Faculty of Medicine

University of Dhaka

Delphi Consensus on Role of Physiotherapy Interventions in Autism Spectrum Disorder (ASD)

Faruq Ahmed

Roll: 107

DU Reg. No: 877

Session: 2019-2020

Master of Science in Physiotherapy

Bangladesh Health Professions Institute (BHPI)

Department of Physiotherapy

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Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Physiotherapy

Department of Physiotherapy

Bangladesh Health Professions Institute (BHPI)

May 2022

We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for acceptance of this thesis entitled, "**Delphi Consensus on Role of Physiotherapy Interventions in Autism Spectrum Disorder (ASD)",** submitted by **Faruq Ahmed**, for the partial fulfillment of the requirements for the degree of Master of Science in Physiotherapy.

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Bangladesh Health Professions Institute (BHPI)

Date of approval: 22.06.2022

Declaration Form

- This work has not previously been accepted in substance for any degree and is not concurrently submitted in candidate for any degree
- This dissertation is being submitted in partial fulfillment of the requirements for the degree of Master of Science in Physiotherapy.
- This dissertation is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged by giving explicit references. A Bibliography is appended.
- I confirm that if anything identified in my work that I have done plagiarism or any form of cheating that will directly awarded me fail and I am subject to disciplinary actions of authority.
- I confirm that the electronic copy is identical to the bound copy of the Thesis.
- In case of dissemination the finding of this project for the future publication, research supervisor & department will highly concern and it will be duly acknowledged as graduate thesis.

Signature:

Name: Faruq Ahmed Date: 22.06.2022

Acknowledgement

All the praises and gratefulness to the Almighty for give me the opportunity to accomplish my study. I would like to gratitude to my honourable supervisor **Professor Md. Obaidul Haque** for his unremarkable guidelines and for not only assisting me but also giving me courage in completion of the study. I am grateful to the Chairman and members of the thesis defense committee for kindly accepting the topic and giving me the opportunity to conduct the study. I am especially indebted with the study participants for giving me valuable time. I would like to give special thanks to **Ehsanur Rahman**, Associate Professor & Course Coordinator, M.Sc in Physiotherapy program, Department of Physiotherapy, BHPI.

It's my privilege to offer my most profound thanks & gratitude to **Kazi Md Amran Hossain**, Lecturer, Department of Physiotherapy & Rehabilitation, Jesshore University of Science & Technology (JUST) for his remarkable help and support to accomplish the study. I would like to gratitude to **Md. Shofiqul Islam** Associate Professor & Head, Department of Physiotherapy, BHPI, for his continuous encouragement. My special gratitude's to the staffs of BHPI library for their cordial help to find out the books and literature of the study.

I would like to thank the respondents from different professional background throughout the country, my colleagues of CRP- Savar and CRP-Mirpur for their participation in the study. I would also like to thank all of my friends and colleagues specially who always inspired and encouraged me and individual who are directly or indirectly involve with this study.

I dedicate my work and study to my beloved wife and my parents who always stand by my side every stages of life believing on me.

Contents

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List of Abbreviation or Symbols

APA	American Psychiatric Association
ASD	Autism Spectrum Disorder
BHPI	Bangladesh Health Profession's Institute
BMRC	Bangladesh Medical Research Council
CNS	Central Nervous System
CRP	Centre for the Rehabilitation of the Paralysed
IQ	Intelligence Quotient
IRB	Institutional Review Board
MPA	Minor Physical Anomalies
MRI	Magnetic Resonance Imaging
NDD	Neuro Developmental Disorder
PA	Physical Activity
QOL	Quality of Life
SMB	Stereotyped Motor Behaviors
SOL	Sleep Onset Latency
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization
WMTS	William & Marie Taylor School

Abstract

Introduction: Autism spectrum disorder (ASD) is characterized by a wide range of physical, cognitive, social and behavioral abnormalities. The Delphi technique is widely used and successful in both healthcare and education to define and specify roles and practice competencies. **Purpose:** The aim of the study is to pursue the role of physiotherapy interventions in ASD. **Method:** A modified two round Delphi study was undertaken using a panel of expert rehabilitation practitioners. The competencies were evaluated in the subsequent rounds by the Delphi panel. The data was collected by frequently mail transferring. Structured close-ended questionnaire were used. Only 50 expert rehabilitation practitioners were sample in this study. The Delphi panel was asked to rate each of the 12 interventions for managing ASD children. Round 1 was opened for 2 weeks and subsequent rounds were opened for 3 weeks to collect rank of intervention through subsequent mail transferring. **Results:** Among 50 participants 43 (86%) participants were rated & ranked the mention 12 interventions in final Delphi round. In the first round, most experience rehabilitation practitioner joined via video-conferencing. Only 6 interventions including hippo therapy, gait training, balance training, coordination practice, proprioception training & physical exercise that were achieved consensus (at least 75% of the panel rating >7) were retained for inclusion in the final core interventions for managing ASD children. The Steering Group approved the revisions and combined capabilities after reviewing the final framework. Binary logistic regression also found higher coefficient & significance values on hippo therapy, gait training, coordination training, balance training, physical exercise & proprioception practice. **Conclusion:** This study highlighted the need of physiotherapy treatments for children with ASD, which should be part of a multidisciplinary team approach that also includes other healthcare professionals. It can be used as a practice guideline & should include overall health-care systems that may apply to children with ASD as physiotherapy's role.

Keywords: *Autism spectrum disorder (ASD), Delphi method, Physiotherapy Intervention.*

Word count: 14615

APPENDIX

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

Ref: Date:

CRP/BHPI/IRB/11/2021/538 23/11/2021

To
Faruq Ahmed
6th Batch (Part-II) M.Sc. in Physiotherapy
Session: 2019-2020, Student ID: 111190077
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal **"Delphi Consensus on Role of Physiotherapy Interventions in Autism Spectrum Disorder (ASD)"** by ethics committee.

Dear Faruq Ahmed
Congratulations.

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned thesis, with yourself, as the principal investigator and Prof. Md. Obaidul Haque as thesis supervisor. The Following documents have been reviewed and approved:

Sr. No.	Name of the Documents
1	Thesis Proposal
2	Questionnaire (English version)
3	Information sheet & consent form.

The purpose of the study is to explore the role of physiotherapy interventions in Autism Spectrum Disorder (ASD) according to the method of Delphi consensus. The study involves use of a self-developed interview question which consists of twelve questions that may take 20 to 25 minutes and there is no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 9:15 AM on 30th March, 2021 at BHPI 27th IRB Meeting (extended).

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,

Muhammad Millat Hossain
Assistant Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

CRP-Chapain, Savar, Dhaka-1343, Tel : 7745464-5, 7741404
E-mail : principal-bhpi@crp-bangladesh.org, Web: bhpi.edu.bd, www.crp-bangladesh.org

Permission Letter

To,
The Chairman
Institutional Review Board (IRB)
Bangladesh Health Professional Institute (BHPI)
CRP, Savar, Dhaka- 1343, Bangladesh

Subject: Application for review and ethical approval

Dear Sir,

With due respect, I am Faruq Ahmed, student of Part II of M.Sc. in Physiotherapy program at Bangladesh Health Professional Institute (BHPI) the academic institute of Centre for the Rehabilitation of the Paralyzed (CRP) under the Faculty of Medicine, University of Dhaka. As per the course curriculum, I have to conduct a thesis entitled **"Delphi Consensus on Role of physiotherapy Interventions in Autism Spectrum Disorder (ASD)"** under the supervision of Professor Md. Obaidul Haque, Vice-Principal of BHPI, CRP. The purpose of the study is to explore the role of physiotherapy interventions in Autism Spectrum Disorder (ASD) according to the method of Delphi consensus. Data will be collected through mail transferring using a structured questionnaire. Here use the questionnaire among 60 participants from specialized hospitals & school settings who are engage in treating ASD. It will take only 20-25 minutes to fill in the questionnaire and there is no likelihood of any harm to the participants. Data collectors will receive informed consent from all participants and the collected data will be kept confidential. Participants will be sent informed consent form & data will be collected through receiving mail.

Therefore, I look forward to having your kind approval for the thesis proposal and to start data collection. I can also assure you that I will maintain all the requirements for study.

Sincerely

Faruq

Faruq Ahmed
6th Batch (Part-II) M.Sc. in Physiotherapy
Session: 2019-2020, Student ID: 111190077
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Recommendation from the thesis supervisor

Prof. Md. Obaidul Haque
Bangladesh Health Profession Institute (BHPI),
CRP, Savar, Dhaka, Bangladesh.

Thesis Presentation date:
30/03/2021
Forwarded
E. Rahman
17-11-2021
Course Coordinator:
M.Sc. in Physiotherapy BHPI.

Code no:

Consent Form

Assalamu Alaikum,

I am Faruq Ahmed, Part-II, M. Sc. in physiotherapy student, BHPI, CRP, Savar, Dhaka-1343. I am conducting a thesis project to partial fulfill of my academic curriculum. I am asking you to participate in a research study. My project title is **"Delphi Consensus on Role of Physiotherapy Interventions in Autism Spectrum Disorder (ASD)".** The purpose of the study is to pursue the role of physiotherapy interventions in ASD. This will take approximately 20 - 25 minutes.

During the interview period if you feel any emotional disturbance, social and economic risk and any other discomfort physical risk please tell me, I will stop the interview immediately. I am committed that the study will not harmful or risk for you. There is no payment for taking part in the study. All information provided by you will be treated as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous.

Your participation in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview. If you have any query about the study or your right as a participant, you may contact with me or my supervisor Professor Md. Obaidul Haque, Vice-Principal, BHPI, CRP, Savar, Dhaka. Do you have any questions before I start?

So, may I have your consent to proceed with the interview?

YES ☐ NO ☐

Signature of the Investigator & Date: ……...

Signature of the Participant & Date: …….

Signature of the Witness & Date: …….

"Delphi Consensus on Role of Physiotherapy Interventions in Autism Spectrum Disorder (ASD)"

A. Demographic Characteristics of Delphi Panel

S/L	Traits	Criteria	Put a tick here
01	Gender	a) Male	
		b) Female	
02	Age	a. 20-29 years	
		b. 30-39 years	
		c. 40-49 years	
		d. 50-59 years	
		e. 60+ years	
03	Years of practice experience	a) 5-10 years	
		b) 11-15 years	
		c) 16-20 years	
		d) > 20 years	
04	Primary scope of practice	a) Pediatric	
		b) Hospital/clinic	
		c) School settings	
05	Area of expertise (Profession)	Physiotherapist	
		Occupational therapist	
		Pediatrician	
		Academic Nurses	
		Speech therapist	
		Clinical Counselor	
		Special Educator	

B. Delphi Questionnaire

1. **Balance practice/training for ASD (Code:01)**

Exercise name: Single leg stance, balance path, dynamic balance, double leg balance, reaching, grasping, walking, running, swimming, cycling, strength & endurance training.

Criteria: Balance problem with ASD

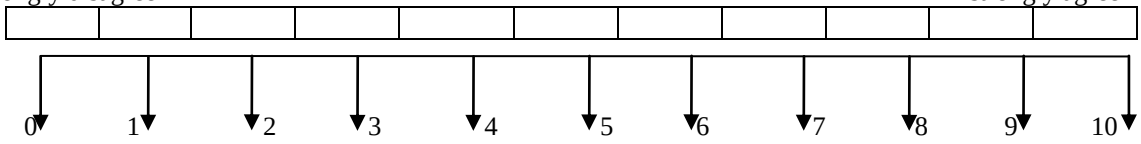
Dosage: 10-weeks program consisting of 20 sessions (2 sessions per week; 60-min per session)

A. Do you agree with balance training is essential for ASD children? Please tick any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



2. Gait practice/training for ASD (Code:02)

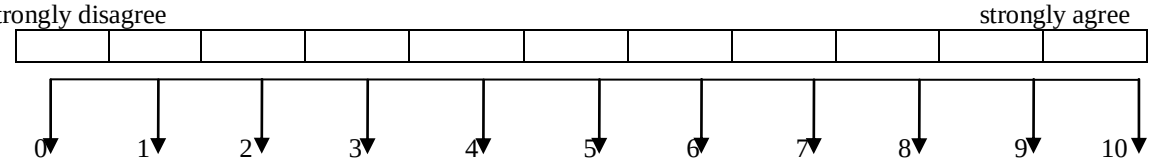
Exercise name: Practice stepping, pacing, jumping, hopping, skipping, staring, spinning, manual dexterity, ball skills, static and dynamic balance.
Criteria: Gait abnormalities with ASD
Attention: Influence gait training improves gross motor function & coordination of ASD.

A. Do you agree with gait training is essential for ASD children? Please tick any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



3. Aerobic exercise training for ASD (Code:03)

Exercise name: Catching, throwing a ball with one and two hands, balancing & jumping

Criteria: Disturbances of sleep, motor skill and mood among children with ASD.

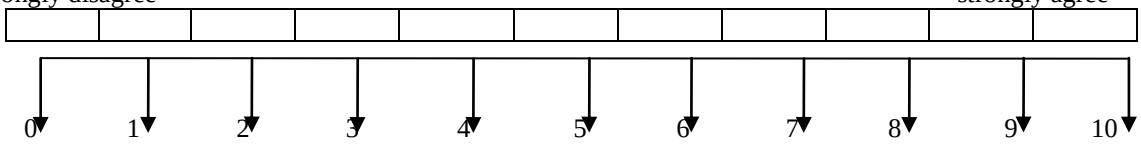
Dosage: Thrice-weekly 60-minute sessions for 3 consecutive weeks.

A. Do you agree with Aerobic exercise is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



4. Muscle strengthening exercise for ASD (Code:04)

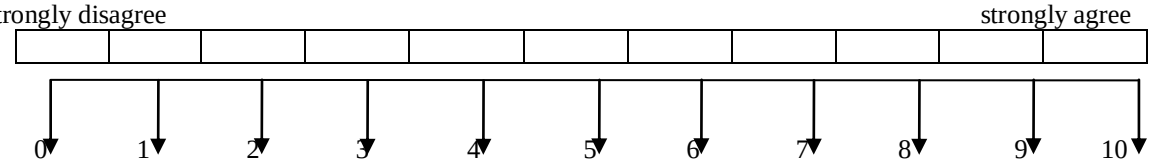
Exercise name: push-ups, curl-ups, trunk lift, grip strength & trampoline training.
Criteria: Low muscle tone & muscle weakness among children with ASD.
Dosage: 32 weeks program training (1 session per week lasting 45 minutes)

A. Do you agree with Aerobic exercise is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



5. Physical exercise for ASD (Code:05)

Exercise name: Locomotors, object control skills, balance, jumping, fine & gross motor coordination, clapping hands, skipping, hopping, throwing, kicking or catching a ball.

Criteria: To achieve motor skills, executive functions, emotion regulation and behavioral functioning in children with ASD.

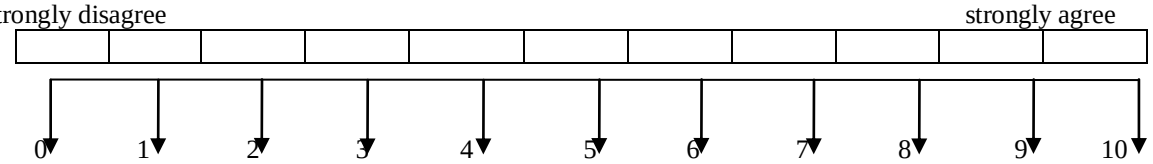
Dosage: 12 weeks exercise consisting of 48 sessions (4 sessions/week & session for 30-minutes)

A. Do you agree with physical exercise is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



6. Evidence Based Practice for ASD (Code:06)

Exercise name: Exercise as an evidence based practice (EBP) for children with ASD.

Criteria: For improvements of cardio-respiratory functioning, motor skill performance and muscular strength of ASD children.

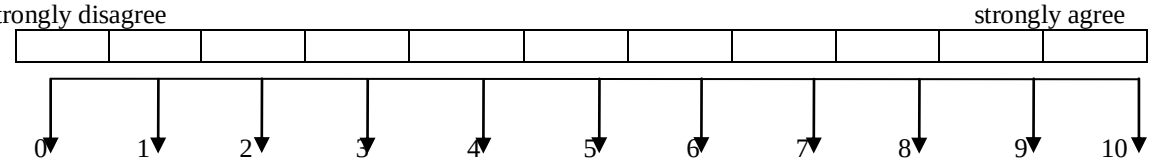
Attention: It appears that exercise can be considered an EBP for children with ASD.

A. Do you agree with evidence-based practice (EBP) is beneficial for ASD? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



7. Hydrotherapy for ASD children (Code:07)

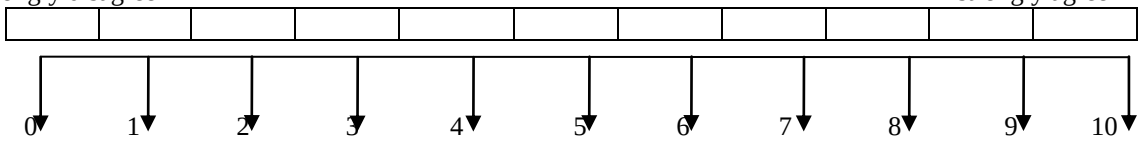
Exercise name: The hydrotherapy sessions were led by registered physiotherapist.
Criteria: Mental health & wellbeing, emotional control among children with ASD.
Dosage: The sessions lasted 45 minutes and were planned once weekly for 8 weeks.

A. Do you agree with hydrotherapy is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



8. Hippo therapy for ASD children (Code:08)

Exercise name: The horse riding portion consisted of a warm up activity, skill review, learning a new skill, lesson review and a cool down activity.

Criteria: Self-regulation, socialization, communication, adaptive and motor behaviors among children with ASD.

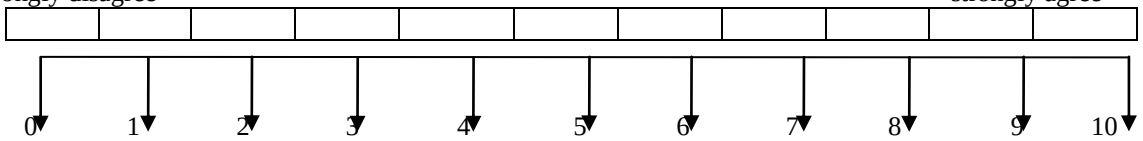
Dosage: 10-weeks interventions were a minimum of 45 minutes long each session.

A. Do you agree with hippo therapy is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



9. Gross motor function for ASD children (Code:09)

Exercise name: Gross motor function (locomotion and object control skills) and health fitness (body composition, flexibility, strength, muscle and cardiopulmonary endurance)

Criteria: Poor strength, endurance, flexibility & control skills

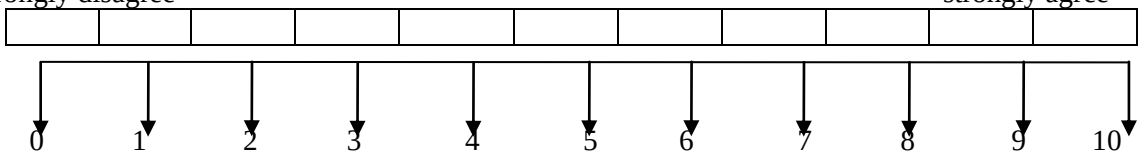
Attention: Exercise programs could provide similar effects, like ASD or ID.

A. Do you agree with Gross motor function is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



10. Coordination practice for ASD children (Code:10)

Exercise name: Gait and balance, arm functions and movement planning, visuomotor integration, visual perception, motor coordination & developmental motor milestones

Criteria: Problem in reaction time, movement accuracy, adaptation rate, gait velocity.

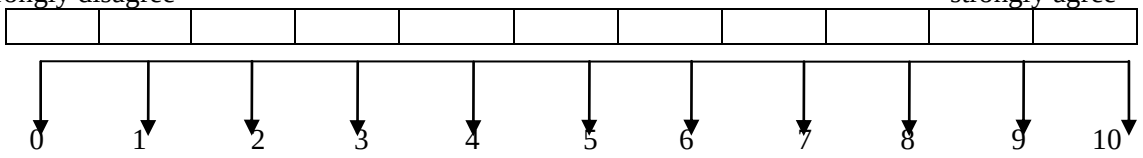
Attention: Motor coordination deficits are cardinal feature of Autism Spectrum Disorder.

A. Do you agree with Coordination practice is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



11. Proprioception practice for ASD children (Code:11)

Exercise name: Position-based proprioception angles: 20 & 5 degrees plantar flexion, and 10 dorsiflexion. The speed-based proprioception: 60 & 120 degrees /sec.

Criteria: Problem with lower extremities strength & proprioception.

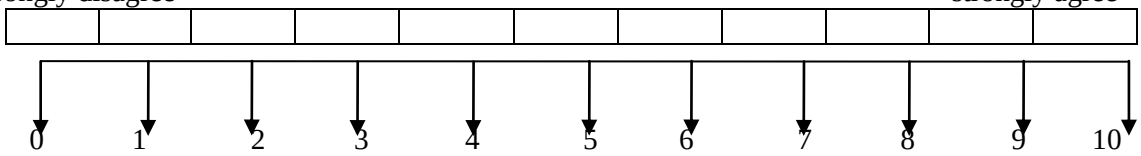
Attention: Rehabilitative program improves lower extremity strength & proprioception.

A. Do you agree with proprioception practice is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



12. Motor performance for ASD children (Code:12)

Exercise name: Manual dexterity, ball skills, balance.

Criteria: Problem with motor skill & function.

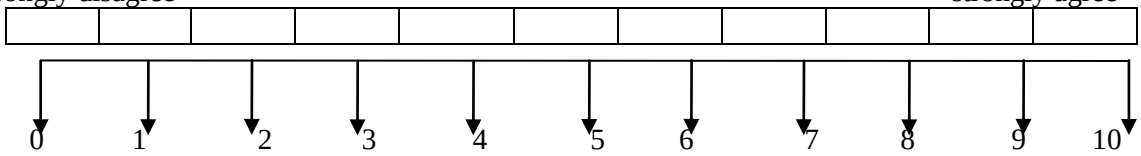
Attention: The greater knowledge & more attention to motor performance of ASD children, as well as importance of physiotherapy.

A. Do you agree with Motor performance is essential for ASD children? Please tick or circle any of the following option.

1. Essential	2. very important	3. important	4. unimportant	5. undesirable

B. Please rank the intervention of your own judgment from (0-10) using tick on below:

Strongly disagree strongly agree



N.B. If you have any comments regarding PT interventions of ASD, obviously please feel free write it down. Also if you have any suggestion or recommendation of any new intervention please writes it with references.

……

……..

Synopsis of selected Article as role of PT intervention:

- Randomized controlled trial
- Autism Spectrum Disorder (ASD)
- Physiotherapy Intervention
- Pedro score more or equal 4/10
- Article published from 2015-2021.

Author	Title/ objectives	Study design	Intervention	Control	Dosage	Tools	Results	Pedro score
(Ansari, Hosseinkhanzadeh, AdibSaber, Shojaei & Daneshfar, 2021).	To compare the effects of a land-based and a swimming-based exercise program on balance abilities in children with autism.	RCT	**Aquatic Exercise:** Warm up, orientation training, basic swimming skill, free swim & cool down **Kata Techniques:** blocking, punching, sticking, and kicking movements	Received no intervention	10-weeks techniques program consisting of 20 sessions (2 sessions per week; 60-min per session)	Stork Test Walking Heel to Toe Test	Both interventions had a significant effect on balance abilities ($p<0.001$).	4/10
(Shahrasfenghar, Arabameri, Daneshfar, Ghasemi & Kashi, 2019)	To determine the effect of aerobic exercise on motor skills and body composition of autistic children	RCT	Aerobic exercise received 90 minutes of each session of total 12 sessions program.	No exercise was provided	12 sessions of 90 minutes of aerobic exercise	Brininx Oresetsky Expedition Test Physical Fitness Machine and Intervention Tool	Aerobic exercise improved the level of fine and elegant motor skills, and body composition as well as the children with ASD.	5/10
(Lourenço, Esteves, Corredeira & Seabra, 2015).	To evaluate the effects of a trampoline-based training program on both the muscular strength in children with ASD.	RCT	Trampoline training in a gym fully equipped with various types of trampolines (1 session per week lasting 45 minutes)	Regular school activities	Once weekly lasting 45 minutes for 32 sessions.	Bruininks–Oseretsky Test (BOT2) Standing long jump without run-up	Motor proficiency is positively correlated with physical exercise, which reduced symptoms of ASD.	5/10

(Andy, 2020).	To explore the effects of physical exercise on emotion regulation & behavioral functioning in children with ASD.	RCT	Received jogging intervention for 12-weeks	Received no intervention	12-week jogging intervention consisting of 48 sessions (four sessions per week; 30-min per session)	Emotion Regulation Checklist Child Behavior Checklist	Physical exercise had a positive influence on emotion regulation & behavioral functioning in children with ASD	5/10
(Pan et al., 2017)	Physical activity intervention on the motor skill proficiency & executive function with autism spectrum disorder	RCT	Motor skills, including locomotor (e.g. running, hopping and jumping), object control (e.g. catching, throwing and striking), gross motor (coordination, balance and agility), and fine motor skills (e.g. precision, integration and manual dexterity).	True control, no intervention.	12-week physical activity intervention	Bruininks–Oseretsky Test 2nd Edition, (BOT2) Wisconsin Card Sorting Test	Physical activity interventions may be a viable therapeutic option for treating children with ASD.	4/10
(Mills, Kondakis, Orr, Warburton & Milne, 2020).	To determine whether hydrotherapy influences behaviours which impact mental health and well-being in children with ASD	Randomized crossover control led pilot trial	Led by a registered physiotherapist variety of activities warm up targeting, swimming skills, balance, eye-hand coordination, cognitive tasks & cool down	Control group only for 4 weeks	(45 minutes session once weekly for 8 weeks).	Child Behaviour Check List - CBCL	Hydrotherapy may enhance behaviours impacting mental health and well-being of children with ASD.	4/10
(Gabriels et al., 2015)	To evaluate the effect of hippo therapy on self-regulation,	RCT	Therapeutic horseback riding intervention	Barn activity control intervention where participa	Both 10 weeks interventions were a minimu	Fidelity instrument 4 point rating	This RCT demonstrating efficacy of hippo therapy for	5/10

	socialization communication and motor behaviors with ASD.			nts had no contact with horses	m of 45 minutes long each session	scale	the ASD	
(Holloway, Long & Biasini, 2018)	To examine the relationship between gross motor skills and social function in young boys with ASD.	Observational study	Motor tests were administered by the same physical therapist with 12 years of experience in pediatrics.	No control group	N/A	Peabody Developmental Motor Scales (PDMS-2) M-FUN test, SSIS Rating Scales	Motor skills and social function are related in young boys with autism where implications for physiotherapy exercise are needed.	N/A
(Armitano-Lago, Bennett & Haegele, 2021).	To compare lower limb proprioception and strength in adolescents with ASD and neurotypical control.	RCT	Position-based proprioception angles: 20 degree plantarflexion, 5 degree plantarflexion, &10 degree dorsiflexion. Speed-based proprioception: 60 degree/sec 120 degree/sec	Three tests were performed on both group	The protocol for both limbs generally required 30 minutes to complete.	Iso-kinetic dynamometer	Proprioception training has promise for important gains in motor functions & improving lower extremity strength	5/10
(QUINTAS, BLASCOVI-ASSIS, Castilho & SANTOS, 2018).	To evaluate the motor performance of school-aged children and adolescents diagnosed with ASD	Observational, case control study	Manual dexterity, ball skills, static and dynamic balance.	The CG was evaluated for motor performance following the same procedures of intervention group	N/A	Movement Assessment Battery Scale for Children (M-ABC2) Autistic Traits Assessment (ATA) scale	The study highlights the need for greater knowledge & more attention to motor performance of ASD children, as well as importance of physiotherapy.	N/A

CHAPTER I: INTRODUCTION

1.1 Background of the study

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects sociocultural communication & behavioural adjustment that naturally occurs at birth (Hynes & Block, 2022). It is a pervasive neurodevelopmental disorder that affects 1–2% of the populace (Roman-Urrestarazu et al., 2021). It is a marked by communication and social interaction deficits, as well as restricted and repetitive behavior in early childhood (Ministry of Health, 2014). Delays in fine and gross motor, gait deformities such as differences in joint angles and ground reaction forces (Dufek, Eggleston, Harry & Hickman, 2015); postural problems due to possible difficulties using sensory input; and coordination challenges with motor plan and execution are all common motor skill deficits in children with ASD (Morris et al., 2015; Holloway, Long & Biasini, 2018).

According to Jachyra, Renwick, Gladstone, Anagnostou & Gibson (2020), physiotherapy engagement for children and adolescents with ASD can provide a range of physical, psychological, and social welfare. In this context, experimental research suggests that PA can increase motor skills and motor function (Ketcheson et al., 2018), improve general fitness and physical health, and improve sleep quality (Tse et al., 2019). Furthermore, PA participation has been linked to improved psychological health, with decreases in stress and anxiety as well as self-injurious (Sowa & Meulenbroek, 2012) and self-stimulating habits (Sorensen & Zarrett, 2014). Finally, PA has been linked to improved social and communication skills (Dillon et al., 2016), as well as aiding community inclusion (Gregor et al., 2018).

The Delphi technique is widely used and successful in both healthcare and education to define and specify roles and practice competencies (Keeney, Hasson & McKenna, 2011). Delphi consensus approaches are excellent for synthesizing knowledge about a specific subject (Hsu & Sandford, 2007). It's a method that works well in instances when individual judgments are required to handle an incomplete state of knowledge (Keeney, Hasson & McKenna, 2011). The Delphi method was used in this study to find out the best opinion regarding physiotherapy for ASD from expert rehabilitation professionals.

The Delphi exercise is a well-known approach for establishing the content validity of assessments by determining expert consensus on the items and topic (Boateng et al., 2018). It's a good way to bridge the gap between theories and practice (Stone Fish & Busby, 2005). Participants found the Delphi technique to be convenient because they could contribute anonymously, did not have to be physically present, and could complete the surveys at their leisure (Green, 2014). The original Delphi technique has been adopted and modified for application in a variety of disciplines and research methods and objectives (Hasson & Keeney, 2011).

The Delphi survey method is an iterative process for establishing 'opinion convergence' among groups (Dalkey & Helmer, 1963). Delphi surveys are commonly used in health research to bring together professional specialists' opinions on poorly understood or under-evidenced topics, with the main goal of generating consensus on what best practice ‘should or might' be (Hsu & Sandford, 2007). Davies et al., (2021) performed a Delphi poll in which respondents were asked to rank each of the specific capabilities for physiotherapy capacities for care delivery through videoconferencing as 'unimportant,' 'important,' or 'essential.'

There is growing evidence that ASD impairs not only speech, cognition, attitude and emotion, and emotional control, but also motor function (American Psychiatric Association, 2013). Although motor abnormalities are not considered a key component of ASD, clinicians and researchers are fully aware of motor difficulties (Sumner et al., 2016). The variety of significant findings from the evidence offered earlier gives adequate evidence that PTs are required to participate in multidisciplinary efforts as researchers, academics, educators, policy experts, and campaigners in ASD (Mieres, Kirby, Armstrong, Murphy & Grossman, 2012).

Children with autism may benefit from physiotherapy to help them develop maturity level physical and motor abilities such as bouncing, clapping hands, skipping, hopping, and throwing, kicking, or catching the ball (Andrea Rosenthal-Malek et al., 1997). Physiotherapists treat impairments in systems that affect movement patterns, such as respiratory function and coordination issues, as well as correcting posture and resolving

musculoskeletal system imperfections, such as chest wall malformations and foot and ankle deformations (Jebakumar, 2017). Physical therapy can help children with autism with posture, attention, and eye contact, chest wall misalignments, foot or ankle misalignments, coordination and motor functions, as well as building a fitness routine (Rosenthal-Malek, 1997). ASD may benefit from aquatic therapy as a type of exercise. Study revealed that participating in physiotherapy for children and adolescents with ASD has a range of physical, emotional and intellectual benefits (Cynthia et al., 2019).

PA engagement can be defined as any energy-expending body movements, such as fitness and strength exercises, sports, performing arts, play and active transportation (Jachyra & Gibson, 2016). PA can help children with ASD improve their cardiovascular capacity, strength, motor control, and general fitness (Ketcheson, Hauck & Ulrich, 2018). In addition, PA can help people establish routines and schedules, relieve stress, boost self-efficacy and consciousness, and improve general psychological health (Sowa & Meulenbroek, 2012). Participating in PA activities has also been demonstrated to help manage various symptoms and attitudes (Sorensen & Zarrett, 2014). For contrast, jogging, martial arts, and horse riding have been shown to reduce stereotyped behaviors like rocking and hands flapping (Gabriels et al., 2012). In children with ASD, moderate to intense physical activity has been proven to improve concentration, improve cognitive function, improve communication skills, and reduce self-injurious behaviors (Dillon, Adams, Goudy, Bittner & Mcnamara, 2016). Despite the various benefits of PA, children with ASD frequently fail to satisfy PA guidelines (Bandini et al., 2013), which require that all children have 60 minutes of moderate to vigorous physiotherapy every day (Cynthia et al., 2019).

Individual with autism can be difficult to recognize and diagnose, especially if they also have intellectual disabilities or mental health issues (Wigham et al., 2022). Living with undiagnosed autism can be stressful, and it can influence one's mental health as well as their ability to thrive in lifelong tasks such as job and relationships (Stagg & Belcher, 2019). Receiving an autism diagnosis can help people become more aware of them and gain access to services and community resources (Leedham et al., 2020).

Despite the numerous benefits of physical activity, evidence indicates that children with ASD are primarily inactive (Healy et al., 2017). McCoy et al (2016) found that adolescents with ASD were 60% less likely to engage in PA and 74% less likely to engage in organized sports when comparing to their age-related mates. It hasn't looked at how PA is influenced beyond individual physical limitations like gross-motor deficiencies, and sensory aspects also are lacking (Campos et al., 2019; Jachyra, 2020).

Hynes & Block (2022) was discovered that physical activity (PA) as a treatment option or supplement to other treatments to improve social, behavioral, and academic skills in children and young people with ASD. Parents, professionals, and research all endorse PA as a viable therapy option, with more people becoming interested (Tiner, Cunningham & Pittman, 2021). According to previous research, PA is considered as moderate to strenuous exercise in this review (Piercy et al., 2018). Furthermore, a range of PA programs have been shown to be beneficial for people with ASD (Toscano, Carvalho & Ferreira, 2017).

Autism is a disease that changes how children perceive, understand and experience the world, making it difficult for them to communicate in a social setting. They have a unique reaction to events in their environment, such as loud noises, flash of light, crowds, and may engage in strange, repetitive behavior (Jebakumar, 2017). ASD symptoms include difficulties with social interaction and communication, as well as a variety of motor difficulties that are not explained solely by neurocognitive deficiencies (McPhillips, Finlay, Bejerot & Hanley, 2014). Autism Spectrum Disease (ASD) is a neurodevelopmental condition that impairs one out of every 54 school children (Maenner et al., 2020).

Physical activity has been recognized as an important predictor of motor skill competency in TD kids and teens. Physical exercise may be reduced in those with ASD who have poor physical skills competency. Individuals with ASD who are physically engaged, on the other hand, may develop advanced motor skills. Physical activity is a lifestyle that may be changed (Barnett, van Beurden, Morgan, Brooks & Beard, 2009). Harter's competence motivation theory, a theory of accomplishment motivation

depending on a person's sense of personal competency, can explain the relationship between physical skills competency and physical self-perception (Chu et al., 2019).

DeJesus et al. (2020) found that dance had a favorable effect on ASD symptoms in a systematic review. Social involvement, conduct, communication skills, physical awareness, and mental health were all enhanced. A meta-analysis of 29 articles on PA treatments for children with ASD indicated a moderately positive impact (Healy, Nacario, Braithwaite & Hopper, 2018). However, there were moderate-to-large favorable benefits in the domains of movement manipulative and locomotor skills, physical strength, and endurance. Furthermore, significant gains in a social function were reported (Healy, Nacario, Braithwaite & Hopper, 2018). Children on the spectrum who participated in a 12-week organized PA program exhibited considerable improvements in social function, according to a study conducted on 5–8-year-old children in a special school in China (Zhao & Chen, 2018).

It is now well acknowledged that parents play a critical role in practically all ASD treatment options. ASD was originally thought to be caused by parents. They are, however, now often regarded as the most essential resource and most successful factor in facilitating behavioral changes in children with ASD (Schopler, 1987). Early therapies for children with ASD have been demonstrated to have a moderate-to-large effect on outcomes (Beaudoin, Sébire & Couture, 2014). Parents-only interventions have shown to have much better outcomes and are more intensive (Burrell & Borrego, 2012). Parental engagement has been demonstrated to improve treatment outcomes by supplementing treatment modalities. In comparison to therapy administered without family involvement, PA delivered with family involvement resulted in superior outcomes (Lakin et al., 2007). PA based therapies and keeping ASD individuals physically active tend to rely heavily on parental support and involvement (Nichols, Block, Bishop & McIntire, 2019).

According to Cameron et al. (2020), movement-based therapies that are beneficial for older children with ASD where may not be effective for preschoolers. There are several approaches of administering PA programs in addition to the principles. According to Bremer Crozier & Lloyd (2016), the two best kinds of physical exercise are martial arts and horseback riding, with yoga, dance, and swimming providing it’s only a minimal

benefit. DeJesus et al. (2020), on the other hand, believed that dance had a good impact on children and improved several of their symptoms, including social behaviors, communication skills, and psychological well-being.

Children with developmental impairments may benefit from PA programs that are arranged in a group setting with teammates, classmates, coaches, and teachers (Rinehart, Jeste & Wilson, 2018). Incorporating group-based PA into a social setting would provide for more opportunities for social interaction. Social behavior and communication should be easier in a group situation (Sowa and Meulenbroek, 2012). The individual approach shields the child with ASD from unpleasant emotions such as being misinterpreted by peers (Pan, 2009) and tensions between teams or opponents (Sowa and Meulenbroek, 2012). Future studies should focus on team sports, according to the authors (Howells et al., 2019).

Minor Physical Anomalies (MPAs) of ASD are caused by genetic factors and prenatal events such as maternal hemorrhage with subsequent fetal hypoxia, gestational diabetes, drug use, or toxemia (Stromland, Nordin, Miller, Akerstrom & Gillberg, 1994). Patients with schizophrenia, bipolar illness, ADHD, and Tourette syndrome had higher MPA rates (Akabaliev, Sivkov, Mantarkov & Ahmed-Popova, 2011). Furthermore, MPAs are thought to be indications of sickness severity (Mcgrath et al., 1995). The Waldrop Physical Anomaly Scale discovered eight things by examining epicanthus, hypertelorism, low-settled ears, adherent ear lobe, deformed ears, relative toes lengths, partial syndactylia and sandal gap between first and second toe respectively (Waldrop & Goering, 1971). According to the Waldrop Physical Anomaly Scale the MPAs are separated into six subscales that reflect anatomic body areas: head, eyes, ears, mouth, hands, and feet (Manouilenko, Eriksson, Humble & Bejerot, 2014). Several studies have supported the use of physical exercise as treatment option, defined as a subset of physical activity that is planned, structured, and repetitive with the goal of increasing or maintaining physical fitness (Neely, Rispoli, Gerow & Ninci, 2015).

1.2 Rational of the study:

Every child with autism is different, and not every child with autism will require physiotherapy. Some children with ASD have low muscular tone, poor balance and lack coordination, while others have a combination of these symptoms. A physical therapist can help with all of these issues. Following an examination, the physiotherapist will devise and implement a program to help the child's specific areas of need improve, as well as promote overall mobility function and involvement in ASD individuals. Gross motor abilities, balance and coordination abilities, strengthening, physical functioning, and motor planning are all areas where physiotherapy can help. Physiotherapists are professionals in improving motor development, prescribing physical activity, and addressing physical skills and fitness as movement experts. Physiotherapy, in addition to improving functional mobility, plays a unique role as advocates for physical function and health, and is thus perhaps ideally positioned to encourage and improve participation in physical activity for children with ASD. Physiotherapy treatment for patients with ASD has trailed behind & marked practice gap because there is no available intervention research.

As physiotherapists, we feel the potential and ability to play a significantly larger role in ASD. But there is no exact physiotherapy guidelines for treating ASD children which is needed to design a realistic and successful physiotherapy program. So, we felt the importance of physiotherapy intervention as practice guidelines for ASD children. We wished to choice the Delphi method to conduct a study for establishing physiotherapy treatment guidelines of ASD children. We selected Delphi technique because it is widely used and successful in healthcare professional to define and specify roles & guidelines.

Research showed that physiotherapy is important for ASD management but proper PT guidelines weren’t available. So we explored the evidence guidelines for ASD management. However, policy and practice remain behind in acknowledging physical physiotherapists' potential contributions to ASD research, treatment, and awareness. More research is currently required to guide the structure, procedure and content of physiotherapy intervention for children with ASD.

1.3 Research question:

What is the role of physiotherapy intervention in Autism Spectrum Disorder (ASD)?

1.4 Objectives of the study:

1.4.1General objectives:

- To pursue the role of physiotherapy interventions in Autism Spectrum Disorder.

1.4.2 Specific objectives:

I. To identify the socio demographic information of the respondents.
II. To epistle the expert opinion on role of physiotherapy in ASD.
III. To generate evidence based guideline on role of physiotherapy in ASD.
IV. To identify the agreement of physiotherapy interventions for ASD.
V. To rank the evidence based physiotherapy practice in ASD according to the order of statement.

1.5 Operational definition:

Delphi Consensus: The Delphi consensus technique is widely used and successful in both healthcare and education to define and specify roles and practice.

Autism Spectrum Disorder (ASD): ASD is a multifaceted diagnosis marked by social interaction difficulties and repetitive patterns of behavior, hobbies, or activities, as well as a variety of physiological, behavioral traits spanning sensory, neurological and neuromotor functioning.

CHAPTER II: LITERATURE REVIEW

Autism spectrum disorder (ASD) is a multifaceted diagnosis marked by social interaction difficulties and repetitive patterns of behavior, hobbies, or activities, as well as a variety of physiological, behavioral traits spanning sensory, neurological and neuromotor functioning (American Psychiatric Association, 2013). Significant data suggests that people with ASD have motor impairments (Fournier, Hass, Naik, Lodha and Cauraugh, 2010), with postural stability, walking, coordination, and both gross and fine motor capabilities (Armitano, Bennett, Haegele & Morrison, 2020; Bennett, Ringleb, Bobzien & Haegele, 2021).

ASD is characterized by a wide range of physical, cognitive, social and behavioral abnormalities (American Psychiatric Association, 2013). Self-stimulating motor stereotype and repetitive actions such as hand flapping, head nodding, and spinning coins are examples of these deficiencies (Srinivasan, Pescatello & Bhat, 2014). When compared to others who do not have ASD, these individuals have severe motor coordination issues (Lee & Porretta, 2016). Furthermore, children with ASD have been reported to have lower levels of physical activity than children without ASD (MacDonald, Lord & Ulrich, 2013). Children with ASD benefit from interventions that aim to reduce stereotyped or aggressive tendencies while also increasing physical, intellectual and social development (Sowa & Meulenbroek, 2012). The influence of exercise and physical activity on behavior, academic achievement, social skills and physical fitness in children with ASD has been studied (Young & Furgai, 2016).

ASD is common in early detection at very young ages (Christensen et al., 2016), and many of the existing treatments are administered as early interventions beginning in the preschool years. There is presently no specific cure for ASD, and the only treatment options are behavioral and educational interventions (Medavarapu, Marella, Sangem & Kairam, 2019). There are two types of ASD interventions currently available: comprehensive treatment models, which are structured programs and focused intervention methods, which exclusively address specific behavioral problems (Wong et al., 2015). Pharmaceuticals, nutritional supplements, special diets and alternative or

complementary medicine are examples of single-medication techniques (Medavarapu, Marella, Sangem & Kairam, 2019). Early intervention programs focus on communication and social skills in general. Pediatricians, child psychiatrists, occupational therapists, physiotherapists, speech therapists, psychologists, specialist-teachers and parents are commonly involved in these sessions. These groups help with educational and psychological needs (Sefen et al., 2020).

ASD is characterized by social deficiencies, communication abnormalities and repetitive stereotype behavior in children (World Health Organization, 2016). Maski & Owens (2016) found that insufficient sleep can exacerbate the poorer memory consolidation in children with ASD in a recent case-control study. In reality, children with ASD frequently have cognitive difficulties (Sachse et al., 2012). Meanwhile, sleep deprivation and impaired cognitive function have been linked extensively (Dewald, Meijer, Oort, Kerkhof & Bogels, 2010).

The prevalence of ASD has risen substantially in recent years and continues to rise around the world. According to the World Health Organization (WHO, 2018), one in every 160 children worldwide has an ASD (Keogh et al., 2019). Even so, this figure may not reflect reality; the prevalence of ASD with many low and middle-income nations remains unknown (WHO, 2018). According to current US statistics, the prevalence of ASD among children aged 3 to 17 is estimated to be 1 in 40 (Kogan et al., 2018). In Europe, the estimated average frequency among 7-9 year old children is 1 in 89 (ASDEU, 2018). According to the WHO, the prevalence of ASD has increased over the last 50 years due to a variety of factors including increased awareness, expanded diagnostic criteria, improved diagnostic instruments, and greater reporting (WHO, 2018).

According to statistics supplied by the Centers for Disease Control and Prevention (CDC, 2019), approximately 1-2% of the populace has been identified with autism (Ye, Leung & Wong, 2017). In contrast, the prevalence of ASD among adolescents in selected nations globally as of 2017 found that Japan has the highest incidence of individuals with ASD, estimated to be 161 per 10,000 children, followed by the United Kingdom with 94

per 10,000 children. The United States, as a developed and leading country in healthcare and medicines, had 66 ASD in every 10,000 children (Retrieved on 4th February 2018).

This rising global incidence of ASD is undoubtedly concerning news, since it indicates that ASD is no longer an unusual illness (Bond & Hebron, 2016). Recently, it has become commonly accepted that ASD is caused by a combination of genetic and environmental factors (Ye, Leung & Wong, 2017). Autism is thought to be caused by more than 60 genes (Robinson et al., 2016). The hereditary gene is one of the most influential, affecting around 40% of people (Stein, Parikshak & Geschwind, 2013). According to current studies, environmental factors, have a similar impact and may influence roughly 40-50 percent of ASD cases (Modabbernia, Velthorst & Reichenberg, 2017). The Ministry of Health (MOH), 2014, recognized ASD's etiology as multi-factorial, encompassing both genetic and environmental elements. The effects of risk factors such as parental age, preterm, encephalopathy, immunization, genetic risk and postpartum supplementation on the diagnosis of ASD were investigated (Murphy et al., 2016).

Autism is four to five times most common in boys than in girls (Elsabbagh et al., 2012). In 2006, there were 9 per 1000 children aged 8 years old, or 1 in every 110 children. The Autism and Developmental Disabilities Monitoring Network published a combined ASD prevalence of 11.3 per 1000 children aged 8 years, or 1 in 88 children, in 2012 (Volkmar & Pauls, 2003). In terms of its steady increase over the previous two decades (Centers for Disease Control and Prevention, 2008), as well as the absence of effective therapy, and even the challenges faced by society and families of autistic children, the need of research into the causes of this disease and efforts to prevent it becomes evident. There is a growing amount of evidence indicating autism causation via genetic variations (Weiss & Arking, 2009). Harmful environmental variables can alter the expression of developmental important genes at critical stages of embryo development, raising the risk of genomic imprinting illnesses like autism (Foley et al., 2009). Autism is a complex neurodevelopmental condition that is caused by a combination of genetic and environmental factors (Karahmadi, Karimi, Kamali & Mousavi, 2017).

ASD is estimated to affect one out of every 68 people. The most common male: female ratio recorded in the literature is 4:1 (Young, Oreve & Speranza, 2018). Parents have a

significant influence on children's games and play, with a girl being encouraged to play girls' games such as dolls and cooperative pretend play (Sedgewick, Hill, Yates, Pickering& Pellicano, 2016). Parents of children with ASD expect more social actions from girls than from boys. As a result, parental education may have an impact on the clinical presentation of girls. A growing number of researches demonstrate that females with ASDs have a slower diagnosis. Delays in ASD treatment have been linked to increased developmental difficulties (Lai, Lombardo & Auyeung, 2015). It affects approximately 2% of the population (Wingate et al., 2012). With a sex ratio of around 4:1, males are more affected than females (Fombonne, 2009). ASD is expected to affect 1% of the North American population and 0.3 percent of the Brazilian population (Paula, Ribeiro, Fombonne & Mercadante, 2011). As per estimates, ASD affects more men than women, with a gender ratio of 4.3:1 over the whole intelligence quotient (IQ) range (Fombonne, 2005). Furthermore, prevalence statistics may vary by country, particularly in developing nations where the lack of specialist services for early detection of ASD contributes to lower prevalence rates (Paula, Ribeiro, Fombonne & Mercadante, 2011).

Physical, mental and psychological health and financial state throughout the pregnancy are important factors affecting fetal development and health. A set of prenatal risk factors which increase a child’s susceptibility to autism is advanced parental age, maternal physical health (Buchmayer et al., 2009), maternal mental health, hypertension/edema, nausea or vomiting, maternal bleeding during pregnancy (Gardener, Spiegelman & Buka, 2011), infections during pregnancy, schizophrenia, depression, anxiety and stress & antidepressant drugs (Karahmadi, Karimi, Kamali & Mousavi, 2017).

Natal risk factors increase the fetal risk of autism. Abnormal gestational age, preterm (42 weeks), is associated with a significantly increased risk of autism (Zhang et al., 2010). Prenatal risk factors like bleeding during pregnancy and natal risk factors like fetal complications like fetal distress, umbilical cord complications like fetal nuchal cord, and caesarean section (Gardener, Spiegelman & Buka, 2011) are all linked to hypoxia and, as a result, increased risk of exposure to child autism (Maimburg & Vaeth, 2006).

In postnatal, low birth weight, jaundice and postnatal infection are some of the most significant risk factors for autism (Buchmayer et al., 2009). A newborn with a birth

weight that is determined by three factors: genetic growth potential, pregnancy duration, and fetal development rate (Larsson et al., 2005); low birth weight is defined as less than 2.5 kg grams and is linked to a two fold increase in the risk of autism (Schendel & Bhasin, 2008). Human genetics, metabolic diseases, viral infections, neuroanatomical and biochemical structural abnormalities in the brain, as well as some others now being explored, are the causes of ASD (Roy, Roy, Deb & Unwin, 2015).

The Delphi technique seeks to reach a group of selected experts' consensus of opinion by offering systematic feedback between rounds' when experts aggregate their suggestions (Giannarou & Zervas, 2014). The experts complete multiple rounds of a poll on their own, during which they are asked to evaluate and revise their own thoughts as well as the de-identified opinions of the other panel members until they achieve a consensus (Krippendorff, 2013). This strategy has also been utilized in health care and education to define and clarify roles and performance competencies (Forbes, Mandrusiak, Smith & Russell, 2018). Three rounds of online questionnaires were employed, which is more than the two required for gathering diverse and comprehensive expert viewpoints. The benchmark of agreement amongst 80% of the panel members were chosen a priori to signal that consensus had been established (Martin, Mandrusiak & Forbes, 2021).

The Delphi technique is widely used and successful in both healthcare and education to define and specify roles and practice competencies (Keeney, Hasson & McKenna, 2011). Delphi consensus approaches are excellent for synthesizing knowledge about a specific subject (Hsu & Sandford, 2007). It's a method that works well in instances when individual judgments are required to handle an incomplete state of knowledge (Keeney, Hasson & McKenna, 2011). A priori, consensus was defined as when at least 80% of the panel agreed that the indicated competency should be included (Keeney, Hasson & McKenna, 2011). Jones and Hunter (1995) defined consensus as "a means of determining the amount of agreement among experts in a certain topic area under inquiry" and the Delphi method is based on this (Ferguson, Brownlee & Webster, 2008).

The Delphi survey is excellent for obtaining opinions and building consensus among participants on topics that have received little attention (Langlands et al., 2008). Delphi surveys can save both money and time. They're simple to fill out online, allowing you to

recruit from a large pool of people. Delphi surveys are also designed in such a way that participants can remain anonymous. Theme analysis was used to synthesis Round 1 responses; in order to produce the Round 2 survey (Spain et al., 2022).

Physiotherapy interventions in the study describes as a series of non-invasive procedure for managing children with ASD. Physiotherapists are movement experts who may help with motor performance, physical activity prescription and manual dexterity and fitness (Canadian Physiotherapy Association, 2012). Physiotherapy, in addition to improving physical function, also serves as a physical activity and health advocate, making them uniquely positioned to enhance and improve PA involvement. Indeed, there has been a growing consensus in recent years that physiotherapists have a unique set of skills to help children with ASD (Colebourn, Golub-Victor & Paez, 2017; Holloway, Long, & Biasini, 2018). Recognizing that there may be research and current clinical practice gaps, individuals of the physiotherapy team have been working on a series of research to better understand the PA participation needs of children with ASD (Jachyra, 2019), as well as how to help them by partnership with parents (Gregor et al., 2018). Recognition of impairments in children with ASD enable PT to better evaluate the limitations of their motor activities in a clinical setting (Downey & Rapport, 2012). Warm up, aerobic, agility, balance, strengthening exercise, team exercises, and cool down were likely delivered to children with ASD according to the regular exercise program, which was led and performed by a physiotherapist (Hillier, Murphy & Ferrara, 2011).

According to Sefen et al. (2020), exergames can be a potentially useful strategy to treat both children and adolescents with ASD. Exergames are described as any game that combines video games with physical engagement with internet participants. It has the advantage of being more fun and playful, which may boost adherence. Lima et al. (2020) found that the gains were only recognized in terms of fitness. PA is an effective therapy method for ASD treatment. However, there is a scarcity of studies on the long-term impacts of PA based therapies (Sefen et al., 2020).

One of the most prevalent exercises researched in ASD is jogging, which is followed by water-based exercises and then various cardiovascular exercises (Lang, Koegel,

Ashbaugh, Regester & Ence, 2010). One study indicated that jogging for 8-20 minutes before an academic session or community-based program reduced self-stimulating behaviors while boosting academic and work efficiency in adolescent boys (Rosenthal-Malek & Mitchell, 1997). Another study indicated that 15-20 minutes of group running before classroom activities increased academic response but had no effect on stereotypy in children with ASD (Oriel, Geofge, Peckus & Semon, 2011).

Physical exercise therapies are an antecedent-based intervention that is said to help people with ASD reduce stereotyped motor behaviors (SMB) and enhance other elements of their lives (Bremer et al., 2016). Jogging, cycling, 'exergaming,' or virtual reality exercise activities, ball exercises, therapeutic horseback riding, yoga, and martial arts are some of the workouts that have been reported to reduce SMB (Olin et al., 2017; Teh, Vijayakumar, Tan & Yap, 2021). Another systematic study by Bremer et al. (2016) found that exercise interventions improved stereotypic behavior, socio-emotional functioning, cognition and attention throughout 13 research work out from 1993 to 2013. Ferreira et al. (2019) and Tarr et al. (2020) conducted meta-analyses on the effects of exercise program on SMB and found that ASD children responded positively. In preschool children, PA has been proven to increase motor skills and cognition, particularly in the areas of attention, memory, attitude, and school performance (Zeng et al., 2017).

Therapeutic horseback riding can exert positive effects on social, emotional and physical domains (Freund et al. 2011; Borgi et al., 2016). As an example, positive effects have been demonstrated for the rehabilitation of motor disorders and neurological diseases. The rhythmic horse movements imposed on patient’s body is able to improve balance, muscle symmetry, coordination and posture (Bronson et al. 2010; Tseng et al. 2013). Moreover, horseback riding, as well as goal-oriented interaction with horses, have both been reported to result in a temporary improvement in mental well-being, sense of self efficacy and self-esteem, thus positively affecting individuals’ quality of life and global functioning (Borgi, et al., 2016).

Gabriels, Pan, Dechant, Agnew, Brim & Mesibov (2015) conducted an RCT to see whether therapeutic riding on horse could help children and adolescents with ASD improve their self-regulation, communications, psycho-social, adaptive, and cognitive

behaviors. This RCT revealed efficacy of hippotherapy for children with ASD after a 10-week intervention that lasted at least 45 minutes per session.

Gait training improves autistic patients' gross motor function & coordination, according to the study (Kindregan, Gallagher & Gormley, 2015). Various gait deformities likely pacing, bouncing, hopping, skipping and spinning have all been observed in children with ASD and these have been claimed to be restricting and repetitive behaviors (Goldman et al., 2009). Adjustments in movement patterns in children with ASD frequently revealed "clumsy" gait and motor skill, indicating that children with ASD have poor coordination (Ghaziuddin & Butler, 1998). ASD children may be "less coordinated and demonstrate fewer motor ability" (Fournier, Hass, Naik, Lodha & Cauraugh, 2010). Children with ASD are more likely than age-matched healthy controls to suffer from gait abnormalities prone to toe walking (Barrow, Jaworski & Accardo, 2011). ASD has also been linked to abnormalities in basal ganglia morphology (Qiu, Adler, Crocetti, Miller & Mostoky, 2010). In recent research found that, individuals with ASD have been found to have problems with standing balance, sitting balance, grip force, upper limbs control, locomotor, and other manual dexterity (Eggleston et al. 2017; Miller et al., 2021).

Balance training is effective for children with ASD who require early intervention measures to achieve the best results (Wijnhoven et al., 2018). For example, Cheldavi, Shakerian, Boshehri & Zarghami (2014) created a 6-week balance training program for children with ASD that included a variety of balancing exercises. After the training, it was observed that balance significantly improved. However, it's unclear how these children's basic symptoms, such as emotion management, improved as well (Stins & Emck, 2018). According to Bart et al. (2009), a balance training program reduced childhood anxiety and increased balance confidence. Balance training programs for children with ASD can help them improve their balancing and postural stability (Cheldavi, Shakerian, Boshehri & Zarghami, 2014).

A meta-analytic technique Fournier, Hass, Naik, Lodha and Cauraugh (2010) revealed that motor coordination deficiencies were more prevalent in people with ASD. Gait and balance problems, as well as arm motor control and movement plan problems, are all

real. As a result, the revealed motor coordination deficiency appears to be pervasive, making it a key symptom of ASD that requires physiotherapy as a coordination exercise (Ben-Sasson et al., 2009).

Armitano-Lago, Bennett & Haegele (2021) determined that proprioception training has the potential to improve motor skills and lower extremity strength. Significant data also suggests that people with ASD (Fournier et al., 2010), have motor abnormalities, including issues with postural stability, gait pattern, coordination and both gross & fine motor activities (Armitano et al., 2020; Bennett et al., 2021). Deviant sensory processing is common in autism, affecting all sensory modalities as well as interoception and proprioception (Bertilsson, Gard & Hammarlund, 2022).

Ferreira et al. (2019) discovered that various studies have found positive impact of physical exercise in various symptomatology and comorbidity categories, including: reductions in physical motor deficits (Batey et al., 2014); obesity and overweight (Dickinson & Place, 2014); psychopathological modifications with an increased duration in the execution of tasks (Oriel, George, Peckus & Semon, 2011); improvements in cognitive ability (Bremer (Bremer, Crozier & Lloyd, 2016); behavioral improvements with stereotypies (Levinson & Reid, 1993); reduced aggressive tendencies and improved socio-emotional performance in emotional factor (Bremer, Crozier & Lloyd, 2016). Furthermore, the impact of physical exercise on stereotypic behavior in children with ASD have always been demonstrated to drop rapidly following physical exercise, then gradually increase and return to baseline levels over time (Ferreira et al., 2019).

Exercise therapy is the use of physical effort to reduce problem behaviors or increase suitable behaviors are regarded an evidence-based technique (Wong et al., 2015). Moreover, study has revealed that motor skill abnormalities and impairments are frequently connected with ASD (Ozonoff et al., 2008; Green et al., 2009). Evidence showed that, exercise therapy appears to be a viable therapeutic option for enhancing ASD patients' quality of life (Sefen et al., 2020). Physical activities must therefore be included in the daily lives of ASD children in order to maintain their health and wellness. PA levels in ASD and neurotypical children are considerably different, according to

several studies (Sowa & Meulenbroek, 2012). It is critical to consider a variety of aspects while developing a PA program for children with ASD in order to choose the most effective program elements. Individual vs. group therapy and program organization is the major two concern of physical exercise (Sefen et al., 2020).

Mills, Kondakis, Orr, Warburton and Milne (2020) used a qualified physiotherapist to administer hydrotherapy for 45 minutes once a week for 8 weeks. Hydrotherapy might help children with ASD improve their mental health and well-being. Aquatic programs, water based activities, and swimming programs are all examples of hydrotherapy. The systematic review and found four previous studies investigated that, the usefulness of hydrotherapy in the treating of social and behavioral characteristics of children with ASD (Mortimer, Privopoulos & Kumar, 2014).

Swimming based physical therapies have been utilized to help children with autism spectrum disorders (Lee & Porretta, 2016). According to Pan (2010), children with ASD were participated in a 10 weeks swimming exercise (2 sessions per week) to see how exercise affected their swimming skills, behavioral and social competence. The researchers discovered an increase in motor skill on swimming as well as a reduction in antisocial tendencies (Pan, 2010). According to a meta-analysis evaluating the benefits of exercise on ASD on Individualized treatment procedures have been demonstrated to be more effective than those in a group setting (Sowa & Meulenbroek, 2012).

Conversely, the study found that exercise has physical benefits for children with ASD, including improved cardio-respiratory function, motor skill proficiency & muscular strength, and often a lower BMI (Dillon, Adams, Goudy, Bittner & McNamara, 2017). Cognitive and behavioral functioning gains have been documented in addition to physical benefits. Exercise has also been demonstrated to reduce maladaptive and repetitive behaviors while increasing task activities and academic responses as an intervention (Celiberti, Bobo, Kelly, Harris & Handleman, 1997; Mahar et al., 2006). Academic achievement and social skills have both been found to improve with physical exercise (Nicholson, Kehle, Bray & Heest, 2011).

According to Brand, Jossen, Holsboer-Trachsler, Pühse and Gerber (2015) aerobic activity includes catching, ball throwing with single or both hands, standing balance on single leg, jumping, jumping on uneven surface and balance. It was used in for three weeks, thrice-weekly 60-minute sessions. Aerobic exercise training improves sleep, motor function and mood in children with ASD.

Several researches have been conducted to determine the impact of physical activity and exercise on behavioral, social, cognitive, and physical performance (Young, 2016). Physical fitness and exercise have been found in this demographic to improve fitness levels and other characteristics (Lang, Koegel, Ashbaugh, Regester & Ence, 2010). Aerobic exercise has been demonstrated to improve ASD education outcomes (Neely, Rispoli, Gerow & Ninci, 2015). Exercise has been linked to a short-term decrease in self-stimulation using stereotypic behaviors in some research (Bremer, Crozier & Lloyd, 2016). Individualized attention throughout exercise, as well as the option to exercise until satiated, appears to help children with ASD reduce undesirable behavior and promote favorable ones (Young, 2016).

Active movements can lead to change and the increase of self-awareness and self-confidence (Sheets-Johnstone, 2017). The ability to be active or to experience a sense of engagement is determined by the individual's physical functioning (Grohmann, 2017). People with autism may have difficulties with motor competence, postural stability (Lim, Partridge, Girdler, and Morris, 2017), sensory-motor function, and flexibility when striving to fulfill movement objectives (Bertilsson, Gard & Hammarlund, 2022).

Improvements in aerobic capacity, motor skill proficiency, and muscle strength have been observed for children with ASD, as well as a drop in body mass index (Pan, 2011; Dillon, Adams, Goudy, Bittner & Mcnamara, 2017). Learning and social competence have both been found to improve with exercise (Nicholson, Kehle, Bray & Heest, 2011). Physiotherapists have the potential to play a vastly bigger role in ASD treatment. However, policy and practice remain behind in acknowledging physiotherapists' potential contributions to ASD research, treatment and awareness (Mieres, Kirby, Armstrong, Murphy & Grossman, 2012). Children with ASD have numerous issues with gross motor

abilities such as running, climbing, and throwing a ball when they are in school ages (MacDonald et al., 2013).

Individuals with ASD frequently experience delays or poor motor development (Staples & Reid, 2010). The combination of issues with social, behavioral, and physical abilities has the potential to significantly impact long-term cognitive, physical, and social health (Chu et al., 2019). Obesity-related secondary illnesses, such as hypertension, diabetes, sadness, and low self-esteem in individuals with ASD, may exacerbate the social, physical, and psychological health challenges that many adolescents with ASD already face Rimmer, Yamaki, Davis & Lowry, 2010). A lot of research has been done on the influence of ASD on social and behavioral abilities. Mastery of physical abilities and patterns of movement that allow for joyful involvement in physical activities is known as motor skill competency (Castelli & Valley, 2007). Motor skill competence is required for participating in physical exercise and sports that contribute to the development of a healthier life; on the other hand, participating in physical exercise and sports improves motor skill competence. Individuals with ASD frequently have motor skill difficulties (Ament, Mejia & Buhlman, 2015).

Lourenço, Esteves, Corredeira & Seabra (2015) evaluated trampoline training in a facility with several types of trampolines for a 32-week program that lasted 45 minutes once a week. Motor competency is linked to physical activity, which has been shown to improve symptoms in children with ASD. Push-ups, curl-ups, trunk lifts and strength of grip were among the muscle-strengthening exercises. In ASD patients, higher physical strength was linked to higher executive function (Ludyga, Pühse, Gerber & Mücke, 2021). According to a review of the experimental evidence, exercise-induced advantages for executive function are generally applicable to neurodevelopmental diseases (Ludyga et al., 2021).

CHAPTER III: METHODOLOGY

3.1 Study Design

Delphi consensus method was used in this study. It was e-Delphi survey type of study. It is widely used and successful in both healthcare and education to define and specify roles and practice competencies (Keeney, Hasson & McKenna, 2011). Delphi consensus approaches are excellent for synthesizing knowledge about a specific subject (Hsu & Sandford, 2007). It's a method that works well in instances when individual judgments are required to handle an incomplete state of knowledge (Keeney, Hasson & McKenna, 2011). A priori, consensus was defined as when at least 80% of the panel agreed that the indicated competency should be included (Keeney, Hasson & McKenna, 2011). LBP Jones and Hunter (1995) defined consensus as "a means of determining the amount of agreement among experts in a certain topic area under inquiry" and the Delphi method is based on this (Ferguson, Brownlee & Webster, 2008).

The Delphi technique seeks to reach a group of selected experts' consensus of opinion by offering systematic feedback between rounds' when experts aggregate their suggestions (Giannarou & Zervas, 2014). The experts complete multiple rounds of a poll on their own, during which they are asked to evaluate and revise their own thoughts as well as the de-identified opinions of the other panel members until they achieve a consensus (Krippendorff, 2013). This strategy has also been utilized in health care and education to define and clarify roles and performance competencies (Forbes, Mandrusiak, Smith & Russell, 2018).

3.2 Respondents

The expert rehabilitation professional who has experience of treating Neuro Developmental Disorder (NDD) including ASD is considering the target respondents. We aimed to include a panel of physiotherapy experts with experience in the treatment of ASD children, with at least 5 years of clinical experience. Additionally, we aimed to include experts with other relevant backgrounds such as expert pediatricians, clinical & academic nurses, occupational therapist, clinical counselors, special educator and speech & language therapist.

Delphi expert panel list mention below where physiotherapist (PT) have >5 years experience to treat ASD (17), PT have experience in peadiatrics >5 years (5), PT have practicing experience >15 years (5), pediatrician have experience to treat ASD >15 years (3), occupational therapist have >5 years experience to treat ASD (3), speech & language therapist have >5 years experience to treat ASD (3), clinical & academic nurses have > 5 years experience about ASD (3), clinical counselor have experience >5 years in the field of rehabilitation (3), special educator have experience >5 years in the field of rehabilitation (3), authors have publication in PubMed index journal related treating physiotherapy on ASD (5) which entire respondents were 50.

3.3 Study Site & Area

Data was collected from who were expert physiotherapists & others health professional are working in the hospital & school settings for treating with ASD.

3.4 Study Period

The study was conducted from December 2021 to May 2022. The study was started after the acceptance of protocol; following which data collection was start after permission by the ethical committee and the study period was over after the submission of the final report at June 2022.

3.5 Sample Size

Only 50 expert rehabilitation practitioners were sample in this study. As the less number of physiotherapists are working with ASD, so participants list became comparatively short. Also I found less time to conduct the Delphi method documenting the expert opinion of the role of PT practice regarding ASD, thus why I had to choose a short list of most pioneer rehabilitation practitioners including physiotherapist. No sample size calculation was done in this research. Although there are no precise sample size criteria for Delphi investigations, the literature suggests that a panel of 10 to 15 experts can produce adequate findings if their backgrounds are homogeneous (Skulmoski et al., 2007).

3.6 Inclusion & Exclusion Criteria

3.6.1 Inclusion Criteria

- Physiotherapist who are working at peadiatrics & have experience of treating ASD more than 5 years.
- Physiotherapists who are most experience practitioner in rehabilitation.
- Physiotherapist who are working with ASD in hospital & school settings.
- Being professional registered to practice as a physiotherapist of their own country.
- Other health professionals (Peadiatrician, Occupational Therapist, Speech & Language Therapist, Clinical Counselor, Nurses, Special Educator) who have experience more than 5 years in peadiatrics especially in NDD.

3.6.2 Exclusion Criteria

- Rehabilitation professional who have experience less than 5 years in peadiatrics department, hospital or school setting.
- Physiotherapists who directly not engage to practice NDD especially in ASD.

3.7 Sampling Technique

Purposive sampling technique was applied considering the inclusion and exclusion criteria. Only participants was selected who matched the criteria specially dealing or treating with ASD in different perspectives.

3.8 Data collection tools

Data was collected through mail transferring using a structured questionnaire. Here used the questionnaire among 50 participants from specialized hospitals & school settings. A national & international Delphi panel of experts in the physiotherapy field was established to reach consensus on the role of physiotherapy practice in ASD. Potential panelists was completed a series of e-Delphi survey to ensure eligibility criteria were met. Ineligible people were excluded from participating. For subsequent Delphi rounds, only those participants who were completed the previous Delphi round was emailed the survey.

3.9 e-Delphi survey

The Delphi panel was asked to rate each of the 12 interventions for managing ASD children. Round 1 was opened for 3 weeks and subsequent rounds were opened for 2 weeks. Three reminder emails was sent over that time to non-responders, to encourage completion. Participants were taken approximately 20 to 25 minutes to complete each round of the survey.

Round 1

In Round 1, panel lists was asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for physiotherapists in the delivery of quality care via videoconferencing. The panel was invited to suggest additional interventions that were not already included in the draft framework via a free-text box option of the survey. An individual intervention that was reached panel consensus was retained for further consideration in Round 2. Consensus was defined as 75% of the panel agreeing that the intervention will either 'important' or 'essential' (Diamond et al., 2014). The panel members were asked to rank each statement on a scale of 1–5 (1 = essential, 2 = very important, 3 = important, 4 = unimportant, and 5 = undesirable) (Hanekom et al., 2011). Additional Delphi rounds were judged unnecessary once consensus was established on 80% of the arguments (Kwakman et al., 2019).

Round 2

In Round 2, panel lists were asked to reconsider and re-rate the interventions from Round 1, as well as rate any new interventions suggested by the panel in Round 1. To assist in this process, summary panel data from Round 1 was displayed alongside each intervention showing the proportion of agreement across panel lists. For this round, the panel lists was asked to rate how strongly they agreed or disagreed that each intervention should be included as a role of physiotherapists on ASD to deliver quality care via mail transferring. Panel lists were rated their level of agreement on an 11-point numerical scale (with terminal anchors of 0 = strongly disagree and 10 = strongly agree). Individual intervention that achieved consensus (at least 75% of the panel rating >6) was retained for final phase (Hinman et al., 2020). Summary panel data from Round 2 was presented for consideration alongside each capability in the format: number (%) of participants

rating in each of the ranges 0 to 4, 5 to 6, 7 to 8, or 9 to 10. Only those interventions that were achieved consensus (at least 75% of the panel rating >7) were retained for inclusion in the final core interventions for managing ASD children (Slade et al., 2016; Hinman et al., 2020).

Final phase:

In the final phase, the research team was reviewed the final interventions framework. Capabilities that were comparable in type were melded together. The combined capabilities were sent to the Steering Group for approval. The Steering Group approved the revisions and combined capabilities after reviewing the final framework (Davies et al., 2021).

3.10 Evidence based physiotherapy Role on ASD:

Role of physiotherapy intervention on ASD were search different RCT studies 2015-2021

Table 1: Evidenced based Role of physiotherapy intervention on ASD children

Physiotherapy Role on ASD	Objectives /Target	Intervention /Dosage	Impression /Attention	Evidence /Citation
According to order of respondents statement Order:01 **Hippo therapy**	To evaluating the effect of hippo therapy on self-regulation, socialization, communication, adaptive and motor behaviors with ASD.	Warm up activity, skill review, learning a new skill, lesson review and a cool down activity. (10-week interventions were for 45 minutes long each session).	This RCT demonstrating efficacy of hippo therapy for the ASD.	(Gabriels, Pan, Dechant, Agnew, Brim & Mesibov, 2015)
Order: 02 **Gait Training**	To identify gait abnormalities that may be present in children with ASD.	Practice stepping, pacing, jumping, hopping, skipping, staring, spinning & gait education.	Influence gait training improves gross motor function and coordination of autism.	(Kindregan, Gallagher & Gormley, 2015).
Order: 03 **Balance training**	To compare the effect of a land-based and a swimming-based exercise program on balance abilities in children with autism.	Balance training was implemented under the direct supervision of PT (10-weeks program consisting of 20 sessions (twice weekly; 60-min per session)	Land based training & swimming exercises can be the valuable balance training for ASD.	(Ansari, Hosseinkhanzadeh, AdibSaber, Shojaei & Daneshfar, 2021).
Order: 04 **Coordination practice**	We aimed to determine whether motor problems in ASD represent the possible co-occurrence of Developmental coordination disorder	Visuomotor integration, visual perception, motor coordination & developmental motor milestones	Motor coordination deficits are cardinal feature of ASD, need physiotherapy.	(Miller, Sherrod, Mauk, Fears, Hynan & Tamplain, 2021)
Order: 05 **Proprioception training**	To compare lower limb proprioception and strength in adolescents with ASD and neurotypical control.	Position-based proprioception in different angles & the speed based proprioception	Proprioception training has important gains in motor functions & improving lower extremity strength	(Armitano-Lago, Bennett, & Haegele, 2021).
Order: 06 **Physical exercise**	To explore the effects of physical exercise on emotion regulation and behavioral functioning in children with ASD.	12-week jogging intervention consisting of 48 sessions (4 sessions per week & session sustain for 30 minutes)	Physical exercise had a positive influence on emotion regulation & behavioral functioning in ASD children.	(Andy, 2020).

Physiotherapy Role on ASD	Objectives /Target	Intervention /Dosage	Impression /Attention	Evidence /Citation
Order: 07 **Hydrotherapy**	This study aimed to determine hydrotherapy influences behaviours which impact mental health and well-being in children with ASD.	Hydrotherapy led by a registered physiotherapist (45 minutes session once weekly for 8 weeks).	Hydrotherapy may enhance behaviours impacting mental health and well-being of children with ASD.	(Mills, Kondakis, Orr, Warburton & Milne, 2020).
Order: 08 **Aerobic exercise training**	To explore the effects of aerobic exercise on improving sleep and physical performance in children with ASD.	Catching & throwing a ball and balancing (standing on one leg, jumping, zigzag jumping, balancing). Thrice-weekly 60-minute sessions for 3 consecutive weeks	Aerobic exercise training has a positive impact on sleep, motor skill and mood among ASD children.	(Brand, Jossen, Holsboer-Trachsler, Pühse & Gerber, 2015).
Order: 09 **Evidence Based Practice**	To evaluate exercise as an evidence-based practice (EBP) for individuals with autism spectrum disorder (ASD).	Improvements in cardio-respiratory functioning, motor skill performance and muscular strength, reduce maladaptive and stereotypic behaviors.	It appears that exercise can be considered an EBP for school-aged children with ASD.	(Dillon, Adams, Goudy, Bittner & McNamara, 2017).
Order: 10 **Motor performance**	To evaluate the motor performance of school-aged children and adolescents diagnosed with ASD	Manual dexterity, ball skills, balance	Need greater knowledge & more attention to motor function of ASD children, as importance of physiotherapy.	(QUINTAS, BLASCOVI-ASSIS, Castilho & SANTOS, 2018).
Order: 11 **Gross motor function practice**	Aimed at providing an exercise program for each type of disability after analyzing the exercise program performed by adults with ASD.	Gross motor function, loco motion and object control skills, flexibility, strength, muscle endurance and cardiopulmonary endurance.	Exercise programs could provide similar effects, even with other disorder types having similar symptoms	(Cha, Min, Yoon & Jee, 2020).
Order: 12 **Muscle strengthening**	To explore how physical intervention is enhanced muscle strength, which may improve participation, strengthening & toning activities of children with ASD.	Muscle strengthening exercise was including items of push-ups, curl-ups, trunk lift, and grip strength.	Higher muscle strength was related to higher executive function in ASD patients.	(Ludyga, Pühse, Gerber & Mücke, 2021).

3.11 Data Analysis

After collection of data, this was checked and verified for consistency and reduction of errors. Thereafter these data was transferred to a suitable master sheet for processing and subsequent analysis. Data was entered to the computer and saved in Statistical Package for Social Sciences (SPSS) software version 20.00. Quality and reliability of collected data was re-checked. Appropriate Statistical analysis, calculation and test were carried out to relate variable according to the objectives of the study.

3.12 Ethical Consideration

This research proposal was submitted to the Institutional Review Board (IRB) of Bangladesh Health professional Institute (BHPI) & approval was obtained from the IRB. The approval number was CRP/BHPI/IRB/11/2021/538. Bangladesh Medical & Research Council (BMRC) & World Health Organization (WHO) guideline was followed to conduct the study. A consent form was provided to the participants & written consent was received from the participants when research title objectives or purpose was explained to the participants. All the interviews were conducted in confidence to maximize the participant's comfort and feelings of security. The researcher ensured the confidentiality of the participant's information, sharing it only with the research supervisor.

3.13 Informed consent

Prior to getting information through interview from the respondents, it is important to pick up assent from the subjects. For this investigation, researcher has given informed consent form to each member and disclosed to the subject verbally. Data collector has been referenced those respondents who were completely willing to participate and they reserve the privilege to pull back whenever. Researcher assured them that secrecy would be kept up. The examination result might not have any direct impacts on them however it might be beneficial for their future functioning.

CHAPTER IV: RESULTS

The study aimed to determine the role of physiotherapy interventions in Autism Spectrum Disorder (ASD). The data was collected by frequently mail transferring. Structured questions were used with close-ended questions in the questionnaire. The data were analyzed with the Microsoft Office Excel 2010 with SPSS 20 version software program. In this study researcher used bar, column, figure, pie chart to show the result of the study as it is easier to make sense of a set of data.

4.1 Socio Demographic Characteristics of Delphi Panel

Table 2: Socio-Demographic characteristics of Delphi panel

Variable	Criteria	Frequency	Percentage (%)
Gender	Male	20	46.5%
	Female	23	53.5%
Age	20-29 years	7	16.3%
	30-39 years	22	51.2%
	40-49 years	9	20.9%
	50-59 years	3	7.0%
	60+ years	2	4.7%
Practice Experience	5-10 years	20	46.5%
	11-15 years	13	30.2%
	16-20 years	3	7.0%
	>20 years	7	16.3%
Primary scope of practice	Pediatric	8	18.6%
	Hospital/clinic	22	51.2%
	School settings	13	30.2%
Area of expertise (Health Profession)	Physiotherapist	25	58%
	Occupational therapist	3	7%
	Pediatrician	3	7%
	Academic Nurses	3	7%
	Speech therapist	3	7%
	Clinical Counselor	3	7%
	Special Educator	3	7%

4.2 Exercise Intervention of Delphi Questionnaire

Table 3: Exercise Intervention of Delphi Questionnaire

Name of Exercise	Individual Response	Response score (0-10)	Comments
Hippo therapy	Essential 12 (28%)	**7.79 (± 1.55)**	0-4 rating (Strongly disagree)
	Very important 19 (44%)		5-6 rating (Agree or disagree)
	Important 11 (26%)		**7-8 rating (Agree)**
	Unimportant 0 (0%)		9-10 rating (Strongly agree)
	Undesirable 1 (2%)		
Gait training	Essential 9 (21%)	**7.30 (± 1.79)**	0-4 rating (Strongly disagree)
	Very important 26 (61%)		5-6 rating (Agree or disagree)
	Important 4 (9%)		**7-8 rating (Agree)**
	Unimportant 3 (7%)		9-10 rating (Strongly agree)
	Undesirable 1 (2%)		
Balance training	Essential 9 (21%)	**7.19 (± 1.69)**	0-4 rating (Strongly disagree)
	Very important 20 (47%)		5-6 rating (Agree or disagree)
	Important 13 (30%)		**7-8 rating (Agree)**
	Unimportant 1 (2%)		9-10 rating (Strongly agree)
	Undesirable 0 (0%)		
Coordination practice	Essential 5 (12%)	**7.16 (± 1.70)**	0-4 rating (Strongly disagree)
	Very important 27 (63%)		5-6 rating (Agree or disagree)
	Important 8 (18%)		7-8 rating (Agree)
	Unimportant 3 (7%)		9-10 rating (Strongly agree)
	Undesirable 0 (0%)		
Proprioception practice	Essential 3 (7%)	**7.07 (± 1.53)**	0-4 rating (Strongly disagree)
	Very important 21 (48.8%)		5-6 rating (Agree or disagree)
	Important 17 (39.5%)		**7-8 rating (Agree)**
	Unimportant 1 (2.3%)		9-10 rating (Strongly agree)
	Undesirable 1 (2.3%)		
Physical exercise	Essential 5 (12%)	**7.05 (± 1.65)**	0-4 rating (Strongly disagree)
	Very important 25 (58%)		5-6 rating (Agree or disagree)
	Important 11 (26%)		**7-8 rating (Agree)**
	Unimportant 1 (2%)		9-10 rating (Strongly agree)
	Undesirable 1 (2%)		
Hydrotherapy	Essential 5 (12%)	6.84 (± 1.88)	0-4 rating (Strongly disagree)
	Very important 20 (46%)		5-6 rating (Agree or disagree)
	Important 15 (35%)		7-8 rating (Agree)
	Unimportant 1 (2.3)		9-10 rating (Strongly agree)
	Undesirable 0 (0%)		
Evidence Based Practice	Essential 8 (19%)	6.26 (± 1.97)	0-4 rating (Strongly disagree)
	Very important 9 (21%)		5-6 rating (Agree or disagree)
	Important 22 (51%)		7-8 rating (Agree)
	Unimportant 3 (7%)		9-10 rating (Strongly agree)
	Undesirable 0 (0%)		

Name of Exercise	Individual Response	Response score (0-10)	Comments
Aerobic exercise	Essential 3 (7%)	5.95 (± 2.05)	0-4 rating (Strongly disagree)
	Very important 11 (25.6%)		5-6 rating (Agree or disagree)
	Important 21 (48.8%)		7-8 rating (Agree)
	Unimportant 8 (18.6%)		9-10 rating (Strongly agree)
	Undesirable 0 (0%)		
Motor performance	Essential 8 (18.6%)	5.81 (± 2.28)	0-4 rating (Strongly disagree)
	Very important 6 (14%)		5-6 rating (Agree or disagree)
	Important 18 (41.9%)		7-8 rating (Agree)
	Unimportant 10 (23.3%)		9-10 rating (Strongly agree)
	Undesirable 1 (2.3%)		
Gross motor function	Essential 8 (18.6%)	5.49 (± 2.47)	0-4 rating (Strongly disagree)
	Very important 6 (14%)		5-6 rating (Agree or disagree)
	Important 18 (41.9%)		7-8 rating (Agree)
	Unimportant 10 (23.3%)		9-10 rating (Strongly agree)
	Undesirable 1 (2.3%)		
Strengthening exercise	Essential 2 (4.7%)	5.16 (± 2.02)	0-4 rating (Strongly disagree)
	Very important 10 (23.3%)		5-6 rating (Agree or disagree)
	Important 13 (30.2%)		7-8 rating (Agree)
	Unimportant 3 (7%)		9-10 rating (Strongly agree)
	Undesirable 0 (0%)		

4.3 Evidence based guideline on role of PT in ASD

4.3.1 Hippo therapy (mean) with practice experience & health profession

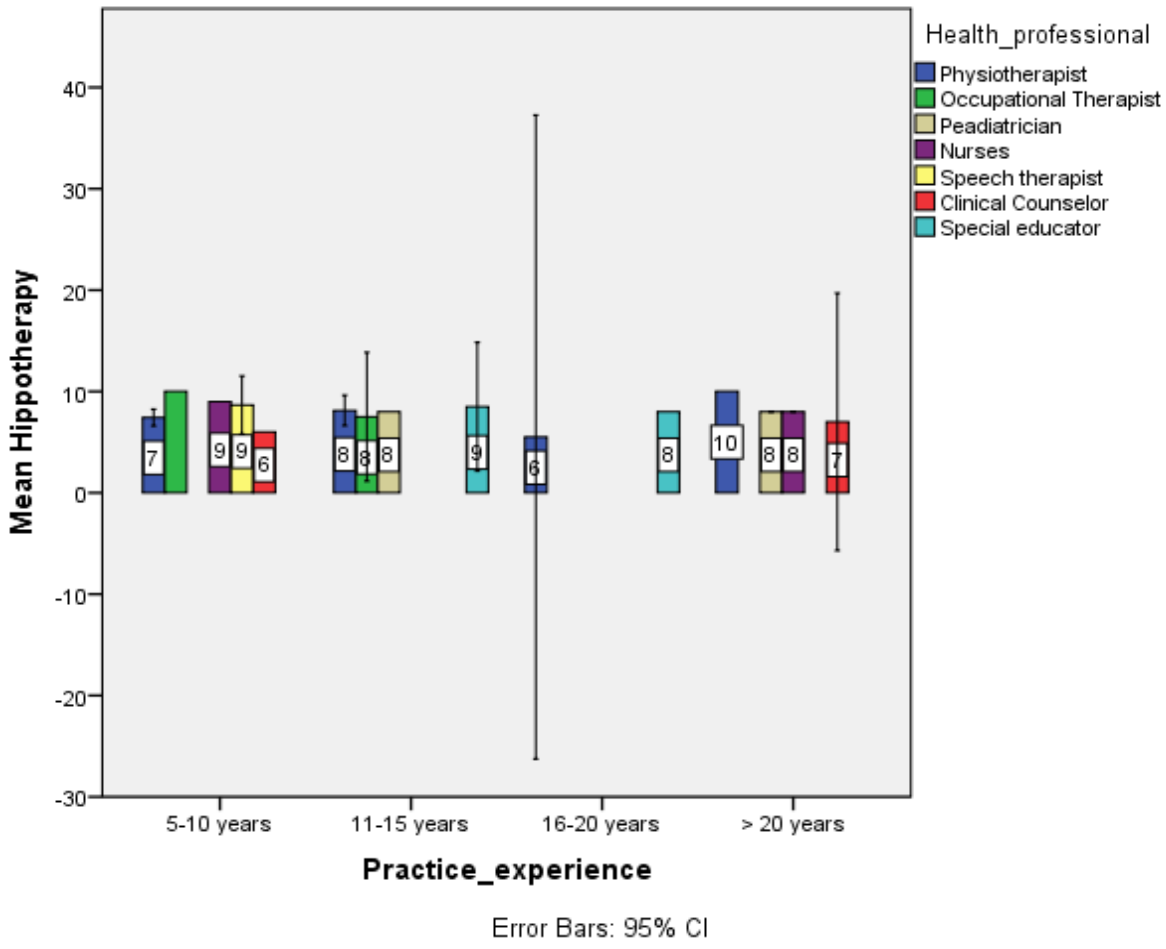


Figure 1: Hippo therapy (mean) with practice experience & health profession

The graphs showed that physiotherapist ranked maximum 10 out of 10 as practice experience of >20 years old; clinical counselor & physiotherapist also ranked lowest 6 as practice experience of 5-10 years & 16-20 years old respectively on hippo therapy for children with ASD.

4.3.2 Gait training (mean) with practice experience

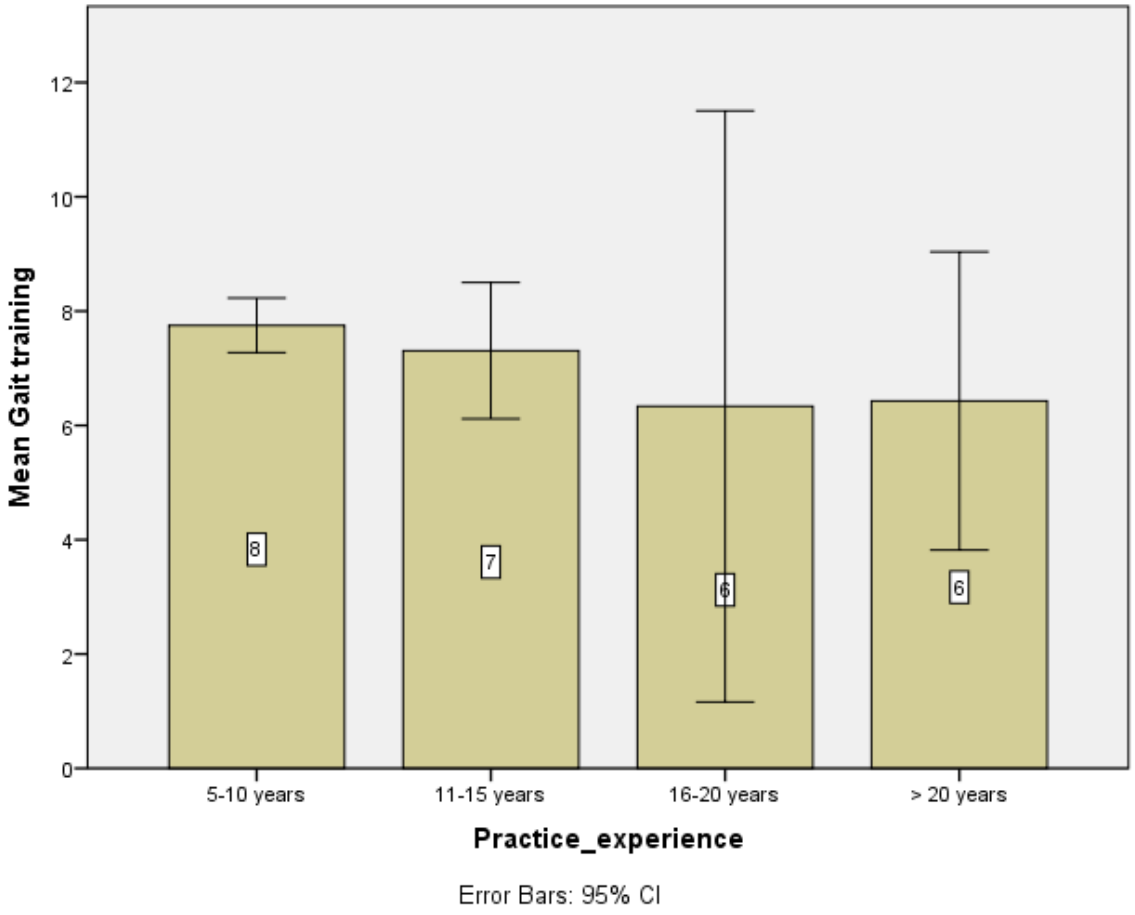


Figure 2: Gait training (mean) with practice experience

This graph represents that practice experiences between 5-10 years rank their opinion maximum 8 out of 10 on gait training for ASD children. Practice experiences between 16-20 years & > 20 years rank their opinion lowest 6 out of 10 for children with ASD.

4.3.3 Balance training (mean) with practice experience & health profession

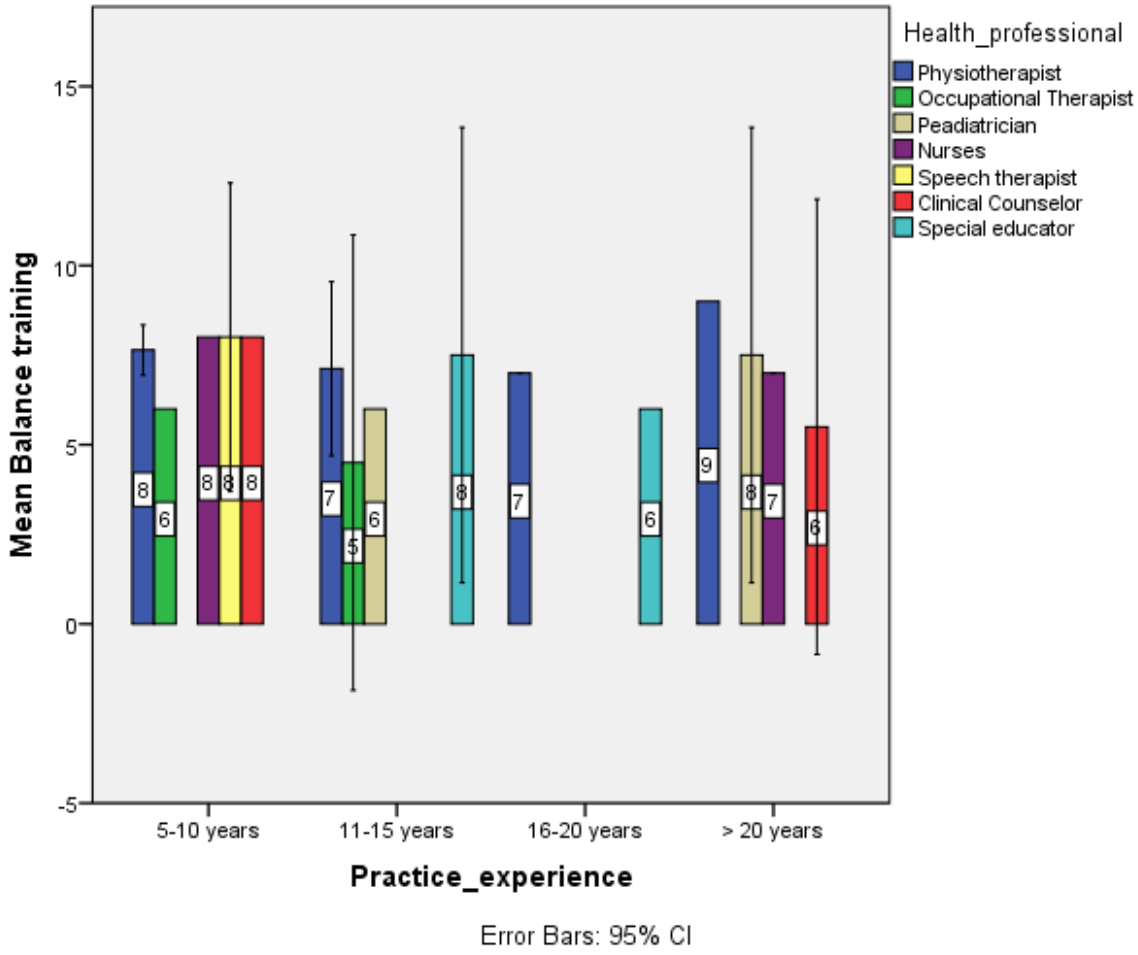


Figure 3: Balance training (mean) with practice experience & health professional

The graphs showed that physiotherapist ranked maximum 9 out of 10 as practice experience of >20 years old & occupational therapist ranked lowest 5 out of 10 as practice experience of 11-15 years old on balance training as children with ASD.

4.3.4 Coordination practice (mean) with practice experience

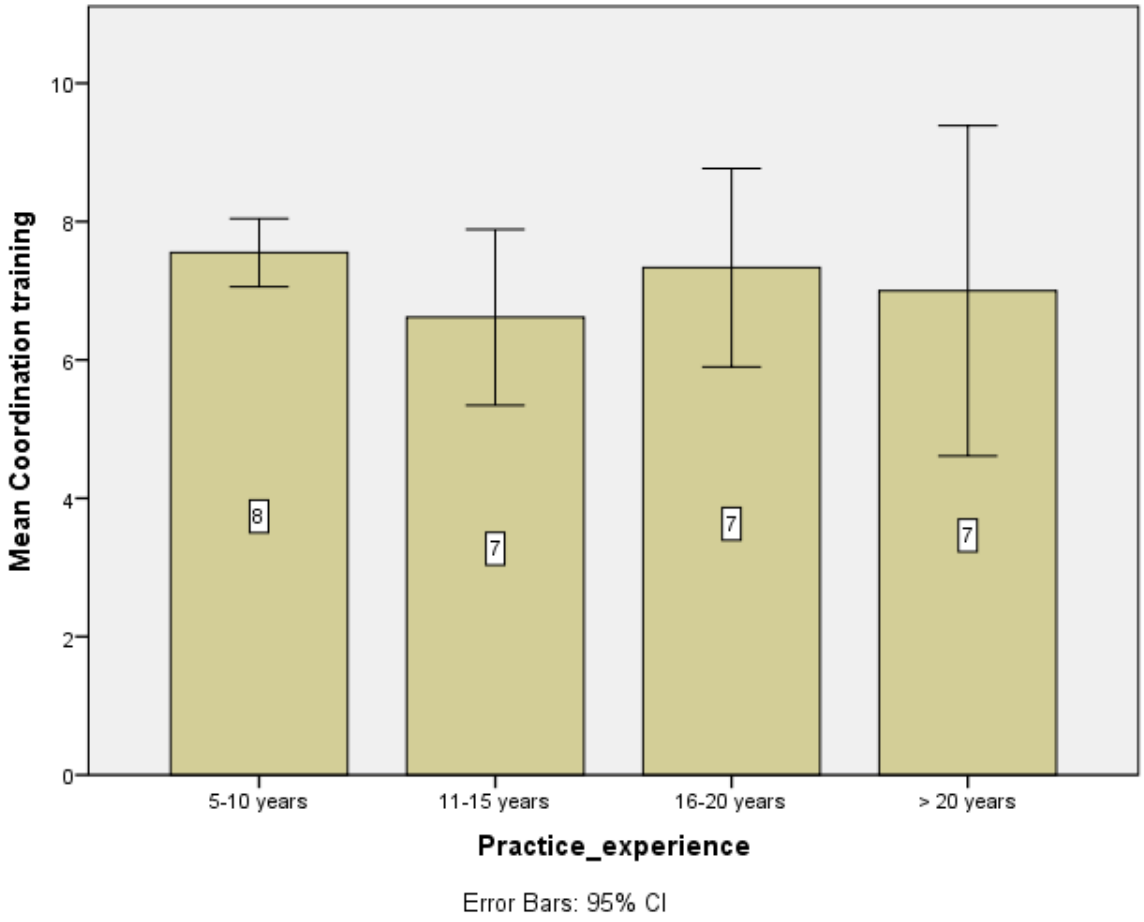


Figure 4: Coordination practice (mean) with practice experience

The graph represents that practice experiences between 5-10 years rank their opinion maximum 8 out of 10 on coordination practice for ASD children. Practice experiences between 11-15 years rank their opinion lowest 6 out of 10 as coordination practice for care of ASD children.

4.3.5 Proprioception training (mean) with practice experience & health professional

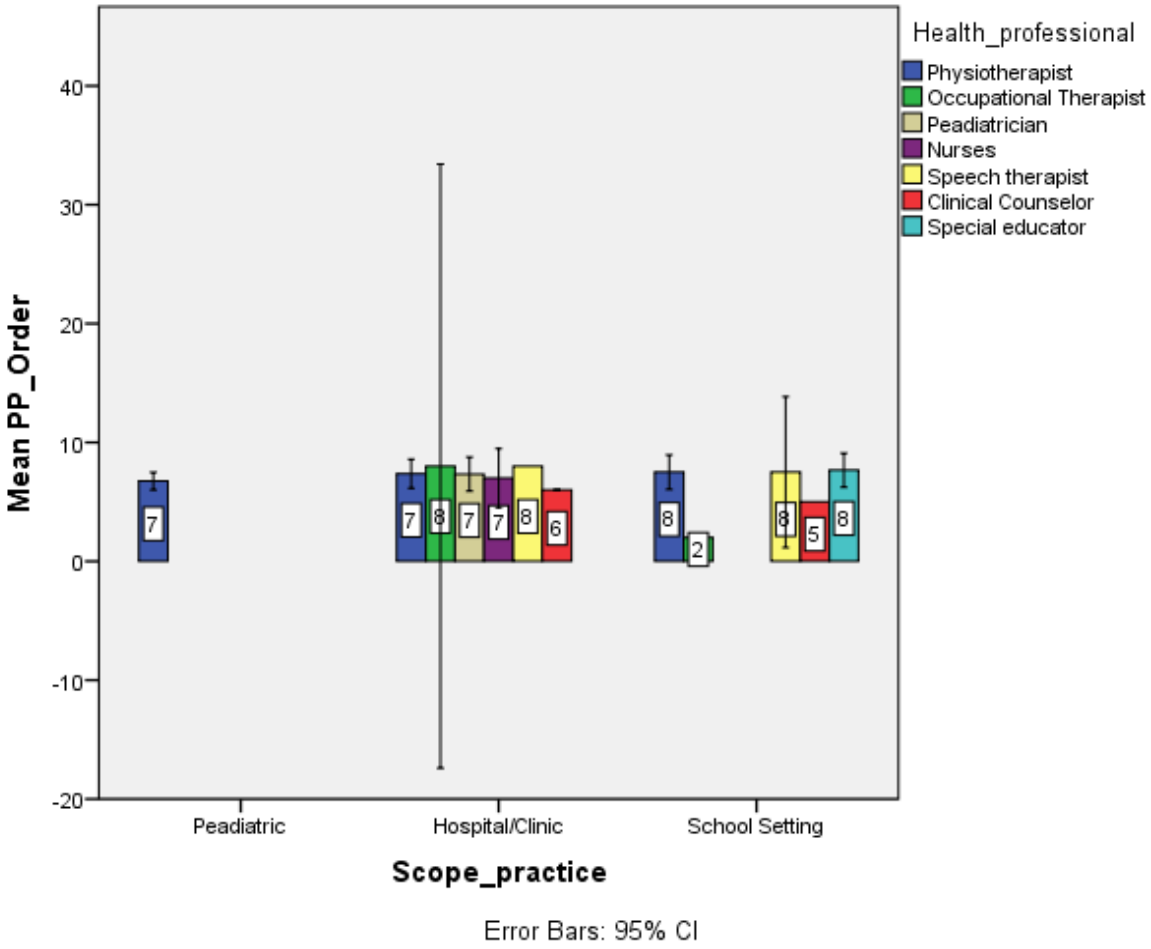


Figure 5: Proprioception training (mean) with practice experience & health professional

The graphs showed that occupational therapist & speech therapist from hospital setting & physiotherapist, speech therapist & special educator from school settings ranked maximum 8 out of 10 & occupational therapist from school settings ranked lowest 2 out of 10 as proprioception training for children with ASD.

4.3.6 Physical exercise (mean) with practice experience & health professional

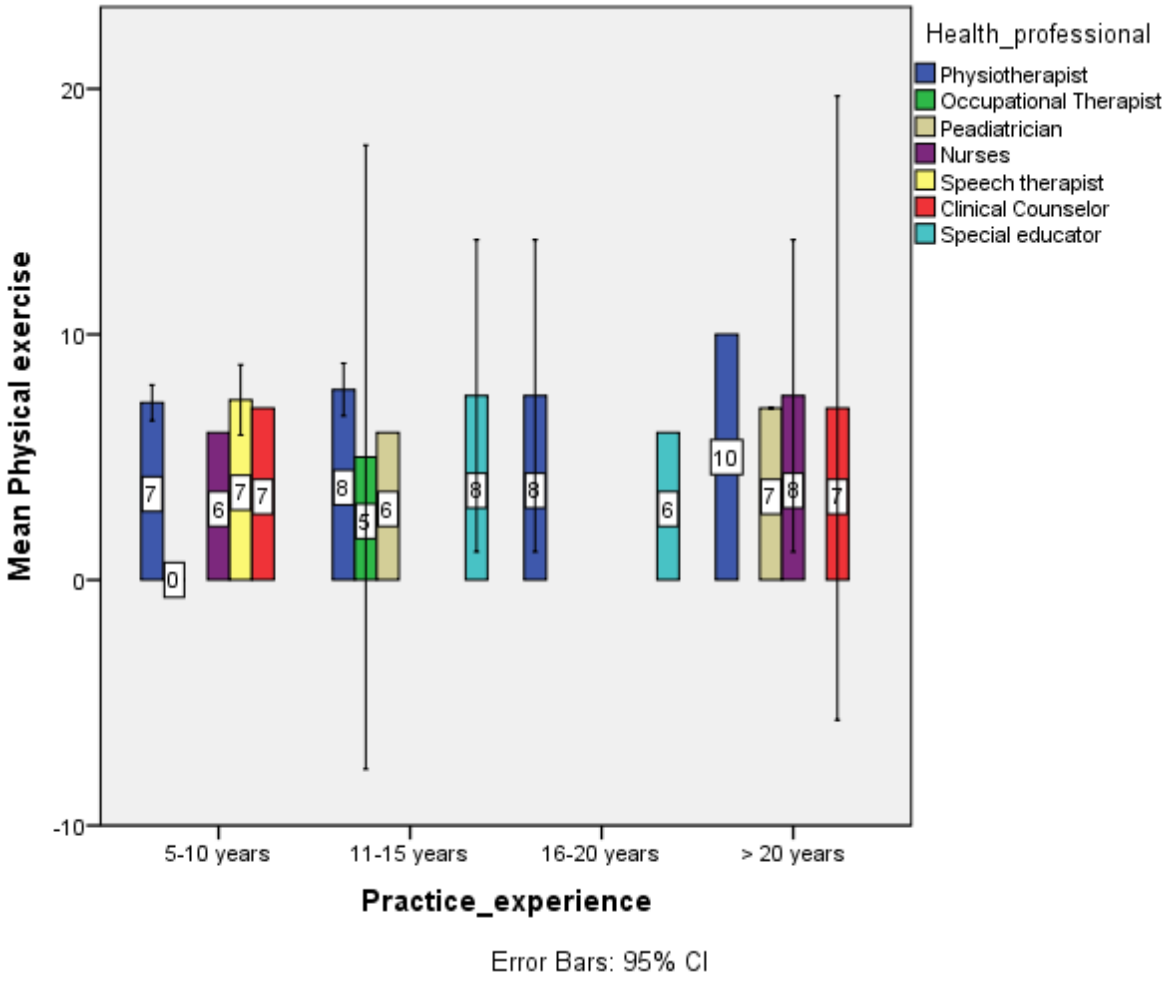


Figure 6: Physical exercise (mean) with practice experience & health professional

The graphs showed that physiotherapist ranked maximum 10 out of 10 as practice experience of >20 years & occupational therapist ranked lowest 0 out of 10 as practice experience of 11-15 years as physical exercise for children with ASD.

4.4 Agreement of PT interventions for ASD:

4.4.1 Hippotherapy for ASD as PT Intervention

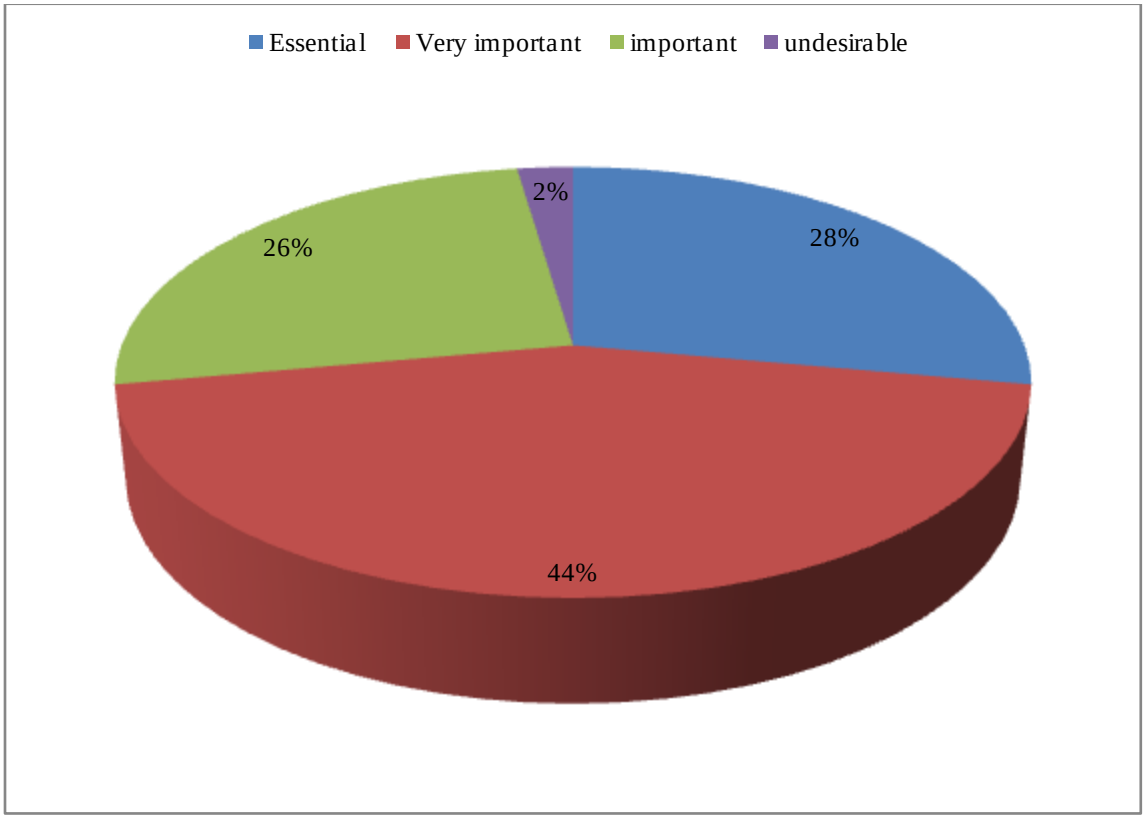


Figure 7: Hippotherapy for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 12 (28%) was essential, 19 (44%) was very important, 11 (26%) was important & 1 (2%) was undesirable respectively as hippotherapy for ASD children.

4.4.2 Gait training for ASD as PT Intervention

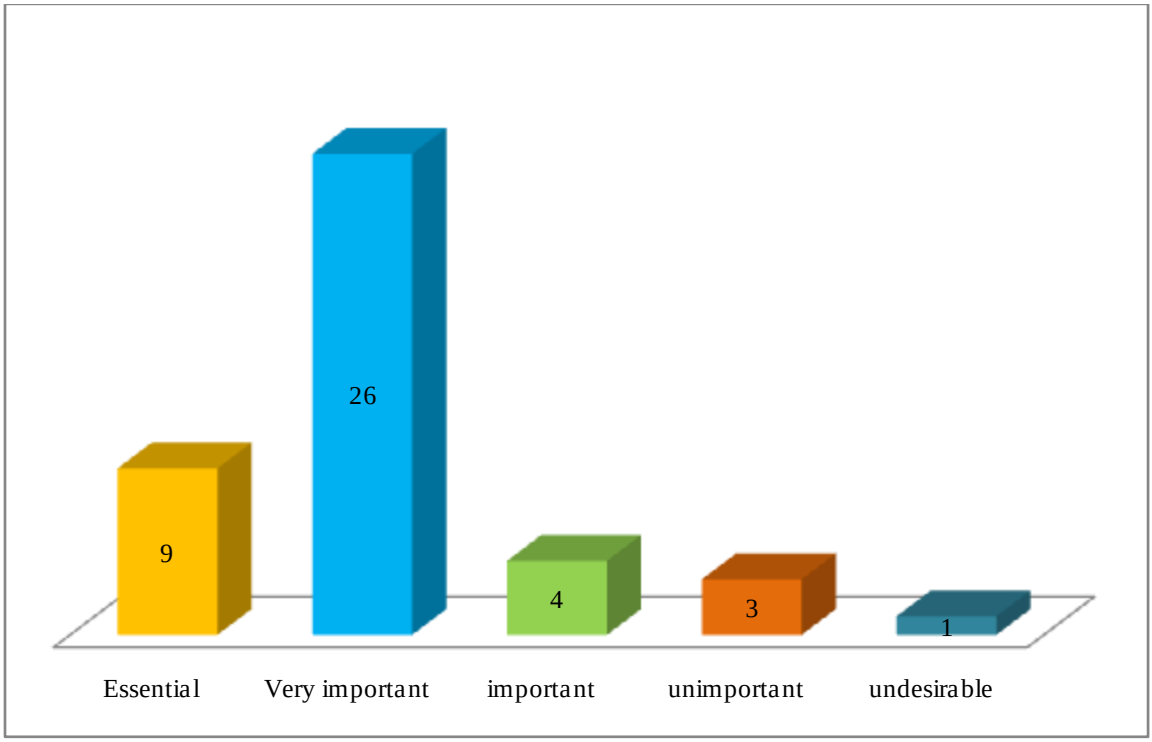


Figure 8: Gait training for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 9 (21%) was essential, 26 (61%) was very important, 4 (9%) was important, 3 (7%) was unimportant & 1 (2%) was undesirable of gait training for ASD children.

4.4.3 Balance training for ASD as PT Intervention

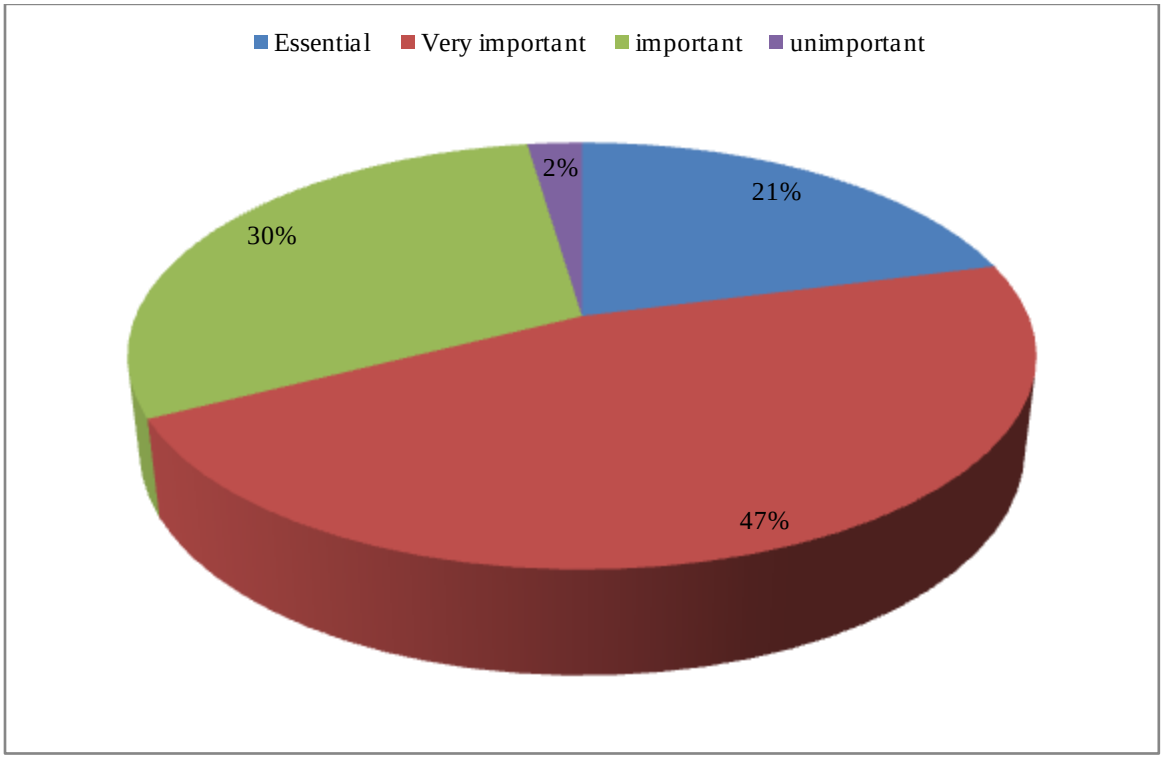


Figure 9: Balance training for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly 9 (21%) was essential, 20 (47%) was very important, 13 (30%) was important and 1 (2%) was unimportant respectively as balance training for ASD children.

4.4.4 Coordination Practice for ASD as PT Intervention

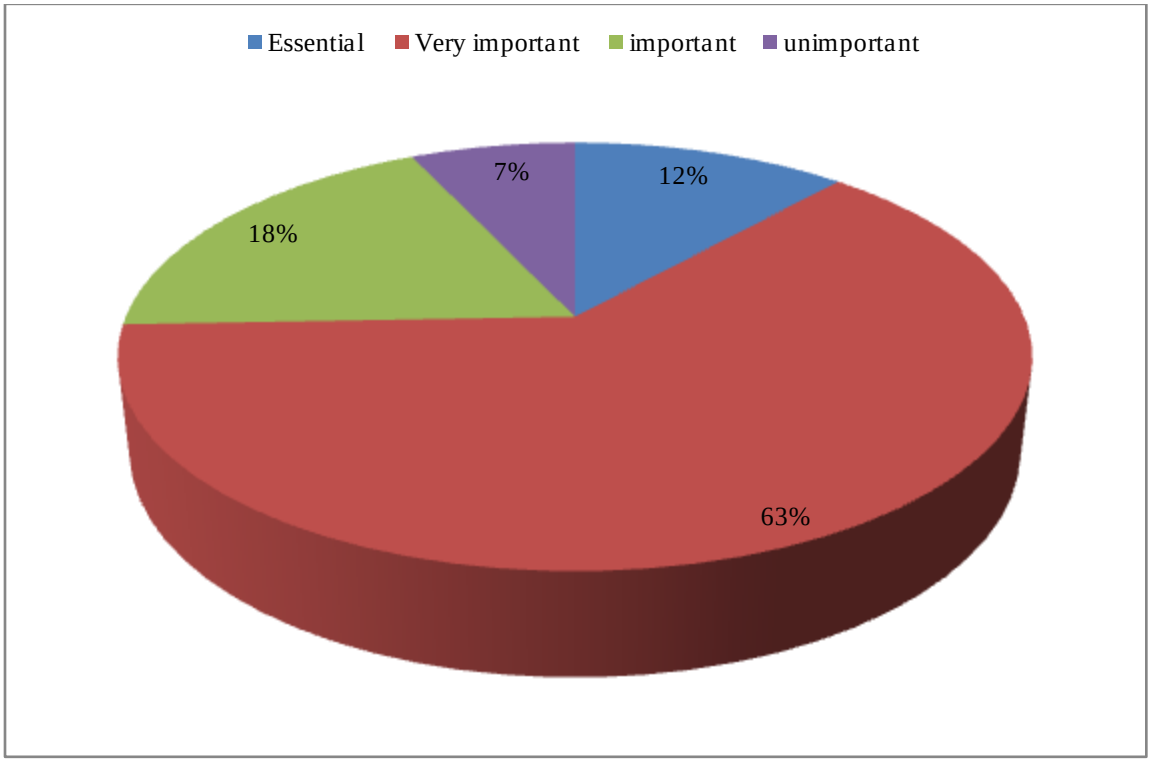


Figure 10: Coordination Practice for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 5 (12%) was essential, 27 (63%) was very important, 8 (18%) was important & 3 (7%) was unimportant respectively as coordination training for ASD children.

4.4.5 Proprioception Practice for ASD as PT Intervention

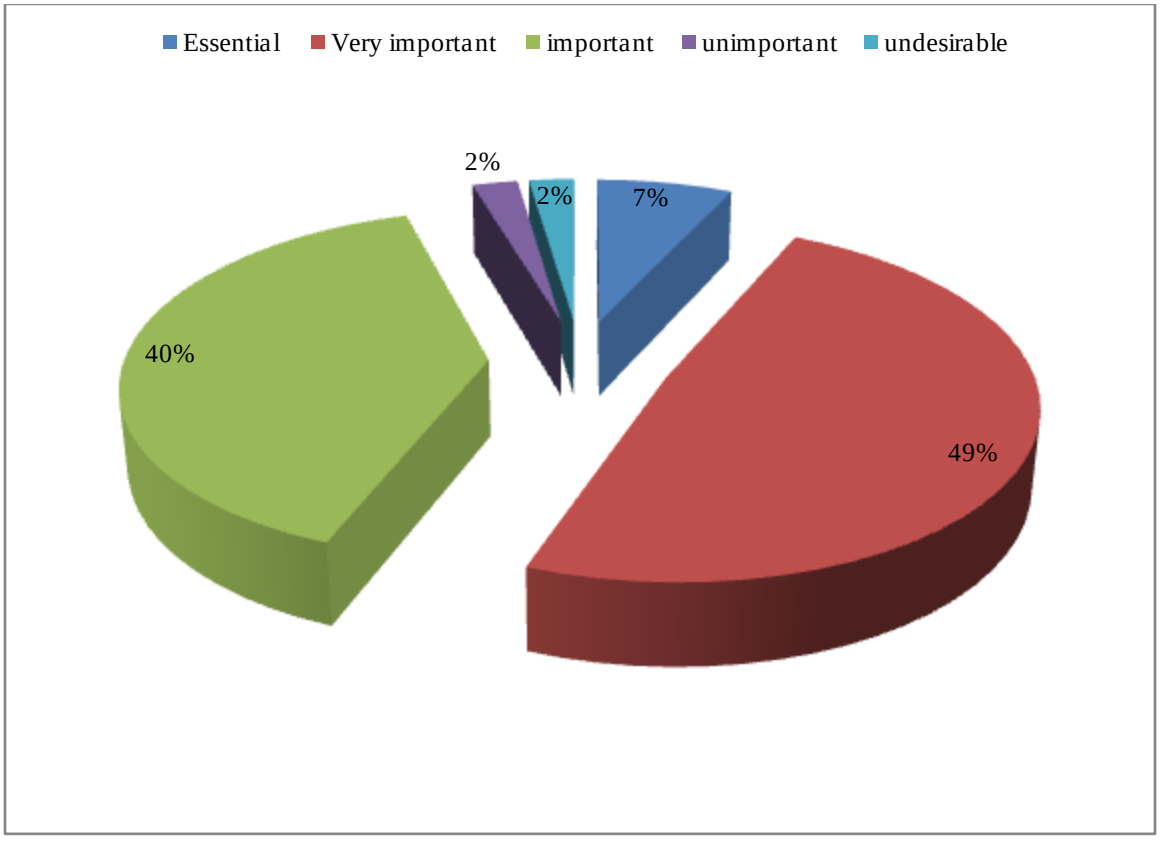


Figure 11: Proprioception Practice for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 3 (7%) was essential, 21 (48.8%) was very important, 17 (39.5%) was important, 1 (2.3%) was unimportant & 1 (2.3%) was undesirable of proprioception training for ASD children.

4.4.6 Physical Exercise for ASD as PT Intervention

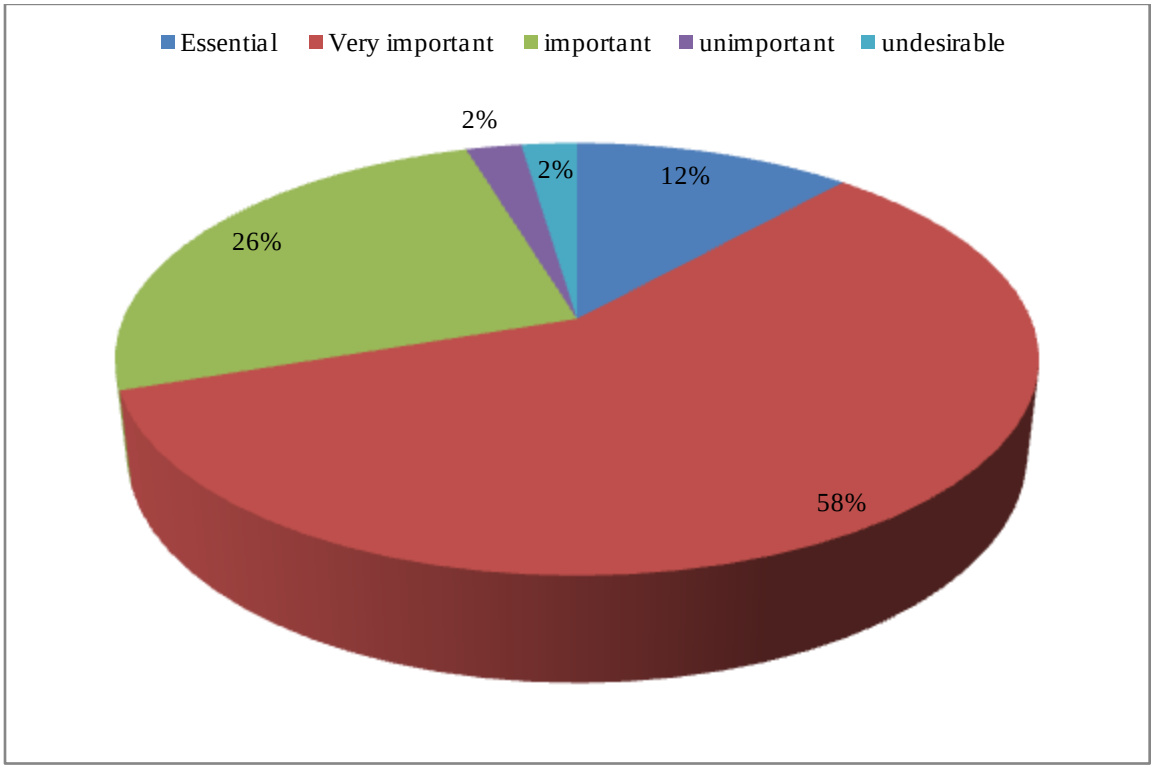


Figure 12: Physical Exercise for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 5 (12%) was essential, 25 (58%) was very important, 11 (26%) was important, 1 (2%) was unimportant & 1 (2%) was undesirable of physical exercise for ASD children.

4.4.7 Hydrotherapy for ASD as PT Intervention

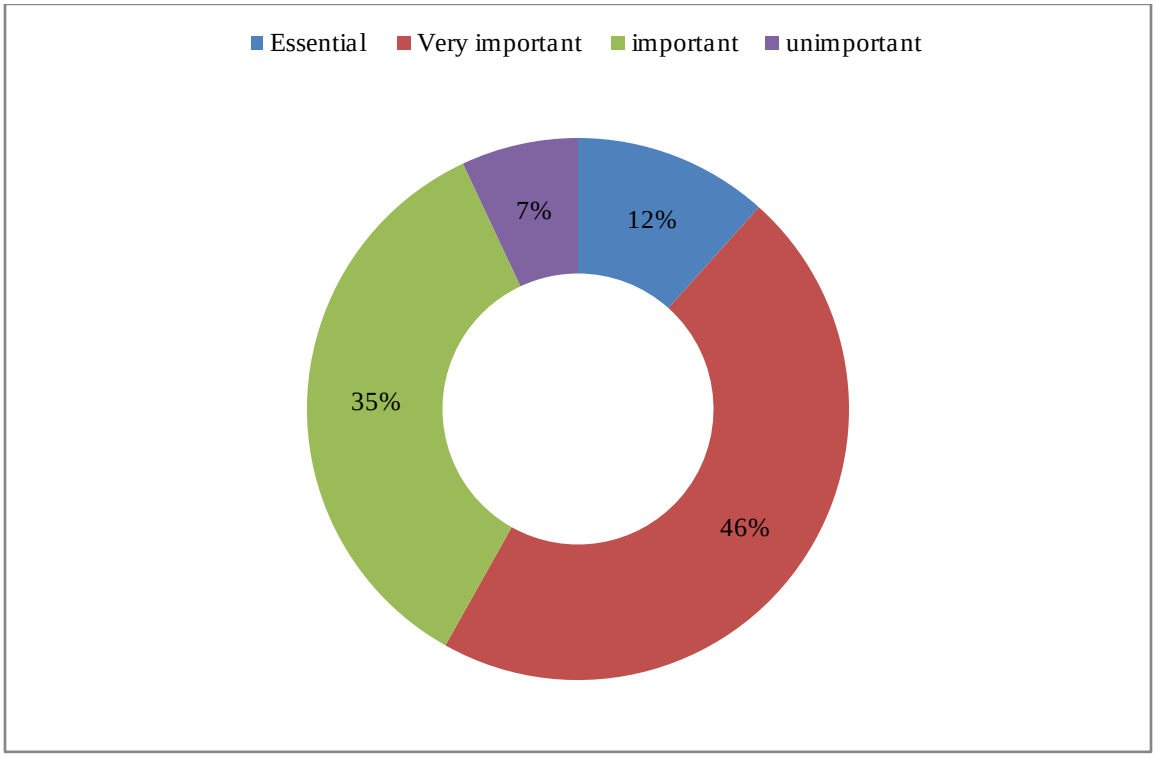


Figure 13: Hydrotherapy for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 5 (12%) was essential, 20 (46%) was very important, 15 (35%) was important & 3 (7%) was unimportant respectively as hydrotherapy for ASD children.

4.4.8 Evidence Based Practice for ASD as PT Intervention

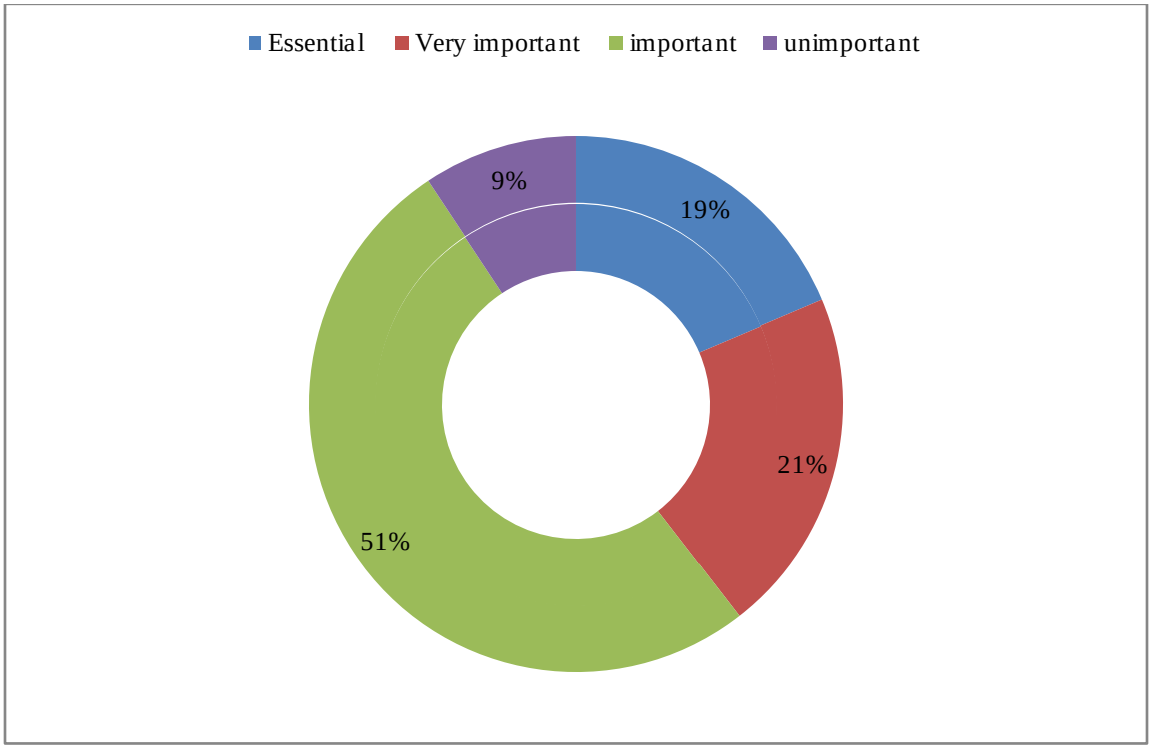


Figure 14: Evidence Based Practice for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 8 (19%) was essential, 9 (21%) was very important, 22 (51%) was important & 4 (9%) was unimportant respectively as evidence based practice for ASD children.

4.4.9 Aerobic Exercise for ASD as PT Intervention

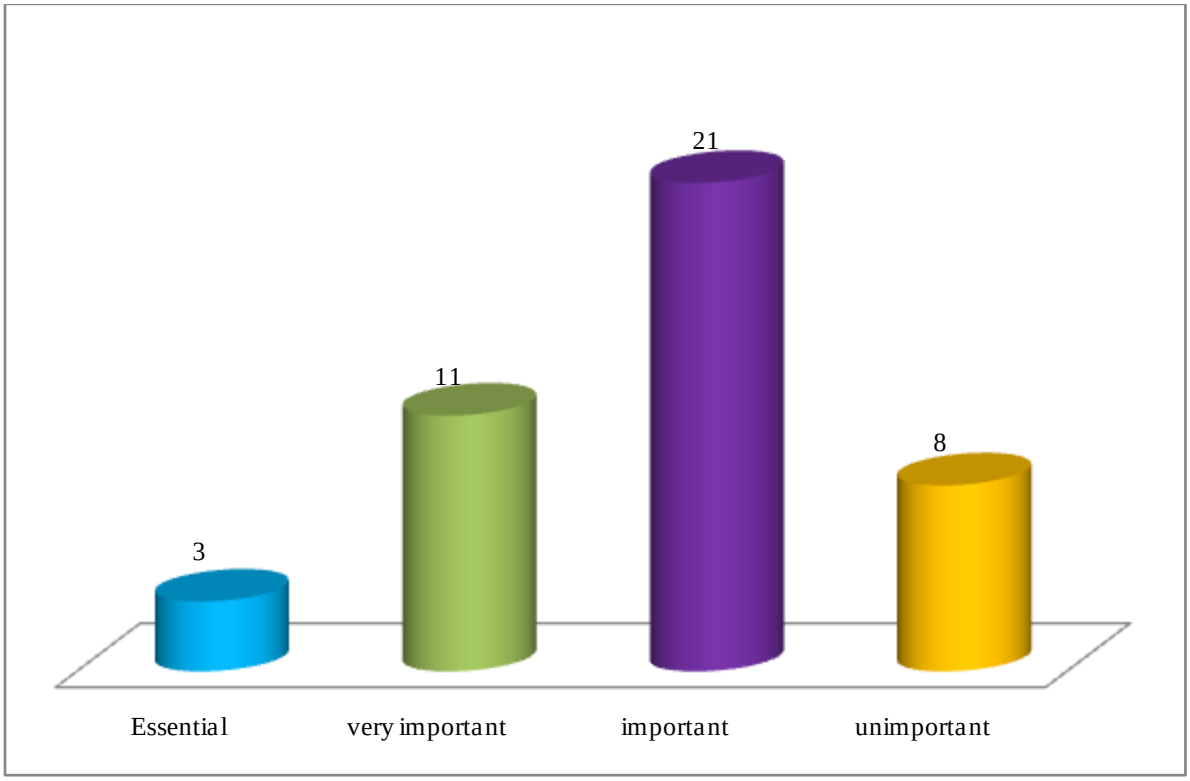


Figure 15: Aerobic Exercise for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 3 (7%) was essential, 11 (25.6%) was very important, 21 (48.8%) was important, 8 (18.6%) was unimportant respectively as aerobic exercise for ASD children.

4.4.10 Motor Performance for ASD as PT Intervention

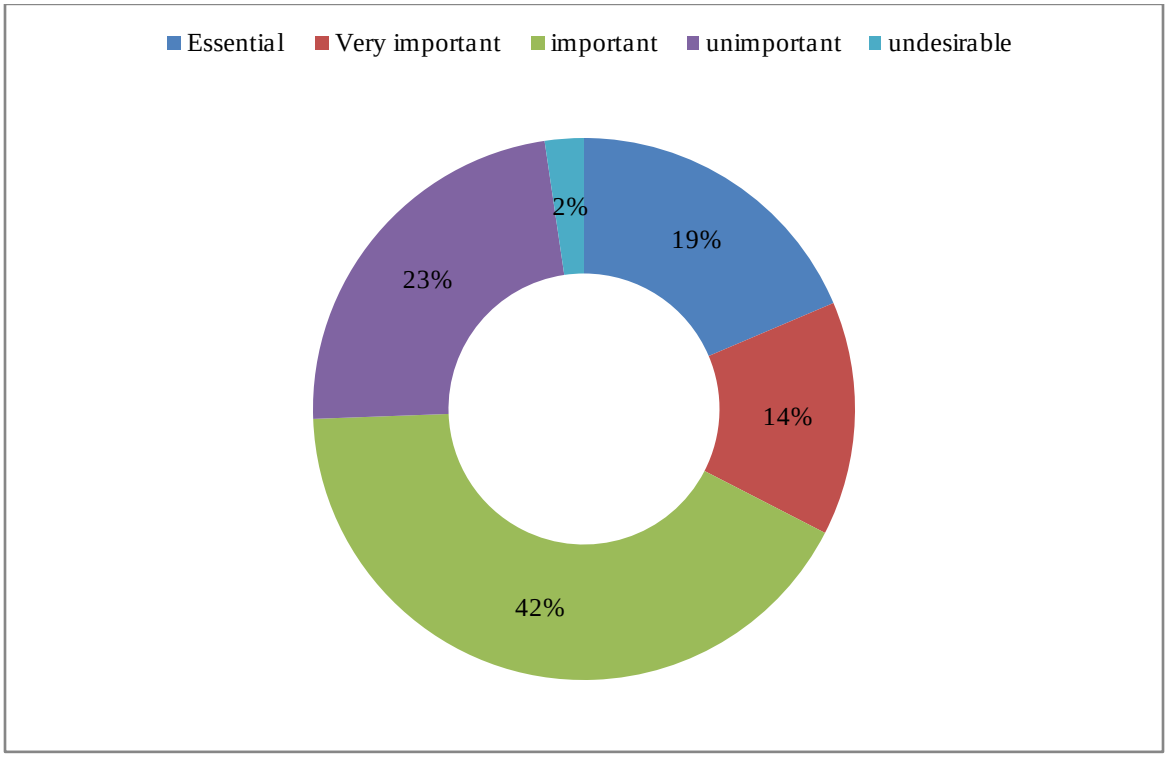


Figure 16: Motor Performance for ASD as PT Intervention

The panel members were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 8 (18.6%) was essential, 6 (14%) was very important, 18 (41.9%) was important, 10 (23.3%) was unimportant & 1 (2.3%) was undesirable of gait training for ASD children.

4.4.11 Gross Motor Function for ASD as PT Intervention

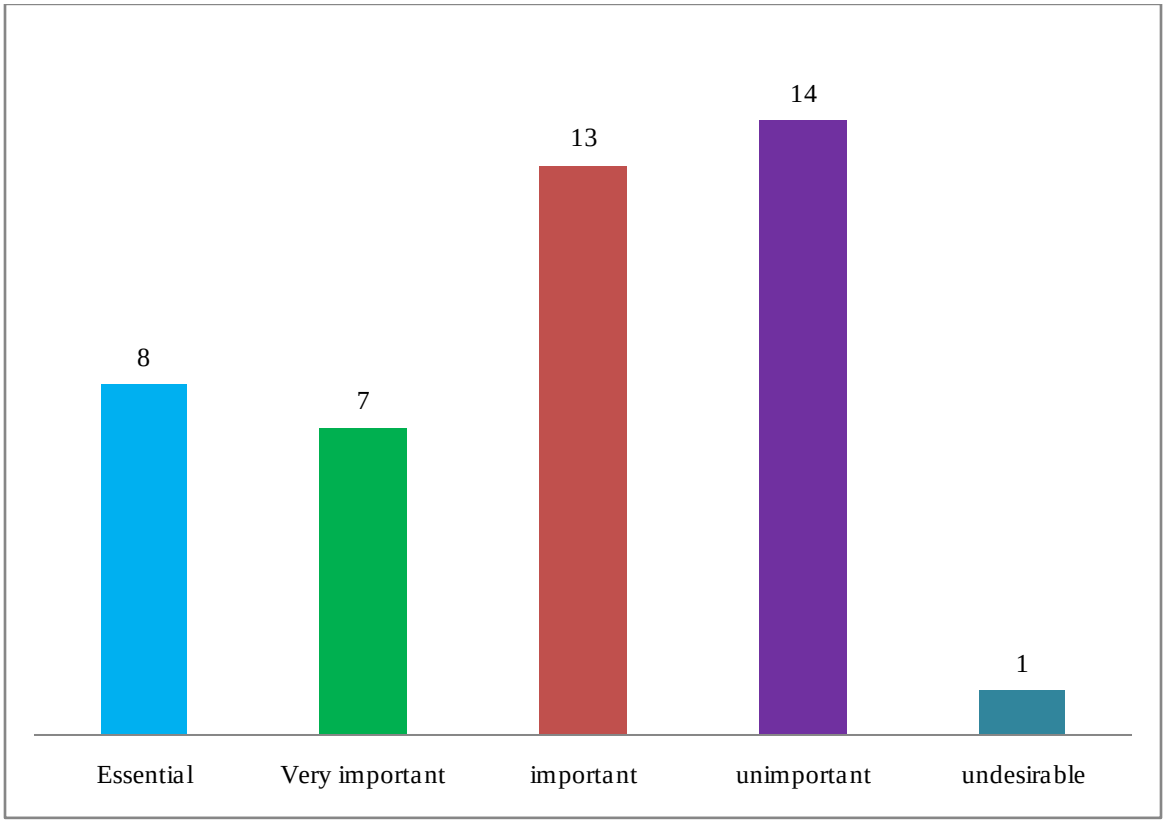


Figure 17: Gross Motor Function for ASD as PT Intervention

The panelists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 8 (18.6%) was essential, 7 (16.3%) was very important, 13 (30.2%) was important, 14 (32.6%) was unimportant & 1 (2.3%) was undesirable respectively as gross motor function for ASD children.

4.4.12 Strengthening Exercise for ASD as PT Intervention

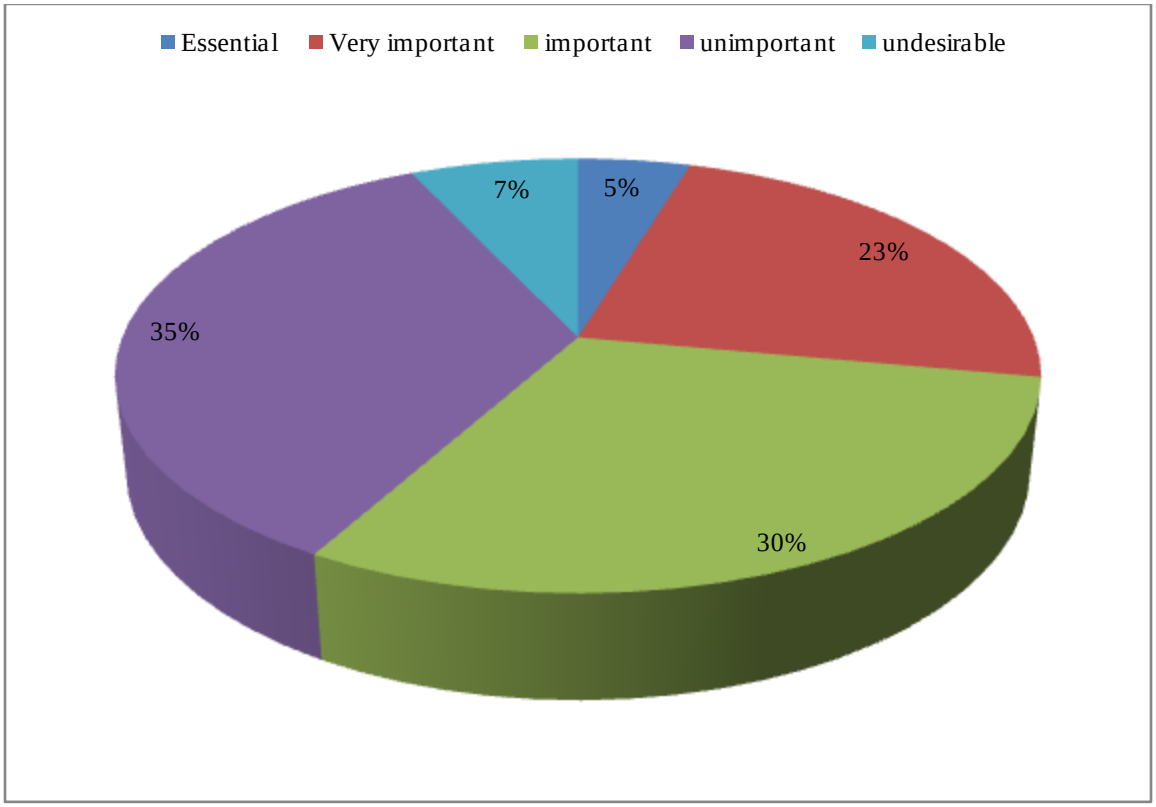


Figure 18: Muscle Strengthening Exercise for ASD as PT Intervention

The panel lists were asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for ASD children as physiotherapy intervention in the delivery of quality care via video conferencing. The panel members were put the rank of each intervention on a scale accordingly where 2 (4.7%) was essential, 10 (23.3%) was very important, 13 (30.2%) was important, 15 (34.9%) was unimportant & 3 (7%) was undesirable respectively as muscle strengthening exercise for ASD children.

e-Delphi survey

The Delphi panels were asked to rate each of the 12 interventions for managing ASD children. Round 1 was opened to invite in online conference of panelists for 2 weeks and subsequent rounds were opened for 3 weeks to collect rank of intervention through subsequent mail transferring. Three reminder emails was sent over that time to non-responders, to encourage completion. Participants were taken approximately 20 to 25 minutes to complete each round of the survey.

Round 1

In Round 1, panel lists was asked to rate each of the specific interventions as 'unimportant', 'important' or 'essential' for physiotherapists in the delivery of quality care via videoconferencing & it was counted as Round 1. All panelists were asked to join the conference & only few panelists were joining whose matched time available conveniently. The panelist were agreed to put agreement that the 12 interventions were either important or unimportant.

Round 2

In Round 2, panelists were asked to consider and rate the interventions from Round 1, as well as no any new interventions suggested by the panel in Round 1. To assist in this process, summary panel data from Round 1 was displayed alongside each intervention showing the proportion of agreement across panelists. For this round, the panelists were asked to rate how strongly they agreed or disagreed that each intervention should be included as a role of physiotherapists on ASD to deliver quality care. Panel lists were rated their level of agreement on an 11-point numerical scale (with terminal anchors of 0 = strongly disagree and 10 = strongly agree).

Among 50 participants 43 (86%) participants were rated & ranked the mentioned 12 interventions. Only those interventions that were achieved consensus (at least 75% of the panel rating > 7) were retained for inclusion in the final core interventions for managing ASD children (Slade et al., 2016; Hinman et al., 2020).

4.5 Physiotherapy in ASD according to order of statement:

Final phase: The research team was reviewed the final interventions framework.

Among 12 interventions only few capabilities that were comparable in type were melded together. Only 6 interventions including hippo therapy, gait training, balance training, coordination practice, proprioception training & physical exercise that were achieved consensus (at least 75% of the panel rating > 7) were retained for inclusion in the final core interventions for managing ASD children. The combined capabilities were sent to the Steering Group for approval. The Steering Group approved the revisions and combined capabilities after reviewing the final framework.

Table 4: Final core intervention framework achieved through Delphi panelists

Name of Intervention	Final rank (mean ± SD)	Final core Intervention
Hippo therapy	7.79 (± 1.55)	Achieved
Gait training	7.30 (± 1.79)	Achieved
Balance training	7.19 (± 1.69)	Achieved
Coordination practice	7.16 (± 1.70)	Achieved
Proprioception training	7.07 (± 1.53)	Achieved
Physical exercise	7.05 (± 1.65)	Achieved

The RCT revealed efficacy of hippo therapy to improve their self-regulation, communications, psycho-social, adaptive and cognitive behaviors for children with ASD (Gabriels, et al., 2015). Gait training improves autistic patients' gross motor function & coordination, according to the study (Kindregan, Gallagher & Gormley, 2015). Balance training programs for children with ASD can help them improve their balancing and postural stability (Cheldavi, Shakerian, Boshehri & Zarghami, 2014). Children with ASD require physiotherapy as a coordination exercise (Ben-Sasson et al., 2009). The proprioceptive practice has the potential to improve motor skills and lower extremity strength (Armitano-Lago, Bennett & Haegele, 2021). Children with ASD physical activity (PA) identify particular benefits on motor skills (Rafiei Milajerdi et al., 2021). Evidence has potential support on six physiotherapy intervention for managing & treating children with ASD.

4.5.1 Binary logistic regression with physiotherapy intervention for ASD:

Among 43 respondents hippo therapy, gait training, coordination training, balance training, physical exercise & proprioception practice had higher coefficient values respectively 3.778, 3.300, 3.300, 2.583, 2.071 & 1.687 & significant values (p value) 0.001, 0.001, 0.001, 0.005, 0.025 & 0.097 respectively. It is indicated that hippo therapy, gait training, coordination training, balance training, physical exercise & proprioception practice has positive agreement with respondents. Obviously this exercise will be effective & standard practice for physiotherapist as managing & treating children with Autism spectrum disorder (ASD).

Table 5: Binary logistic regression with physiotherapy intervention for ASD

Physiotherapy Intervention for ASD	Agreement (n=43)	Coefficient value	Significant value
Hippo therapy	Agree	3.778	**0.001****
Gait training	Agree	3.300	**0.001****
Coordination training	Agree	3.300	**0.001****
Balance training	Agree	2.583	**0.005***
Physical exercise	Agree	2.071	0.025
Proprioception practice	Agree	1.687	0.097
Hydrotherapy	Agree	1.529	0.173
Strength exercise	Agree	0.344	**0.002****
Evidence based practice	Agree	0.483	0.025
Gross motor function	Agree	0.536	0.051
Aerobic exercise	Agree	0.593	0.097
Motor performance	Agree	0.654	0.173

CHAPTER V: DISCUSSION

The researcher intended to explore the role of physiotherapy interventions in children with Autism Spectrum disorder (ASD). Data was collected through mail transferring using a structured questionnaire. Here used the questionnaire among 50 participants from specialized hospitals & school settings. The Delphi panel of experts in the rehabilitation field was established to reach consensus on the role of physiotherapy practice in ASD. Potential panelists was completed a series of e-Delphi survey to ensure eligibility criteria were met. For subsequent Delphi rounds, only those participants who were completed the previous Delphi round was emailed the survey. This framework is a model that communicates the key capabilities required of health professionals to ensure excellence in best practice ASD care. The final framework comprised 6 specific capabilities including balance training, gait training, physical exercise, hippo therapy; coordination practice & proprioception training that were achieved consensus (at least 75% of the panel rating > 7) were retained for inclusion in the final core interventions for managing ASD children.

Only 50 expert rehabilitation practitioners were sample in this study. Among 50 participants 43 (86%) participants were responses in final Delphi round. Among 43 participants 23 (53.5%) were female & 20 (46.5%) participants were male. The participants age range between 20-29 years were 7 (16.3%), 30-39 years were maximum 22 (51.2%), 40-49 years were 9 (20.9%), 50-59 years were 3 (7%) & 2 (4.7%) were age >60 years of old.

Among 43 participants 20 (46.5%) participants has 5-10 years of practice experience, 13 (30.2%) participants has 11-15 years of practice experience, 3 (7%) participants has 16-20 years of practice experience & 7 (16.3%) participants has >20 years of practice experience respectively. Besides, 22 (51%) participants practice in hospital or clinic, 13 (30.2%) participants practice in school settings & 8 (19%) participants practice in pediatrics department. Among 43 participant 25 (58%) participants were physiotherapist & 3 (7%) were occupational therapist, pediatricians, speech therapist, nurses, clinical counselor & special educator respectively.

The panel lists was asked to rate each of the specific interventions for quality care of ASD children as physiotherapy intervention. The panel members were put the rank of each intervention on a scale maximum 19 (44%) was very important & lowest 1 (2%) was undesirable respectively as hippo therapy for ASD children. The mean of the intervention rank achieved consensus 7.79 (± 1.55) which is > 7 & finally hippo therapy included in the core interventions for managing ASD children.

Gabriels, Pan, Dechant, Agnew, Brim & Mesibov (2015) conducted an RCT to see whether therapeutic riding on horse could help children and adolescents with ASD improve their self-regulation, communications, psycho-social, adaptive and cognitive behaviors. This RCT revealed efficacy of hippotherapy for children with ASD after a 10-week intervention that lasted at least 45 minutes per session. Here evidence strongly suggests hippotherapy as intervention of children with ASD where expert collaterally put positive agreement on hippotherapy as intervention of children with ASD.

The panel members were put the rank of each intervention on a scale maximum 26 (61%) was very important & lowest 1 (2%) was undesirable of gait training for ASD children. The mean of the intervention rank achieved consensus 7.30 (± 1.79) which is > 7 & finally included in the core interventions for managing ASD children.

Gait stereotype like pacing, jumping, hopping, skipping, and spinning have all been observed in children with ASD, and it has been claimed that they may be considered limiting and repetitive behavior (Goldman et al., 2009). Idiopathic toe walking has been found to be more common in children with ASD than in same aged healthy children's (Barrow, Jaworski & Accardo, 2011). Gait training improves autistic patients' gross motor function & coordination, according to the study (Kindregan, Gallagher & Gormley, 2015). Evidence has strong suggestion on gait training as physiotherapy intervention of children with ASD where expert similarly put positive agreement on gait training as physiotherapy intervention of children with ASD.

The panel members were put the rank of each intervention on a scale maximum 20 (47%) was very important & lowest 1 (2%) was unimportant respectively as balance training for ASD children. The mean of the intervention rank achieved consensus 7.19 (± 1.69)

which is > 7 indicate agree & finally included in the core interventions for managing ASD children.

Balance training is effective for children with ASD who require early intervention measures to achieve the best results (Wijnhoven et al., 2018). For example, Cheldavi, Shakerian, Boshehri & Zarghami (2014) created a 6-week balance training program for children with ASD that included a variety of balancing exercises. After the training, it was observed that balance significantly improved. However, it's unclear how these children's basic symptoms, such as emotion management, improved as well (Stins & Emck, 2018). According to Bart et al. (2009), a balance training program reduced childhood anxiety and increased balance confidence. Balance training programs for children with ASD can help them improve their balancing and postural stability (Cheldavi, Shakerian, Boshehri & Zarghami, 2014).

The panelist were put the rank of each intervention on a scale maximum 27 (63%) was very important & lowest 3 (7%) was unimportant respectively as coordination training for ASD children. The mean of the intervention rank achieved consensus 7.16 (± 1.70) which is > 7 indicate agree & finally coordination included in the core interventions for managing ASD children.

A meta-analytic technique Fournier, Hass, Naik, Lodha and Cauraugh (2010) revealed that motor coordination deficiencies were more prevalent in people with ASD. Gait and balance problems, as well as arm motor control and movement plan problems, are all real. As a result, the revealed motor coordination deficiency appears to be pervasive, making it a key symptom of ASD that requires physiotherapy as a coordination exercise (Ben-Sasson et al., 2009). Here evidence strongly recommends on coordination training as physiotherapy intervention of children with ASD where expert panel collaterally put positive agreement on coordination training as physiotherapy intervention of children with Autism spectrum disorder (ASD).

The panelists were put the rank of each intervention on a scale maximum 21 (48.8%) was very important & lowest 1 (2.3%) was unimportant & 1 (2.3%) was undesirable of proprioception training for ASD children. The mean of the intervention rank achieved

consensus 7.07 (± 1.53) which is > 7 indicate agree & finally proprioception included in the core interventions for managing ASD children.

Armitano-Lago, Bennett & Haegele (2021) determined that proprioception training has the potential to improve motor skills and lower extremity strength. Significant data also suggests that people with ASD (Fournier et al., 2010), have motor abnormalities, including issues with postural stability, gait pattern, coordination and both gross & fine motor activities (Armitano et al., 2020; Bennett et al., 2021). Evidence has strong suggestion on proprioception training as physiotherapy intervention of children with ASD where expert members similarly put positive agreement on proprioception training as physiotherapy intervention of children with ASD.

The panel lists were put the rank of each intervention on a scale maximum 25 (58%) was very important & lowest 1 (2%) was unimportant & 1 (2%) was undesirable of physical exercise for ASD children. The mean of the intervention rank achieved consensus 7.05 (± 1.65) which is > 7 & finally physical exercise included in the core interventions for managing ASD children.

Andy (2020) completed a 12-week jogging program consists of 48 sessions lasting 30 minutes, with four sessions each week. In children with ASD, physical activity improved emotion management and behavioral performance. Children with ASD benefit from physical activity (PA) therapies that identify particular motor skills (Rafiei Milajerdi et al., 2021). Physical exercise finds the significance of managing of children with ASD. Also expert rehabilitation panel fixed their opinion on physical exercise as physiotherapy intervention of ASD children.

The panel lists were put the rank of each intervention on a scale maximum 20 (46%) was very important & lowest 3 (7%) was unimportant respectively as hydrotherapy for ASD children. The mean of the intervention rank achieved consensus 6.84 (± 1.88) which is along 5-6 rank indicate either agree or disagree. Finally hydrotherapy didn't include in the core interventions for managing ASD children.

Mills, Kondakis, Orr, Warburton and Milne (2020) used a qualified physiotherapist to administer hydrotherapy for 45 minutes once a week for 8 weeks. Hydrotherapy might

help children with ASD improve their mental health and well-being. Aquatic programs, water-based activities, and swimming programs are all examples of hydrotherapy. The systematic review and found four previous studies investigated that, the usefulness of hydrotherapy in the treating of social and behavioral characteristics of children with ASD (Mortimer, Privopoulos & Kumar, 2014). Evidence suggests hydrotherapy as physiotherapy treatment option for ASD children but expert panel put their agreement just short of inclusion level.

The panel lists were put the rank of each intervention on a scale maximum 22 (51%) was important & lowest 4 (9%) was unimportant respectively as evidence based practice for ASD children. The mean of the intervention rank achieved consensus 6.26 (± 1.97) which is along 5-6 rank indicate either agree or disagree. Finally evidence based exercise didn't include in the core interventions for managing ASD children.

Conversely, the study found that exercise has physical benefits for children with ASD, including improved cardio-respiratory function, motor skill proficiency & muscular strength, and often a lower BMI (Dillon, Adams, Goudy, Bittner & McNamara, 2017). Cognitive and behavioral functioning gains have been documented in addition to physical benefits. Exercise has also been demonstrated to reduce maladaptive and repetitive behaviors while increasing task activities and academic responses as an intervention (Celiberti, Bobo, Kelly, Harris & Handleman, 1997; Mahar et al., 2006). Academic achievement and social skills have both been found to improve with physical exercise (Nicholson, Kehle, Bray & Heest, 2011). Research recommends evidence based practice as physiotherapy treatment option for ASD children but expert panel put their agreement just short of inclusion level.

The panel lists were put the rank of each intervention on a scale maximum 21 (48.8%) was important & lowest 3 (7%) was essential of aerobic exercise for ASD children. The mean of the intervention rank achieved consensus 5.95 (± 2.05) which is < 6 indicate either agree or disagree. Finally aerobic exercise didn't include in the core interventions for managing ASD children.

According to Brand, Jossen, Holsboer-Trachsler, Pühse & Gerber (2015) aerobic activity includes catching, ball throwing with single or both hands, standing balance on single leg, jumping, jumping on uneven surface and balance. It was used in for three weeks, thrice-weekly 60-minute sessions. Aerobic exercise training improves sleep, motor function and mood in children with ASD. But panel members don't agree with the literature.

The panel members were put the rank of each intervention on a scale maximum 18 (41.9%) was important & lowest 1 (2.3%) was undesirable respectively as motor performance for ASD children. The mean of the intervention rank achieved consensus 5.81 (± 2.28) which is between 5-6 rank indicates either agree or disagree. Finally motor performance didn't include in the core interventions for managing ASD children.

The study emphasizes the need for more knowledge and attention to ASD children's motor performance, including the relevance of physiotherapy (QUINTAS, BLASCOVI-ASSIS, Castilho & SANTOS, 2018). For parents of children with ASD, early accurate diagnosis expedites referral for early physiotherapy interventions such as motor learning (Harris, 2017). But opinion of the panel members doesn't match with the literature.

The panel lists were put the rank of each intervention on a scale maximum 14 (32.6%) was unimportant & lowest 1 (2.3%) was undesirable respectively as gross motor function for ASD children. The mean of the intervention rank achieved consensus 5.49 (± 2.47) which is along 5-6 rank indicate either agree or disagree. Finally gross motor function didn't include in the core interventions for managing ASD children.

Expert panelist's ranked gross motor function on the Delphi method had not identified compelling evidence for caring for children with ASD. Exercise regimens could have a comparable effect, even if the symptoms of other disorders are similar. Locomotion and object trying to balance, flexibility, strength, muscular endurance, and respiratory endurance are all examples of gross motor function (Cha, Min, Yoon & Jee, 2020).

The panel members were put the rank of each intervention on a scale maximum 15 (34.9%) was unimportant & 3 (7%) was undesirable respectively of muscle strengthening exercise for ASD children. The mean of the intervention rank achieved consensus 5.16 (±

2.02) which is < 6 indicate either agree or disagree. Finally muscle strengthening exercise didn't include in the core interventions for managing ASD.

Lourenço, Esteves, Corredeira & Seabra (2015) evaluated trampoline training in a facility with several types of trampolines for a 32-week program that lasted 45 minutes once a week. Motor competency is linked to physical activity, which has been shown to improve symptoms in children with ASD. Push-ups, curl-ups, trunk lifts and strength of grip were among the muscle-strengthening exercises. In ASD patients, higher physical strength was linked to higher executive function (Ludyga, Pühse, Gerber & Mücke, 2021). According to a review of the experimental evidence, exercise-induced advantages for executive function are generally applicable to neurodevelopmental diseases (Ludyga et al., 2021). But opinion of the panel members doesn't match with the evidence.

5.1 Limitation of the study:

There are certain limitations to our research that should be considered. We limited our sample size (n=50) to specialists who work in the field of ASD care. We reached out to clinicians and rehabilitation professionals who had more practicing experience in rehabilitation field, but we didn't reach out to everyone with significant knowledge about ASD. Our panel consisted of just 50 professionals, 27 of whom were physiotherapists; three members were represented by occupational therapists, nurses, speech therapists, clinical counselors, and special educators. Outside of Bangladesh, it's also possible that physiotherapy for children with ASD is provided differently. We had hoped for a higher response rate from the participants, but it was not to be. This might be due to a variety of variables, including time, the length of the first survey, and time intervals between rounds. It meant that some respondents from prior rounds were no longer in the office or on leave when surveys were sent out.

CHAPTER VI: CONCLUSION & RECOMMENDATION

The findings of this study can be used as a practice guideline that may apply to children with Autism spectrum disorder (ASD) as physiotherapy's role. This study highlighted the need of physiotherapy treatments for children with ASD, which should be part of a multidisciplinary team approach that also includes other healthcare professionals. Our study finally revealed that only 6 interventions including hippo therapy, gait training, balance training, coordination practice, proprioception training & physical exercise that were achieved consensus (at least 75% of the panel rating >7) were retained for inclusion in the final core interventions for managing ASD children. It will ultimately improve the quality of treatment and efficiency of physiotherapy services for children with ASD. This strategy can boost the professional growth of physiotherapists who provide quality care to children with ASD in the future.

6.1 Recommendation of the study:

The proposed guidelines as a function of physiotherapy are likely to be successfully integrated in daily practice for the care of ASD children because the recommendations represent the viewpoints and needs of many experts along with patients. To explain the usefulness of physiotherapy treatments in children with ASD, more research is needed. Physiotherapists should concentrate on the type of interventions for children with ASD. Another suggestion is that if the sample size can be increased, the study results will be more generalized. In the context of Bangladesh, more study to develop possible evidence on physiotherapy care for children with ASD is strongly encouraged.

CHAPTER VII: BIBIOGRAPHY

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