different behavioral therapy programs for average period of 3 years. We calculated the child overall percentage improvement in performing assigned tasks of these programs as the main outcome of study for the last 6 months. We used SPSS V 25 for data analysis and prediction model construction.

Results: Sixty children participated in this study, 5.9 ± 2.11 years old and 81.7 % males. Almost 80% of these children were diagnosed with ASD. Almost 83.3 % were moderate to over moderate on Gilliam. Three categories of behavioral therapy programs were assigned for these children: language, social and communication, and/or cognitive and self-help. Almost 120 children used first category programs, 57 children used second category, and 59 children used the third category. Average improvement was 64.93 ± 16.51%. Diagnosis significantly affected total improvement, p=0.000. Pervasive developmental disorder (PDD) and complex disorder significantly predict improvement among autistic children at p=0.047 and 0.001, respectively.

Conclusions: improvement of autistic child on behavioural therapy programs is dependent on age and severity of condition upon diagnosis.

Key words: autism; PDD; behaviour therapy; language; speech; cognitive; self-help; functionality

Introduction:

Autism is a neurobiological disorder that remains a clinical diagnosis. It characterized by core deficits in social communication and interaction, as well as restricted and repetitive patterns of behavior and interests **[1].** In some cases, ASD might develop in days to weeks, while it develops slowly in others **[2]**. Autistic Spectrum Disorder (ASD) is becoming more prevalent. This could be due to increased awareness of the disorder, over-diagnosis, or over-inclusive diagnostic criteria [3].

The worldwide estimated prevalence of individuals with ASD diagnosis is strikingly high with prevalence varying across numerous studies. Most studies estimated that one in 160 children has an ASD worldwide, and expected to increase globally [4].

A study pointed that numerous and complex signaling pathways are involved in the etiology and pathophysiology of autism spectrum disorder (ASD) [5]. Genetic studies revealed that alteration in the developmental pathways of neuronal and axonal structures that are strongly involved in synaptogenesis emerge from single gene mutations [6], could be involved in autism.

Habenula which is a small epithalamic structure that has rich widespread connections to multiple cortical, subcortical and brainstem regions was identified as the central structure modulating the reward value of social interactions, behavioral adaptation, sensory integration and circadian rhythm.

Using anatomical magnetic resonance imaging (MRI) and automated segmentation, neurologists showed that habenula was significantly enlarged in children and adults with ASD compared to age-matched controls [7]. They also observed a decrease in grey matter volume in the brainstem in autistic subjects with no difference in white matter volume using MRI **[8].** This was considered as brain stem impairment pathology.

Elevations in the cell-packing density in specific amygdalar sub-regions were observed, which also included a 30–35% reduction in cell size in the central, cortical, and medial nuclei. Minor changes were observed in the basolateral complex [9]. These results, when combined with the MRI studies, reported that the amygdala of autistic cases underwent abnormal growth and development postnatally and showed enlarged and reduced neuronal numbers [10, 11]. The expansion of the term Autism to ASD representing a range of disorders affecting an individual's communication, behavior, and social interaction [12].

Specialists make a diagnosis of autistic disorder when there are impairments in communication and reciprocal social interaction with the presence of restricted repetitive and stereotyped patterns of behaviors or interests, prior to the age of 3 years. Percentage affected is 20% of the population. Patients of this type are self-injurious with unusual behavior [13]. Alternatively, Asperger disorder, is used when autistic symptoms are present with no significant general delay in language and cognitive development. Percentage affected is majority of the population [14].

On the other hand, not otherwise specified autism is called pervasive developmental disorder (PDD), or atypical autism. Challenges in social interaction and communication is given when the triad of symptoms is present but the criteria are not met for a specific ASD form. PDD percentage affected is below 5%–7% of the population [15].

The Diagnostic and Statistical Manual of Mental Disorders defined the diagnostic criteria for ASD [16]. These criteria include Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview-

Revised (ADI-R) or a combination of both which had better reflected consensus clinical judgments of autism and ASD [17]. The professionals who provide diagnosis of ASD are Speech and language Pathologists, Psychologists, pediatricians, psychiatrists and Occupational therapists [18].

In addition, the Gilliam Autism Rating Scale was developed to identify individuals with autism in research and clinical settings with little empirical attention [19].

In this study, we will shed the light on a cohort of ASD children in one leading centre in the city. We will investigate various behaviour therapy modalities available in managing the condition while monitoring factors associated with improvement in their condition in a retrospective fashion.

Methods and materials:

This retrospective cohort study involved 60 children registered as ASD at Muhmamd Ben Al Maktoom Centre at Hebron City, West Bank. Their average age was 5.95±2.11 years and they were 81.7% males. Inclusion criteria: all children who were admitted to the centre with ASD diagnosis who were on one or more of the teaching and behavioral programs in the centre. A psychiatrist confirmed ASD diagnosis for all children prior to admission to the centre. Psychiatrists diagnosed most children as having ASD with abnormal biforntal spikes on EEG; left side is more than right side, suggestive of frontal epileptic features. Severity of condition: Almost 83.3 % were moderate to over moderate on Gilliam. We reviewed children`s profiles, met with their care providers and close family members. We collected their sociodemographic and clinical data as pertaining to the question of the study. We collected also all medical, behavioral, occupational therapy, or other learning modalities and interventions during the past six months of 2021. By then, most children have spent at least 3 years in the centre. We used Gilliam Autism Rating Scale (GARS2) to determine degree of ASD for these children at the beginning of the study (present score). We also recorded Gilliam score at time of admission to the centre (past score). We categorized children according to Gilliam score as mild to severe Gilliam. All participants were on low sugar and protein diet. Some of these kids were on psychotropic drugs. Therapy specialists in the centre assigned the proper behaviour therapy program for each child according to his diagnosis, Gilliam score, and areas of deficiency. Almost 120 children used first category programs, 57 children used second category, and 59 children used the third category. The child will receive training by speech therapists, physical therapists, psychologists, and/or occupational therapists. Finally, we calculated the overall percentage improvement in performance of the assigned tasks and learning programs for each child as main outcome of study. Some of the programs used for behavioural therapy were LOVAS, TEACCH, ABILS, ABICC, Mentsory, Portage, and Help. We used SPSS V 25 for data analysis.

Results:

Sixty children participated in this study, 5.9 ± 2.11 years old and 81.7 % males. We reviewed their profiles during the last six months and interviewed their family members, caregivers and professionals who worked closely with them. All data collected was included in table 1 below. Almost 80% of these children was diagnosed with ASD and 83.3 % were moderate to over moderate on Gilliam. Average improvement was 64.93 ± 16.51%.

Variables	N	Percentage (%)
Gender		
Male	**49**	**81.7**
Female	**11**	**18.3**
Gilliam		
Mild	**2**	**3.3**
under moderate	**5**	**8.3**

Moderate	37	61.7
above moderate	13	21.7
Severe	3	5.0
Diagnosis		
ASD	48	80.0
PDD	6	10.0
Complex disorder	6	10.0
Number of drugs		
0	48	80.0
One	7	11.7
Two	3	5.0
Three	2	3.3
Portage		
Yes	40	66.7
No	20	33.3
Ables		
Yes	39	65.0
No	21	35.0
Lovaas		
Yes	42	70.0
No	18	30.0
Teacch		
Yes	41	68.3
No	19	31.7
Help		
Yes	22	36.7
No	38	63.3
Mentessori		
Yes	18	30.0
No	42	70.0
Bicc		
Yes	19	31.7
No	41	68.3
Sonrise		
Yes	15	25.0
No	45	75.0
Multivitiron		
Yes	3	5.0
No	57	95.0

Table 1: Participants sociodemographic and clinical data

Study of the differences of main outcome of study (total percentage improvement) with the different behaviour therapy programs, gender, and diagnosis showed that diagnosis significantly affected the total improvement, p=0.000. In a sense, the worse the diagnosis of the child at admission (Complex disorder and PDD), the least expected benefit he/she will get from any of the learning programs as shown in table 2 below.

Variables	N	Mean	Stander deviation	P-value
Gender				**0.326‡**
Male	**49**	**65.84**	**15.83**	
Female	**11**	**60.91**	**19.6**	
Portage				**0.355‡**
Yes	**40**	**63.6**	**16.86**	
No	**20**	**67.6**	**15.86**	
Ablls				**0.169‡**
Yes	**39**	**63.26**	**16.62**	
No	**21**	**68.05**	**16.24**	
Lovaas				**0.536‡**
Yes	**42**	**63.48**	**18.2**	
No	**18**	**68.33**	**11.38**	
Teacch				**0.761‡**
Yes	**41**	**64.78**	**17.22**	
No	**19**	**65.26**	**15.32**	
Help				**0.378‡**
Yes	**22**	**63.55**	**14.56**	
No	**38**	**65.74**	**17.68**	
Montessori				**0.569‡**
Yes	**18**	**61.22**	**20.08**	
No	**42**	**66.52**	**14.71**	
Bicc				**0.442‡**
Yes	**19**	**65.95**	**19.81**	
No	**41**	**64.46**	**14.99**	
Sonrise				**0.218‡**
Yes	**15**	**60.67**	**19.99**	
No	**45**	**66.36**	**15.17**	
Multivitiron				**0.798‡**
Yes	**3**	**61.67**	**27.54**	
No	**57**	**65.11**	**16.11**	
Diagnosis				**0.000†**
ASD	**48**	**67.06**	**13.24**	
PDD	**6**	**76.67**	**7.53**	
complex disorder	**6**	**36.17**	**17.61**	

‡A Mann-Whitney U test was used to calculate significant levels (P value).
†: Comparison of means using independent samples Kruskal Wallis test.

Table 2: Factors associated with differences in total percentage improvement for ASD

Out of the main factors of different effect on main outcome of the study, what are the most important ones? In order to answer this question, we run a multi-regression analysis that led to the data shown in table 3 below.

Variables	Coefficient	Robust Std. Err.	t	Sig.	[95% Conf. Interval]	
Constant	84.700	13.320	6.360	0.000	57.960	111.441
Age	-1.764	0.980	-1.800	0.078	-3.731	0.204
Number of drugs	2.415	2.947	0.820	0.416	-3.500	8.331
Gilliam level						
under moderate	-15.531	14.290	-1.090	0.282	-44.219	13.158
moderate	-5.330	12.342	-0.430	0.668	-30.108	19.449
above moderate	-11.177	13.042	-0.860	0.395	-37.360	15.006
severe	-14.964	17.097	-0.880	0.386	-49.286	19.360
Diagnosis						
PDD	8.984	4.412	2.040	0.047	0.126	17.842
complex disorder	-31.914	8.810	-3.620	0.001	-49.601	-14.227

Table 3: Factors associated with child`s percentage improvement in overall performance of various behaviour therapy programs

Dependent variable: OUTCOM. R^2=48.54%; F (8, 51) =5.98; Sig=0.00 test of model in general

Discussion:

Autism, the silent condition of silence. The enigmatic neuropsychiatric condition with no cure neither full understanding of the underlying pathogenesis or manifestations. Most of time it went underdiagnosed or mixed up with other conditions such as ADHD. Some other times, it could be over-estimated due to non-professional judgment by non-trained neither clinically educated schoolteachers, social workers, nor psychotherapists.

ASD can be distinguished by a pattern of multiple symptoms, and is typically identified before 2 years of age [20]. The symptoms of ASD are classified into two broad categories: the core and the secondary symptoms. The core symptoms consist of reduced language skills and social interaction, as well as the presence of repetitive and stereotypic behaviors (American Psychiatric). In contrast, secondary symptoms include complications such as self-injury, hyperactivity, aggression, and co-occurring psychiatric disorders such as anxiety and major depression [21]. Participants in this study suffered a spectrum of both symptoms at different degrees.

Management of autism requires behavior therapy, environmental therapy, and medications.

Behavior therapy mainly focuses on methodically training the patient to re-learn self-care, language, and social skills. Professionals from different domains, like speech therapists, physical therapists, psychologists, and occupational therapists with different levels of competence can benefit from this. Teachers, parents, and caretakers are always advised to use these behavior models [22].

Speech therapy, occupational therapy, physical therapy and environmental therapy are all adopted worldwide for the autistic children [23, 24]. They are fully adopted in

the centre where we run this study.

Medications are used to treat psychiatric symptoms as they develop during the disease. There is no direct medical cure for this disease. Twelve patients in our study were on 1-3 psychotropic and non-psychotropic medications according to their needs.

Hyperbaric oxygen therapy (HOBT) at ATA 1.3 using different oxygen pressures ranged from 28-100 % in some studies, showed hope in some cases and was used successfully in case series studies in Thai children and other areas of the world [22, 25-30]. Few children used oxygen bubble in our study. Family claimed the child was very tired after the session, and they were withdrawn from the whole program.

Having this said, the major improvement was in behaviour and functionality of these children. Average improvement was 64.93 ± 16.51% in the different behaviour therapy programs. However, this improvement in behaviour was not accompanied by improvement in Gilliam score neither in the original diagnosis. This proves valid the argument that improvement was functional.

When we first analyse the difference in improvement according to behaviour therapy programs and other factors, age was significant at p value less than 0.05. The earlier you admit the child the faster and better he/she will learn and achieve better level of improvement in the assigned behaviour therapy programs. Further regression analysis showed that the most important factor in improvement was diagnosis rather than age. Age, then, was slightly significant in this prediction model at p value less than 0.1.

Diagnosis is the most important factor in learning, improvement, and achieving positive outcomes. In a sense, even if the child was admitted at young age but he/she had PDD or complex ASD, late ADHD on top of autism or mental retardation, the child will achieve, if any, very little improvement. In certain programs, child will not be able to achieve even a slight improvement. Some children in the centre had slight mental retardation component and they kept shifting them from a program to another without improvement.

Behaviour therapy programs was divided into three categories: language and speech (Teacch, portage, and ablls), social and communication focused programs (lovaas, sonrise), and cognitive management and self-help (Bicc, montessori, and help). Specialists in the centre assigned different programs for these children according to initial need, diagnosis, and Gilliam score at time of admission. First category programs were used in120 child (41 children in teach, 40 in portage, and 39 in ablls), second category programs were used in 57 child, and third category in 59 children. Children were assigned different combinations of these programs and average percentage improvement was 64.93 ± 16.51% in each sector of these 3 programs.

Some children went to regular schools after doing extremely well in all programs, others drop earlier form the training by family, and third portion had hard situation such as mental retardation component where they needed medical attention and were dismissed from the centre. Maximum age of acceptance was 12 years old.

Actually, one of the most important barriers in therapy is family illiteracy and higher expectations of cure for their kids, which lead to early withdrawal from the centre. Financial cost is another barrier since these services are private, very expensive, and not covered by any third party neither by the government. A third barrier was the difficulty in choosing the proper program(s) from the beginning for the child. Specialists in the centre kept trying various therapy programs until they decide on which one, they want to start the child. This leads to frustration of the family, care providers, and the child himself in addition to unnecessary extra cost and higher drop rate.

We highly recommend building a prediction model depending on staggering data from this study and other similar studies to predict efficacy of any program for ASD ahead of implementing the program.

Actually, one of the most important contributions of our research is quantifying improvement, the evaluation of overall quality and efficacy of therapy programs, and the implementing for prediction model for ASD.

Conclusions and recommendations:

Early diagnosis and involvement in behaviour therapy programs improves markedly the outcomes of the child. Knowing that no cure for this condition thus far, at least starting early improves functionality and increase child`s self-independency skills.

Education and raising awareness of communities, families, parents, schoolteachers and social workers to autistic behavior and withdrawal from the community as the first sign of autism is crucial.

Research at the level of neurotransmitters in order to unravel the electrical circuits or the synapse(s) of autism is a present and future research priority.

Ethics approval and consent to participate:

A consent form was signed by attending family member (s) and caregivers in the centre on behalf of the child in order to participate in this research. We guarantee the rights for voluntarily participating in this study and the right to withdraw at any time or at any stage of the study. We guaranteed information confidentiality of subjects of the study and the centre.

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Author's contributions: MS: hypothesis, project idea and design, field supervision, monitoring progress and time schedule, scheme of analysis, follow up on SPSS details, and writing the manuscript. Other three co-authors: literature-review, data collection, fieldwork, Google form preparation, participated in data analysis.

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