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METHODS AND INDICATORS FOR EVALUATING THE EFFECTIVENESS OF PHYSICAL THERAPY FOR PRESCHOOL CHILDREN WITH AUTISM

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Abstract. Autism spectrum disorder (ASD) is a developmental disorder that affects the way people perceive the world. The learning, thinking, and problem-solving abilities of people with ASD can range from gifted to very challenging. Some people with ASD need a lot of help in their daily lives, while others need less.

Symptoms of ASD range from mild to severe. Children with ASD may have delays in developing basic skills. For example, some children with ASD may be able to talk. Others may communicate in other ways or have trouble relating to other people. People with ASD may also limit their behaviors or have repetitive behavioral patterns. Children with autism spectrum disorder (ASD) often have delayed motor skills, limited coordination, and poor postural control. They also have to work harder to learn imitation skills. This can make it difficult to develop social skills. The task of a physical therapist is to help children with ASD develop gross motor skills, basic motor skills and improve their quality of life. Intervention programs, including physical therapy, have benefits for children with ASD, but the lack of reliable diagnostic tools makes it difficult to assess children with ASD in the context of their holistic development and provide timely therapy. In order to design an effective rehabilitation program, a physical therapist needs to qualitatively assess physical development using standardized tools, so it is important to understand what assessment tools and indicators a physical therapist can use. Only after assessing and identifying impairments in movement or aspects of motor skills that are delayed in a child's development can a physical therapist set functional goals with the parents (guardians) of a child with ASD to optimize the child's functional mobility in the most effective way.

The aim of the research: to determine which assessment tools and indicators are most commonly used by researchers to evaluate the effectiveness of physical therapy and rehabilitation of children with autism.

Materials and Methods. A search for systematic reviews related to physical therapy, rehabilitation, exercise and physical activity in children with ASD in the Cochrane, PubMed and Pedro libraries over the past 10 years was conducted and 11 of them were selected, which included 225 scientific studies.

Results. The analysis of scientific studies based on 11 systematic reviews ensured the use of high-quality data and the consideration of modern and relevant assessment tools for children with ASD. From the 286 assessment tools and indicators used, six groups of assessment criteria were formed in the following main areas: mental functions (97 assessment tools), motor development (127 tools and indicators), life activities (21 tools), quality of life (12 tools) and assessment of children with ASD (12 tools) and comprehensive assessment (17 tools). We divided motor development into three subgroups, which included questionnaires/observations of motor skills development (23 instruments), clinical tests for assessing motor skills and physical qualities (43 instruments), balance and vestibular function (61 instruments).

Conclusions. In our study, the examination of children with ASD covered several areas that are important and allow a specialist to comprehensively assess the child, but since their large number and their repeatability in studies is insignificant, it is very difficult to choose those that will be effective in the use of a physical therapist.

Keywords: physical therapy, physiotherapy, rehabilitation, autism.

Introduction. Autism, also known as autism spectrum disorder (ICD 10 code F 84.0), is a diverse group of conditions related to brain development characterized by problems with social skills, repetitive behaviors, speech, and non-verbal communication [1].

The number of people with autism spectrum disorders (ASD) in Ukraine is steadily increasing, and as of 2021, 1 in 130 people is diagnosed with autism [2]. Despite the significant increase, the prevalence of ASD in Ukraine remains noticeably lower than in the United States and European countries.

Up to 83% of children with ASD have difficulty performing age-appropriate motor skills [3]. Several studies that have examined motor impairments in children with ASD have shown low muscle tone, significant impairments in coordination, poor balance, impaired imitation and practical skills, and presence of motor stereotypes such as hand flapping or fixation on objects. There is speculation about abnormal movement patterns, such as tiptoeing, in ASD children; however, there are no systematic studies on secondary muscle wasting or contractures development in children with ASD [4].

Rationale for the research. There is growing evidence that children with ASD have motor impairments, which are expressed in changes in motor developmental stages, clumsiness, impaired skills (e.g., reaching,

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grasping), changes in gross and fine motor skills, and impaired postural control [5]. Preschool age (3-6 years) is a critical period for the development of motor skills and a favorable time for rehabilitation interventions. Delayed or impaired motor skill acquisition can negatively affect a child's ability to participate in daily life, as well as deterioration in academic, cognitive, and socio-emotional outcomes. Preschool children with motor disorders are less likely to participate in games and physical activity than children with normal development. It is important to note that low levels of motor skills development in childhood are associated with lower levels of physical activity in adolescence and adulthood. For children with or at risk of motor disorders, effective interventions are needed to support the development of motor skills. Physical therapy interventions can help improve motor skills and provide an opportunity to build, improve, and reinforce these skills [6].

Rehabilitation care for children with ASD in Ukraine mainly includes development of mental processes and speech, correction of undesirable behavior, as well as development of cooperation and self-care skills. Unfortunately, there are no protocols for examining and documenting physical therapy in children with ASD. Assessment is one of the main components of physical therapy process, essential for formulating a rehabilitation diagnosis, setting goals and objectives of physical therapy, developing an effective program, and monitoring and controlling the effectiveness of interventions.

The use of appropriate and valid evaluation methods for Ukrainian children with ASD during physical therapy is relevant.

The aim: to analyze examination methods and indicators to evaluate motor functions and the effectiveness of physical therapy in children with autism.

Materials and methods. To form a list of examination methods and indicators for evaluation of motor functions and performance criteria most used in physical therapy and rehabilitation in children with autism, a search for systematic reviews was conducted in Cochrane, PubMed, and Pedro sources.

Search criteria. The search was conducted by following keywords: "physical therapy", "physiotherapy", "rehabilitation" with the Boolean function AND for "autism" and "systematic review" (for PubMed and Pedro).

Selection criteria: we included systematic reviews that covered physical therapy, rehabilitation, exercise, and physical activity in children with autism spectrum disorders over the past 10 years.

Exclusion criteria: systematic reviews that focused only on social and behavioral interventions, acupuncture, occupational therapy, music therapy, pet therapy, pharmacological interventions, sensory integration, and alternative communication were not selected for the review.

Data collection and analysis Data on research methods and criteria for evaluating the effectiveness of physical therapy and rehabilitation in children with ASD were collected from clinical trials included in selected systematic reviews.

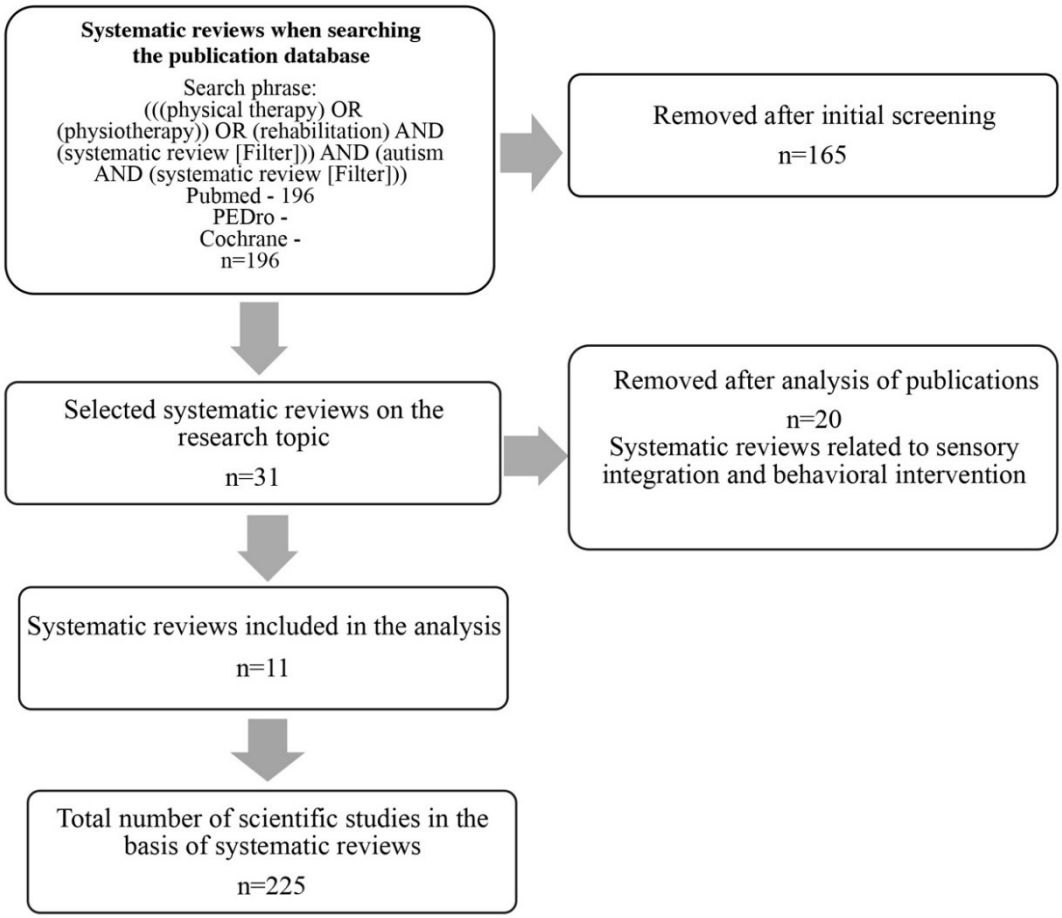

Fig. 1. Selection of systematic reviews for analysis.

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Results. The article included review of 11 systematic surveys from the e-database of medical and biological publications PubMed on physical therapy in preschool children with autism, based on the analysis of 225 scientific studies. The survey instruments and indicators used to assess the results and effectiveness of physical therapy for children with autism were identified.

In 225 clinical trials, a total of 286 survey instruments and indicators were used (table 1). Selected research methods and indicators made up six groups of evaluation criteria:

1. Motor development:
1.1 Questionnaires/observations on the development of motor skills;
1.2 Clinical tests to assess motor skills and physical qualities;
1.3 Keeping balance and vestibular function.
2. Mental functions.
3. Vital activity.
4. Quality of life.
5. ASD assessment.
6. Comprehensive assessment.

The main list of motor development assessment methods and their characteristics is provided in Table 2, 3, 4.

Table 1.

Analysis of the number of research studies and survey instruments in selected systematic examination

Systematic examination	Number of included studies	Number of methods and indicators used in studies
Ruggeri A. et al., 2019 [25]	41	76
Lim Y. H. et al., 2021 [21]	13	18
Hecke R.V. et al., 2019 [23]	20	54
Cameron K. L et al., 2019 [8]	17	3
Lami F. et al., 2017 [14]	7	10
Schipper E. et al., 2015 [13]	71	4
Millman L. S. M. et al., 2020 [15]	15	42
Valagussa G. et al., 2018 [12]	10	19
Fang Q. et al., 2019 [11]	10	6
Hourston S., Atchley R., 2017 [9]	16	42
Menezes DeJesus B. et al., 2019 [30]	5	15
Total	**225**	**286**

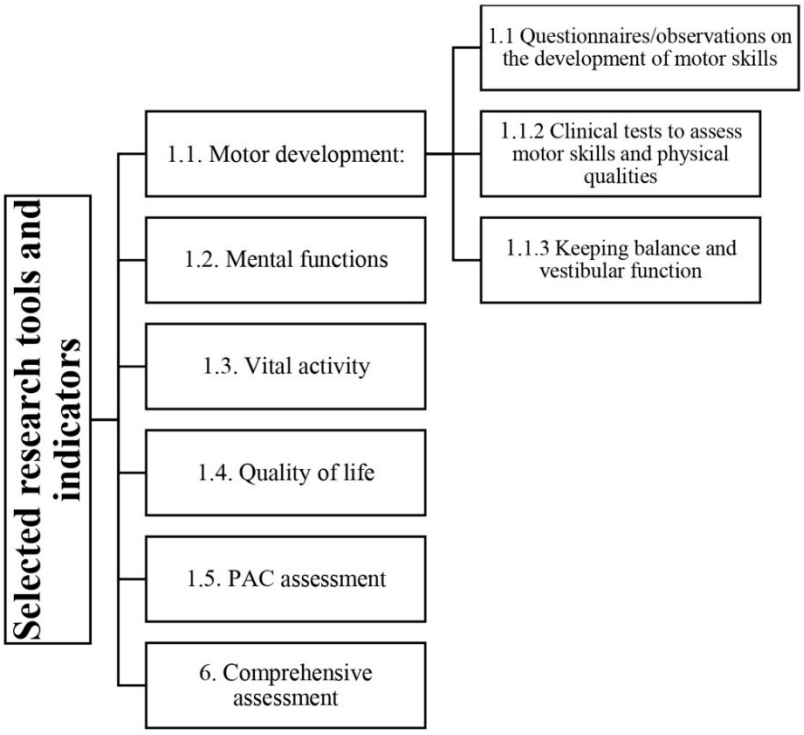

Fig 2. Selected research methods and indicators.

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Table 2

Methods for examining motor development of children with autism spectrum disorders

Methods	Description	Number of applying
Motor development		**127**
Questionnaires/observations on the development of motor skills		**23**
Bruininks-Oseretsky Test of Motor Proficiency (BOT)	Assessment of fine and gross motor skills	11
Test of Gross Motor Development (TGMD)	Assessment of gross motor development for children aged 3-10 years	5
Peabody Developmental Motor Scales (PDMS)	Assessment of fine and gross motor skills development	2
Movement Assessment Battery for Children (MABC)	Identification of problems or delays in motor development	1
General Movements Assessment (GMA)	Identifying the risk of cerebral palsy in infants	1
The Pictorial Scale of Perceived Movement Skill Competence (PMSC)	Assessment of young children's perception of competence in basic motor skills and active play	1
Tests for fine manual control	Assessment of fine motor skills development	1
Physical activity (accelerometer)	Assessment of light-intensity physical activity (with the help of device that measures acceleration)	1

Table 3

Methods for examining motor development of children with autism spectrum disorders

Methods	Description	Number of applying
Motor development		**127**
Clinical tests to assess motor skills and physical qualities		**43**
Humphries Assessment of Aquatic Readiness (HAAR)	Assessment of skills (orientation, swimming, breathing) in water by Humphries	4
Throwing accuracy	Functional motor test of throwing accuracy	3
Modified curl-ups	Evaluation of abdominal muscles strength by performing trunk flexion and rotation	3
Sit and reach	Functional motor test of sitting and reaching	2
Gait velocity	Speed of walking	2
Aquatic Skills Checklist (ASC)	Skills in water	1
YMCA Water Skills	Skills in water	1
Tests on body composition, speed, endurance, strength, and flexibility	Assessment of body composition, speed, endurance, strength and flexibility	1
The object control subscale	Involves assessment of throwing, handling, catching, and kicking/punching a stationary or moving object	1
Tests on ball skills	Functional movement test of ball play skills	1
Broad jump score	Functional motor test of broad jump from a standing position	1
Subtests of the KTK	Assessment of gross motor skills coordination	1
Running tests (30-yard run and 15-yard agility run)	Agility running. Ability to accelerate, decelerate and change direction during run	1
Swimming Classification Scale (SCS)	Swimming skills classification scale	1
The 20m multistage fitness test (MSFT)	Maximum aerobic fitness test	1
Progressive Aerobic Cardiovascular Endurance Run (PACER)	Assessment of progressive aerobic cardiovascular endurance running	1
Tests as one- and two-legged side hop	One- and two-legged jumping tests	1
Toe Walking Assessment	Assessment of toe walking	1
Golf skills	Assessment of golf playing skills	1
Shuttle test	Shuttle running assessment	1
Isometric push-up	Assessment of isometric push-ups	1
½ mile walk/run	½ mile walk/run assessment	1
Jumping up	Jumping up (bouncing) assessment	1
Walk between cones	Assessment of walking between cones	1
Run between cones	Assessment of running between cones	1
Physical activity (pedometer)	Assessment of physical activity (by pedometer)	1

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Roll on mat	Rolling on mat skills	1
Catching	Catching	1
Throw ball	Throwing the ball	1
Run straight	Straight running	1
Run with ball	Running with the ball	1
Jump forward	Forward jumping assessment	1
Kicking accuracy	Accuracy of kicking assessment	1
Hand grip strength	Assessment of hand grip	1

Table 4

Methods for examining motor development of children with autism spectrum disorders

Methods	Description	Number of applying
Motor development		**127**
Keeping balance and vestibular function		**61**
Nystagmus and oculomotor test	A quick test to determine presence of a vestibular disorder (central, peripheral, or both)	9
Positional testing	The positional test to determine whether a change in position of the patient's vestibular apparatus in space provokes nystagmus	6
Vestibular velocity steps test (VVST)	Nystagmus is measured, peak slow phase velocity is recorded and the time constant is measured	6
Caloric test	Assessment of the functional state of individual parts of vestibular system	6
Romberg Test	Assessment of balance keeping	6
Assessment of Spontaneous Interaction in Movement (ASIM)	Assessment of spontaneous interaction while moving (ASIM)	2
The Sensory Integration and Praxis Test (SIPT)	Assessment of series of movements in a certain sequence	2
cervical Vestibular Evoked Myogenic Potentials (VEMP)	Assessment of the function of the pouch and inferior vestibular nerve	2
Dynamic Visual Acuity test (DVA)	Assessment of vestibulo-ocular reflex (VOR) function in response to functional head movements	2
Balance skill	Balance keeping skills assessment	2
Single Leg Stance (SLS)	Assessment of static posture and balance control	1
Clinical Test of Sensory Interaction and Balance (CTSIB)	Measuring the influence of visual, vestibular and somatosensory information on standing balance	1
Sensory organization test (SOT)	Balance keeping assessment	1
Rotatory chair testing (mid-frequency function)	Determination of dizziness occurrence due to disorders of the inner ear or brain	1
Gait Analysis/Dynamic Gait Index (DGI)	The ability to maintain balance while walking is assessed	1
Manual post-rotatory nystagmus test (in light and dark)	Determining whether a child has vestibular insufficiency	1
Past-pointing test	Test for defective functioning of the vestibular nerve	1
Finger-to-finger sequencing	Assessment of motor asymmetry in patients	1
Diadochokinesis	Assessment of ability to perform antagonistic movements in rapid succession, alternately bringing the limb to opposite positions	1
Tandem stance test	Predicting walking impairment and need for mobility aids	1
Evaluation of the gait	Walking skills assessment	1
Subjective Visual Vertical (SVV)	Assessment of the ability to perceive verticality, depending on visual, vestibular and somatosensory data	1
Computerized posturography	Objective quantitative assessment of the balance	1
modified Emory Clinical Vestibular Chair Test (m-ECVCT)	Determines whether the vestibular (inner ear) or neurological system is the cause of the balance disorder	1
Head Impulse Test (HIT)	Diagnosis of decreased vestibular function in one ear compared to the other	1
Wii Fit performance: 1-foot balance time; 2-feet balance time	Balance maintenance assessment	1
Postural stability (COM: center of mass; COP: center of pressure)	Assessment of postural stability	1
Postural stability (7 parameters and conditions)	Assessment of postural stability	1

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The researchers used many different methods, among which those for assessing balance and vestibular function had the largest number of applying (61 methods). The most used tests were those for determining vestibular disorders (Nystagmus and oculomotor test, Vestibular velocity steps test, Positional testing), functional state of individual parts of vestibular system (Caloric test), and balance assessment (Romberg Test). The motor development assessment methods also included tests that evaluated motor skills and physical qualities in children with ASD, including swimming, running, walking, ball play skills, jumping, kicking accuracy, etc. Questionnaires and observations of motor skills development were applied 23 times, among which the Bruininks-Oseretsky Test of Motor Proficiency (BOT) was used 11 times.

The group of methods for assessing mental functions (Table 5) was the most numerous (97 points).

The studies assessed problematic and stereotypical behavior, anxiety, depression, empathy, attention, and other mental functions. The most repeated was the Diagnostic and Statistical Manual of Mental Disorders (DSM), as classification of mental disorders in the United States. The same number of applying was in parental reports of physical aggression and disruptive behavior in children with ASD. The Vineland Adaptive Behavior Scales, second edition (m-VABS-II), developed to measure adaptive behavior or personal and social skills necessary for daily independent living throughout the life span (from birth to 90 years), were applied to seven times.

Methods for mental functions assessing in children with ASD are presented in Table 6.

The methods used in the studies to assess activity and quality of life in children with ASD are presented in Table 7.

Table 5

Mental functions assessment methods

Methods	Description	Number of applying
Mental functions		**97**
Diagnostic and Statistical Manual of Mental Disorders (DSM-IV i DSM-V)	Psychopathology classification system	9
Sibling/parent reports	Report from parents, siblings about presence of physical aggression, destructive behavior	9
The Vineland Adaptive Behavior Scales, second edition (m-VABS-II)	Adaptive behavior scale	7
Interpersonal Reactivity Index (IRI)	Multidimensional empathy assessment	4
Symptom Checklist-90-Revised (SCL-90-R)	Assessment of a wide range of psychological problems and psychopathological symptoms	4
Positive and Negative Symptom Scale (PANSS)	Medical scale for measuring severity of symptoms in patients with schizophrenia	4
Rosenberg Self- Esteem Scale (SES)	Scale of personality self-esteem	3
Child Behavior Checklist (CBCL)	Method for identification of problem behavior in children	3
Scale for the Assessment of Negative Symptoms (SANS)	Measuring negative symptoms in schizophrenia cases	3
Mindful Attention and Awareness Scale (MAAS)	Assessment of awareness and attention	2
Dutch Global Mood Scale (GMS)	Mood assessment	2
Rumination-Reflection Questionnaire (RRQ)	Measuring the extent of patients` tend to constantly think about their past and reflect on themselves	2
Cognitive and Emotional Empathy Questionnaire (CEEQ)	Cognitive and emotional empathy questionnaire	2
Beck Depression Inventory (BDI-II)	Measuring the severity of depression	2
Aberrant Behavior Checklist (ABC, ABC-C)	Behavior assessment	2
Hamilton Depression Rating Scale (HAM-D)	Depression level assessment	2
Multifaceted Empathy Test (MET)	Cognitive and emotional empathy assessment	2
Embodied Intersubjectivity Scale (Koch) (EIS)	Scale for measuring the degree of closeness	2
Simpson-Angus Scale (SAS)	Effectiveness scale to measure symptoms of drug-induced parkinsonism	2
Questionnaire of Movement Therapy (FBT)	Assessment of ability to realize own body and interaction between two people	2

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Table 6

Mental functions assessment methods

Methods	Description	Number of applying
Mental functions		**97**
Behavioral Assessment System for Children (BASC-2)	Monitoring changes in children's behavior or emotional state	1
Reaction speed (within exergame)	Measuring reaction time (by playing a video game)	1
Strengths and Difficulties (SDQ)	Short questionnaire to check the behavior of children aged 2 to 17	1
Children's Social Behavior Questionnaire (CSBQ)	Assessment of social behavior in children	1
Evaluation of mirror qualities of the movement	Evaluation of mirroring movement	1
Clinical Outcomes in Routine Evaluation – Outcome Measure (CORE-OM)	Psychological distress assessment	1
Structured and semi-structured interviews and cognitive tests	Structured and semi-structured interviews and cognitive assessment	1
Hospital Anxiety and Depression Scale (HADS)	Assessment of clinical manifestations of anxiety and depression	1
Children's Color Trails Test (CCTT)	Assessment of sustained attention, consistency, and other executive functions	1
Dresden Body Image Questionnaire (DBIQ)	Assessment of 5 parts of body image: vitality, self-perception, self-esteem, physical intimacy, and sexual satisfaction	1
Brief Negative Symptom Scale (BNSS)	Assessment of 5 spheres: blunted affect, alogia, antisociality, anhedonia, and will	1
State-Trait Anxiety Inventory (STAI)	Assessment of anxiety and its differences from depressive syndromes	1
Five Point Test (FPT)	Assessment of fluency in imagery	1
Repetitive stereotyped behavior test battery (RSBTB)	Assessment of repetitive stereotypical behavior	1
Behavior Rating Inventory of Executive Function (BRIEF)	Assessment of executive function behavior at home and at school in children and adolescents aged 5-18 years	1
Self-Control Rating Scale (SCRS)	Assessment of children's self-control skills	1
Test of Attention D2	Neuropsychological index of selective and sustained attention and visual scanning speed	1
Heidelberger Befindlichkeitsskala (HBS)	Mood assessment	1
State-Trait Anger Expression Inventory (STAXI)	Assessment of anger state, anger traits, expression, and their impact on disease	1
VAS on body cathexis	Assessment of satisfaction or dissatisfaction with various body parts and aspects	1
Primary Health Questionnaire (PHQ-9)	Diagnosis of common mental disorders	1
Somatic Symptom Screening Scale (SOMS-7)	Screening for somatic symptoms	1
Stress Survey Schedule (SSS)	Stress survey	1
Beck Youth Inventory (BYI)	Assessment of depression, anxiety, anger, disruptive behavior symptoms and self-esteem in children and adolescents	1
Tower of London Test (TOL)	Assessment of executive functioning to identify planning deficits	1
Ruminative Response Scale (RRS)	Assessing a person's reaction to depression	1
Emotional Empathy Scale (EES)	Assessment of person's ability to emotional empathy	1
Self-other awareness (SOA)	Assessment of awareness of self and other	1
Imitation/synchronization Paradigms.	Evaluation of synchronous actions for imitation and memory	1

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Table 7

Methods of vital activity and quality of life assessment in children with ASD

Methods	Description	Number of applying
Vital activity		**21**
World Health Organization Disability Assessment Schedule (WHODAS 2.0)	Assessment of disability level	2
Canadian Occupational Performance Measure (COPM)	Assessment outcomes of person`s self-perception of productivity in everyday life	2
Body Self-Efficacy Scale (BSE)	Assessment of self-efficacy in performing functional tasks of everyday life	2
Goal Attainment Scale (GAS)	Evaluation of degree of achievement of individual tasks	2
Experience sampling method	Studying the thoughts, feelings, behaviors, and/or environment of patient through a diary.	2
Children's Assessment of Participation and Enjoyment (CAPE)/ Preferences for Activities of Children (PAC)	Documenting of children with and without disabilities participation in daily activities besides of compulsory school classes	1
The experience sampling method (ESM)	Assessment of subjective experience in everyday life	1
Functional Independence Measure (FIM)	Assessment of disability in different population groups	1
The Pediatric Activity Card Sort (PACS)	Determining the level of a child's involvement in work	1
School Function Assessment (SFA)	Assessment of children`s performance of functional tasks that affect academic and social aspects of the primary school program	1
Vocational index	Assessment of current professional status of patients from the most to the least independent, scaling from 9 to 1.	1
AYA-ACS, adolescents and young adults activity card sort	Assessing activity of adolescents and young adults in various spheres of life	1
Patient-Reported Outcomes Measurement Information System (PROMIS)	A set of person-centered measures that assess and monitor physical, mental, and social health of adults and children	1
Social Responsiveness Scale (SRS)	Assessment of severity of autistic social impairment in whole autism spectrum, from none to severe	1
The Helping Alliance Scale	Indicator of patient's self-assessment of his/her perception of the therapist and therapy as useful	1
Semi-structured exit interviews	Semi-structured exit interviews	1
Quality of life		**12**
Pediatric Quality of Life Inventory (pf-PedsQL)	Set of methods for assessing children's health-related quality of life	4
Manchester Short Assessment of Quality of Life (MANSA)	Assessment of quality-of-life level	3
Child Health Questionnaire (CHQ)	Assessment of level of quality of life related to the health of children and adolescents aged 5 to 18	2
Short-Form Health Survey-36 (SF-36)	Assessment of health-related quality of life	1
Subjective Happiness Scale (SHS)	Assessing the overall level of happiness of a person by self-assessment	1
World Health Organization-Five Well-being Index (WHO-5)	Assessment of subjective psychological well-being	1

Two questionnaires for assessing quality of life, the Pediatric Quality of Life Inventory (pf-PedsQL) and the Manchester Short Assessment of Quality of Life (MANSA), were applied to more often than others. The vital activity assessment methods had a small number of repeated applying.

Diagnostic methods and scales for assessing autism spectrum disorders in children (Table 8) were used in studies infrequently (12 studies).

The group of comprehensive assessment methods (Table 9) included that, which allowed study of 5-6 areas of child development, including fine and gross motor skills, social skills, visual-motor perception and coordination, and cognitive-adaptive skills. The Mullen Scales of Early Learning (MSEL) comprehensive assessment had the largest number of applying, namely seven times. In several studies, authors describe that comprehensive standardized assessment methods are the most convenient for assessment of children with ASD.

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Table 8

Methods of identification autism spectrum disorders in children

Methods	Description	Number of applying
ASD assessment		**12**
Autism Diagnosis Observation Schedule (ADOS)	Diagnosis and assessment of autism disorder	3
Autism Diagnostic Interview (ADI)	Autism diagnosis, treatment planning and differentiation of autism from other developmental disorders	2
Childhood Autism Rating Scale (CARS)	Identifying children with autism and determining severity of symptoms using quantitative assessment based on direct observation	2
Check List for Autism in Toddlers	ASD risk assessment in children aged 18-24 months	2
Autism Quotient (AQ)	Assessment expression of autism spectrum traits in person by their own subjective self-assessment	1
Autism Research Institute E-2 checklist (ARI-E-2 checklist)	Diagnosis in children with Kanner`s syndrome, also known as "classic autistic disorder"	1
Autism Treatment Evaluation Checklist (ATEC)	Diagnostic assessment of ASD	1

Table 9

Methods of comprehensive assessment

Methods	Description	Number of applying
Comprehensive assessment		**17**
Mullen Scales of Early Learning (MSEL)	Assessment of cognitive abilities and motor skills development	7
Pediatric Evaluation of Disability Inventory, Computer Adaptive Test (PEDI-CAT)	Test for caretakers to measure daily activity, mobility, social/cognitive abilities, and responsibility	2
The Ages and Stages Questionnaire, Second Edition (ASQ-2)	Assessment of skills in children aged 2-60 months in five developmental areas, including communication, fine motor skills, gross motor skills, problem solving, personal and social skills	2
Bayley Scales of Infant Development (BSID)	Assessment of 5 development indexes: cognitive, language, motor, socio-emotional and adaptive	1
Bayley Short Form Research Edition (BSFR)	Assessment of mental and motor abilities in children aged 9 months - 2 years	1
Pediatric Evaluation of Disability Inventory (PEDI)	Monitoring of self-care, mobility and social skills	1
Griffiths Mental Developmental Scales–Extended Revised (GMDS-ER)	Assessment of six development indexes: motor skills, personal-social, language, hand-eye coordination, productivity, practical thinking	1
Denver Developmental Screening Test (DDST)	Assessment of general motor skills, speech, fine motor skills, adaptive and personality-social features	1
Kyoto Scale of Psychological Development (KSPD)	Assessment of child's postural-motor, cognitive-adaptive and linguistic-social development	1

Discussion. The study presents first systematic study of modern and relevant examination methods and indicators most often used by researchers to assess the effectiveness of physical therapy and rehabilitation in children with autism within international practice.

The research methods extracted from 11 systematic reviews were classified for assessing motor development, mental functions, quality of life, participation in daily life, and comprehensive assessment.

The motor development assessment included a wide range of tests, scales and questionnaires that determined development of motor skills, physical qualities, balance, and vestibular function. Considering sensory impairments in children with ASD, the number of methods for assessing balance and vestibular function accounted for 46% of the motor development group. Among the questionnaires and observations of motor skills development, the most common were Bruininks-Oseretsky Test of Motor Proficiency (BOT), which assesses development of fine and gross motor skills in 4 areas of the motor sphere with 8 subtests, and Test of Gross Motor Development (TGMD), a criteria-based test that assesses 10-12 basic motor skills in children aged 3-10 years using three to five criteria for motor development performance [7;8]. Standardized motor tests (BOT [7;9], PDMS [10] and TGMD [8;11]) and all its subtests are often used to document changes in activity with motor intervention. Anneliese Ruggeri et al., 2019 [3] also recommend using GAS in

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addition to standardized motor assessments to document individual child's change because of any intervention, as it may be more sensitive to changes resulted by intervention than standardized motor assessments (McDougall & Wright, 2009).

However, many professionals find it difficult to choose assessment method to examine children with ASD, especially given the number of them available. Each motor assessment method has its own pros and cons. Practitioners and researchers should consider purpose of the assessment when selecting a testing method. If goal is to measure task performance over a certain period, a quantitative approach such as MABC-2 and BOT-2 is best. If the goal is to describe qualitative changes, the TGMD-2 method is preferable. If the goal is to evaluate both qualitative and quantitative measures, the choice often falls on PDMS-2 [12].

Unfortunately, all standardized motor tests reviewed in the studies are not available in Ukrainian and are not used in everyday practice by physical therapists of Ukraine. Given the wide range of methods for assessing motor development of children with ASD, it is difficult to identify a single or at least several basic assessment tools.

In the case of ASD, the main efforts of specialists providing medical and social rehabilitation to children are devoted to assessment and work with mental functions. Therefore, the lion's share of research methods for children with ASD in process of rehabilitation from the analyzed articles was devoted to the study of mental functions.

Among the most used assessment methods found is Diagnostic and Statistical Manual of Mental Disorders (DSM-IV [13] and DSM-V [14;15]), which allows to assess severity of autism spectrum disorders based on impaired social communication and limited, repetitive behavioral patterns. The second common assessment method of this group is Aberrant Behavior Checklist (ABC, ABC-C) [16], a symptom checklist for assessing problematic behavior in children and adults with developmental disabilities (intellectual disability, ASD, cerebral palsy, epilepsy).

The goal of physical therapy is to restore a person's ability to work and adapt them to perform all necessary life functions, thereby improving their quality of life. Therefore, assessing quality of life is one of key factors, allowing additional assessment of the value and effectiveness of rehabilitation. According to the analyzed studies, in 33.4% of cases, Pediatric Quality of Life Inventory (PedsQL) [17] was used to assess quality of life, as a general health method with 23 elements with forms for both parents and children that assesses five areas of health (physical functioning, emotional functioning, psychosocial functioning, social functioning, and school functioning) in children and adolescents aged 2 to 18 years.

The study conducted by Viecili MA, Weiss JA. [18] assessed the reliability and validity of PedsQL in individuals with intellectual and developmental disabilities, including individuals with autism spectrum disorders. The PedsQL demonstrates excellent reliability across all scales and distinguishes healthy individuals from those with chronic illnesses, as well as individuals with ASD from those without.

The study by Lal D V [19] assessed pediatric quality of life (PQOL) of children with ASD from a multidimensional perspective based on a cross-sectional survey that included physiological function, emotional function, social function, and school performance.

The assessment methods of the vital activity group aim to assess the child's participation in daily life. In study by Anneliese Ruggeri et al. 2019 [3], it is recommended to use participation outcome assessment that can be individualized according to the child's and family's goals, such as Canadian Occupational Performance Measure (Law et al., 2014) [20] or Goal Attainment Scale (McDougall & Wright, 2009) [21]. Both methods are individualized, criterion-referenced assessments that allow clinicians to identify a few specific tasks for a child with ASD and then define a range of specific outcomes for each task. These methods may be more sensitive to changes because of intervention than standardized motor activity assessments.

The methods of the comprehensive assessment group allow studying 5-6 areas of child development, such as fine and gross motor skills, cognitive, language, socio-emotional and adaptive. Yi Huey Lim et al. (2021) [22] describes that an important point in developing strategies for early identification of children at risk is selection of appropriate standardized motor assessment methods for children aged 0 to 24 months. In his systematic review, Mullen Scales of Early Learning (MSEL) [23] was used most often and accounted for 41.2% of all methods from comprehensive assessment group. It is an assessment that can be applied in children from birth to 68 months. Additional research on the psychometric properties of the MSEL is needed to determine its appropriateness as a tool for assessing motor function in children at risk aged 0 to 24 months.

Having regard to all six groups of evaluation criteria for the methods and indicators identified, the physical therapist has a wide range of assessment tools to provide high-quality therapy for children with ASD. But which of these methods are the most effective remains unexplored. International professionals often use sets of standardized assessment methods in their sets, but their repeatability in our study is low. Unfortunately, the absence of validated Ukrainian versions of most of these research methods complicates practice of physical therapy by Ukrainian specialists and prevents conducting of high-quality research in children with ASD.

Conclusions. There are many standardized methods for assessing the effectiveness of physical therapy and rehabilitation in children with ASD. The main groups of assessment tools for children with ASD include methods for examining mental functions, motor development, vital activity, quality of life, and comprehensive assessment tools. However, the focus is on the examination of mental functions and motor development without a single generally accepted approach to the assessment of children with ASD. The analyzed studies contain numbers of methods, but they have little repeatability of their applying within the studies, which indicates that the search for optimal methods and indicators goes on.

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ІНСТРУМЕНТИ ТА ІНДИКАТОРИ ОЦІНЮВАННЯ ЕФЕКТИВНОСТІ ФІЗИЧНОЇ ТЕРАПІЇ ДІТЕЙ З АУТИЗМОМ ДОШКІЛЬНОГО ВІКУ

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Резюме. У дітей з розладами аутистичного спектру (РАС) часто спостерігається затримка формування рухових навичок. Завдання фізичного терапевта полягає у тому, щоб допомогти дітям з РАС розвинути загальну моторику, основні рухові навички та покращити їхню якість життя. Програми втручання, зокрема фізичної терапії, мають переваги для дітей з РАС, але брак надійного діагностичного інструментарію ускладнює оцінювання дітей із РАС у контексті їх цілісного розвитку та забезпечення своєчасної терапії. Для того, щоб створити ефективну програму реабілітації, необхідно зрозуміти, якими інструментами оцінювання та індикаторами може користуватись фізичний терапевт та наскільки ці інструменти є ефективними та частими в застосуванні.

Мета: визначити, які інструменти обстеження та індикатори найчастіше застосовуються дослідниками для оцінювання ефективності фізичної терапії та реабілітації дітей з аутизмом.

Матеріали і методи. Здійснено пошук систематичних оглядів у бібліотеках Cochrane, PubMed та Pedro та відібрано 11 із них, в основі яких було 225 наукових досліджень.

Результати. Аналіз наукових досліджень, на основі яких було виконано 11 систематичних оглядів, забезпечив роботу із якісними даними та врахував застосування сучасних та актуальних інструментів оцінювання дітей з РАС. На основі використаних 286 інструментів обстеження та індикаторів ми сформували шість груп критеріїв оцінювання за такими основними напрямками, як: психічні функції, моторний розвиток, життєдіяльність, якість життя, оцінювання дітей з РАС та комплексне оцінювання.

Висновки. У нашому дослідженні обстеження дітей з РАС охоплювало декілька напрямків, які є важливими, оскільки надають можливість спеціалісту всесторонньо оцінити дитину. Проте через їх велику кількість постає проблема у виборі та використанні фізичним терапевтом саме тих інструментів, які будуть найбільш ефективними у використанні під час проведення фізичної терапії дітям з аутизмом дошкільного віку.

Ключові слова: фізична терапія, фізіотерапія, реабілітація, аутизм.

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