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Parental Perspectives on Motor Development in Preschool-Age Children with Autism Spectrum Disorder: A Qualitatively Led Mixed-Method Study

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Abstract

Background: Early childhood motor development plays a critical role in shaping participation and quality of life for children diagnosed with autism spectrum disorder. Parental perspectives provide unique insights into barriers, facilitators, and the real-world impact of interventions. *Objectives:* This study applied qualitatively led an exploratory mixed-method design grounded in a biopsychosocial paradigm. The qualitative component captured parental narratives, while quantitative summaries were generated to identify consensus areas of motor challenges and environmental influences. This dual approach aimed to reveal both the diversity of lived experience and recurring patterns that may inform screening and intervention planning. *Methods:* Semi-structured interviews were conducted with 58 parents of preschool-aged children diagnosed with autism spectrum disorder in Hungary. Transcripts were analysed thematically, and through descriptive frequency summaries and exploratory chi-squared analyses of coded data. *Results:* Parents consistently reported fine and gross motor differences, with consequences extending to participation in family, school, and community contexts. Early diagnosis was seen as beneficial primarily when it facilitated access to supportive services. Environmental adaptations, such as inclusive playgrounds and adaptive tools, were perceived by parents as enhancing children's opportunities to participate, while the lack of accommodations amplified difficulties. Interventions embedded in real-life contexts and actively involving families were viewed as most effective. Exploratory quantitative summaries indicated consensus on five key challenges, including pencil grip, small object manipulation, and playground participation. *Conclusions:* The findings demonstrate that motor development in autism spectrum disorder is best understood within a biopsychosocial framework linking individual abilities, environmental modifications, and social acceptance. By integrating qualitative and quantitative perspectives, this study illustrates how family experiences can inform the design of family-centred interventions and context-sensitive policies that foster meaningful participation.



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1. Introduction

Autism spectrum disorder is characterised by the early onset of atypicalities in social communication and the presence of restricted, repetitive patterns of behaviour. Globally, the prevalence of autism spectrum disorder has increased, leading to the identification of numerous children before they enter formal schooling [1]. In addition to these core diagnostic criteria, autism spectrum disorder is further linked to substantial variations in motor development. These motor differences necessitate analysis through multifaceted biopsychosocial frameworks [2–5].

Global prevalence estimates suggest that approximately 1 in 100 children worldwide are diagnosed with autism spectrum disorder, although rates vary considerably due to differences in screening, diagnostic criteria, and health system capacities [1]. In high-income countries, early identification systems typically involve coordinated paediatric screening, preschool-based surveillance, and multidisciplinary diagnostic teams, while in many middle-income contexts, pathways to diagnosis remain fragmented. These disparities are critical, as early recognition strongly predicts access to interventions that integrate motor, communication, and social goals [6–8]. However, diagnostic benefits are not universal: in some contexts, early detection improves developmental outcomes, while in others, it leads to labelling without adequate services. This variability highlights the importance of considering systemic differences in health care, early childhood education, and intervention infrastructures.

Empirical evidence indicates that children with autism spectrum disorder frequently present with both fine and gross motor challenges, including alterations in grasping, drawing, running, and balance. These motor differences do not represent mere isolated impairments but instead emerge from the dynamic interplay between neurological factors and the child's social and physical surroundings [9–14]. Specifically, fine motor difficulties—such as the handling of small objects and pre-writing abilities—may restrict engagement in different settings and hinder the acquisition of self-care skills [15–17]. Gross motor limitations, including running and jumping, restrict access to active play and contribute to social exclusion [18–20]. Perceptual-motor difficulties (e.g., hand–eye coordination) reduce accuracy and efficiency in object manipulation [21–23], while sensory-motor regulation problems alter movement planning and endurance [24]. These motor differences co-occur with communication and social difficulties [25,26], compounding participation barriers across home, school, and community settings. International evidence suggests that motor difficulties occur in the majority of children with autism spectrum disorder, but the findings are not uniform: some studies describe motor differences as near-universal, while others report that only specific subgroups show clinically significant impairments [27]. Debate persists regarding whether motor differences constitute a core feature of autism spectrum disorder or characterise only specific subgroups. Even when not all children present with pronounced motor differences, subtle variations can still affect quality of life and participation.

Motor differences in autism spectrum disorder are best understood through ecological and biopsychosocial perspectives that interpret functioning in relation to environmental demands and supports. The International Classification of Functioning, Disability and Health (ICF) is a World Health Organisation framework that classifies health and disability across body functions, activities, participation, and environmental factors [1]. This frame-

work positions motor challenges as outcomes of interactions among these domains [1–4]. Evidence from paediatric rehabilitation also supports applying this model to children with autism spectrum disorder [2–4].

Motor differences can reduce quality of life [28], affect learning [29], and constrain opportunities for self-care, peer play, and mobility [30–32]. These difficulties are amplified in environments lacking adaptive play equipment, structured opportunities for guided practice, or adequate professional support [7,33]. Coordination and spatial orientation challenges particularly limit safe mobility in school and community environments [27]. Motor-focused interventions such as physiotherapy, movement therapy, sensory integration, and adapted physical education have been shown to support skill acquisition [34–36]. A systematic review [34] shows that movement therapy and sensory integration approaches are most effective when embedded in inclusive, context-sensitive environments that promote skill generalisation. Their effectiveness depends on more than therapeutic content; successful programs address environmental barriers, engage families as partners, and promote children’s participation in meaningful everyday activities [14,16].

Parent perspectives have long been valued in documenting developmental trajectories [37–39]. Contemporary research situates families within ecological and systems frameworks, showing how resources, service structures, and community attitudes shape children’s opportunities [40–44]. Parents are often the first to notice developmental concerns across motor, social, and communication domains, initiating referrals [45–48]. Yet, without sufficient support, stress may undermine intervention implementation [49]. Conversely, parent training and targeted supports improve parent competence and children’s motor and communication outcomes [50]. An emerging line of research compares parent-reported outcomes with clinician-administered assessments, with divergences pointing to the complementary value of integrating both perspectives. Families serve both as co-therapists and as co-designers of environmental modifications and daily routines that facilitate participation. Intervention programs that emphasise parental engagement in planning and goal-setting enhance both the feasibility and efficacy of outcomes [35,50]. Parental insights are essential for intervention evaluation, given that parents observe children across diverse settings and are thus uniquely positioned to identify shifts in skills, as well as contextual influences [45,51,52].

The Hungarian context offers a distinctive case for examining these issues. While international research on motor development in autism spectrum disorder has expanded rapidly, few large-scale or nationally representative studies have examined parental perspectives in Central and Eastern Europe. Hungary operates a nationwide system of special pedagogical services (Unified Special Education Methodology Centres), yet regional access to early intervention remains uneven: urban areas typically offer shorter waiting times and more specialised professionals, whereas rural regions face limited availability of diagnostic and therapeutic services. This variation provides an opportunity to explore how structural and environmental factors shape family experiences. Identifying these patterns can not only address a national knowledge gap but also contribute to comparative insights across countries with differing diagnostic and intervention infrastructures.

Gap and aims: While medical and clinical studies on autism spectrum disorder motor development are abundant [2,3], research explicitly centring parental perspectives within a biopsychosocial framework remains limited. This study addresses that gap by foregrounding not only individual motor differences but also the environmental, social, and family-level factors shaping development and participation. The present study examines parental experiences of motor development in preschool-age children diagnosed with autism spectrum disorder before age 3, focusing on how children’s abilities, family resources, and environmental supports or barriers interact to shape motor skill develop-

ment and participation. Applying the biopsychosocial model provides a comprehensive framework for understanding how biological, psychological, and social factors converge to influence outcomes [5]. Given the limited prior research on parental perspectives in this context, this study was exploratory rather than hypothesis-testing. Specifically, we aimed to: (1) describe diagnostic circumstances for preschool autism spectrum disorder; (2) characterise fine and gross motor differences as reported by parents; (3) examine environmental and social influences on these experiences; (4) identify the types and perceived effectiveness of motor development sessions; and (5) document parents' advice for other families navigating similar challenges. The findings indicate that parents perceived motor development as shaped by environmental accessibility and professional support, with early diagnosis viewed as beneficial primarily when linked to timely services; these results underscore the value of family-centred, context-sensitive approaches to intervention.

2. Materials and Methods

2.1. Study Design and Analytic Paradigm

This study used a qualitatively led mixed-method design with an embedded quantitative pattern analysis. The analytic stance was pragmatic and interpretivist: we prioritised parents' lived accounts of motor development and participation, and then quantised the final codebook to summarise how widely specific challenges were reported across interviews. This QUAL (Qualitative) → quan (Quantitative) approach allowed us to (i) develop themes from semi-structured interviews, and (ii) identify consensus areas that may be useful for screening and intervention planning. Quantising was limited to descriptive frequencies and exploratory chi-squared summaries; these are presented as heuristic indicators of pattern breadth rather than confirmatory statistical evidence. Given that coded qualitative data does not meet standard assumptions for inferential testing (e.g., independence of observations, predefined sampling for statistical power), chi-squared results should be interpreted cautiously as descriptive pattern illustrations rather than formal hypothesis tests.

This investigation aimed to assess variations in fine and gross motor functions among preschool-age children with autism spectrum disorder while simultaneously elucidating the environmental, social, and familial determinants of motor development. This study was theoretically anchored in the biopsychosocial model [2–4], positing that motor development arises from the interplay between individual capacities, family resources, and wider environmental contexts. To implement this framework, the International Classification of Functioning, Disability, and Health (ICF) was adopted, guiding data collection and analysis through its domains of body functions/structures, activities, participation, and environmental/personal factors [1].

Based on these objectives, five guiding research questions were formulated:

1. What motor function areas do parents identify as challenging, and how do environmental and social factors influence these challenges?
2. What motor, social, and cognitive areas show interconnected patterns of development?
3. What parental observations and experiences relate to motor differences during the diagnostic process, and how did early identification of motor concerns affect access to support and services?
4. What types of motor development interventions did preschool-age children with autism spectrum disorder participate in, and how did these address both individual needs and environmental factors?
5. How do family resources, community support, and environmental barriers influence motor development outcomes?

2.2. Participants and Sampling Strategy

The age range of 3–6 years was selected to focus on the preschool developmental period, defined as the stage before compulsory school entry, during which motor participation demands and intervention contexts are relatively homogeneous. Additionally, the recruiting organisation provides access to families of children from age 3 onward, which determines the lower bound of the sample. A purposive sampling approach was combined with geographical stratification to ensure balanced representation across Hungary, thereby strengthening the transferability of findings.

Inclusion criteria: (a) parents of children diagnosed with autism spectrum disorder by an expert committee before age 3; (b) children currently aged 3–6 years; (c) participation in motor development programs for at least 6 months; (d) availability of official documentation confirming diagnosis and program participation; (e) parental willingness to complete 45–80 min interviews.

Exclusion criteria: (a) children diagnosed after age 3; (b) children outside the 3–6 age range; (c) participation in motor development programs shorter than 6 months; (d) lack of official diagnostic documentation.

Autism spectrum disorder diagnoses were established through multidisciplinary expert and rehabilitation committees within the Hungarian public health and educational systems. These committees typically include a child psychiatrist or neurologist, a clinical psychologist, and a special education teacher, who jointly evaluates the child’s developmental profile. Diagnostic decisions are based on integrated clinical assessment, developmental history, and standardised instruments when indicated (e.g., Autism Diagnostic Observation Schedule, Autism Diagnostic Interview–Revised), and follow internationally recognised diagnostic frameworks (DSM-5 and ICD-10/ICD-11). Official diagnostic documentation issued by these committees was required and verified for inclusion in this study.

Recruitment: Families were recruited through the National Association for the Protection of the Interests of People with Intellectual Disabilities and Their Helpers (Hungarian: Értelmi Fogyatékosággal Élők és Segítőik Országos Érdekvédelmi Szövetsége, ÉFOÉSZ). County coordinators contacted parents via email and telephone. A total of 58 families agreed to participate out of 80 invited (response rate = 72.5%).

Sample size determination: Qualitative adequacy was justified using saturation principles [53], with two independent researchers confirming the absence of new themes across three consecutive interviews. For the quantitative component, we note that while a priori calculations suggested 50–60 participants would detect medium effects, such power considerations are secondary in a qualitatively led design; the sample size was primarily determined by saturation and practical constraints of eligibility (diagnosis before age 3) rather than statistical power requirements. Geographical representation included all 19 counties and Budapest (Figure 1), with proportional distribution ensuring both rural and urban diversity (Table 1).

Table 1. Distribution by county.

County/Region	Participants	Percentage
Baranya	3	5.17%
Bács-Kiskun	3	5.17%
Békés	3	5.17%
Borsod-Abaúj-Zemplén	3	5.17%
Csongrád-Csanád	3	5.17%
Fejér	3	5.17%
Győr-Moson-Sopron	3	5.17%

Table 1. Cont.

County/Region	Participants	Percentage
Hajdú-Bihar	3	5.17%
Heves	3	5.17%
Jász-Nagykun-Szolnok	3	5.17%
Komárom-Esztergom	3	5.17%
Pest	3	5.17%
Somogy	3	5.17%
Szabolcs-Szatmár-Bereg	3	5.17%
Vas	3	5.17%
Veszprém	3	5.17%
Zala	3	5.17%
Budapest	3	5.17%
Nógrád	2	3.45%
Tolna	2	3.45%
Total	58	100%

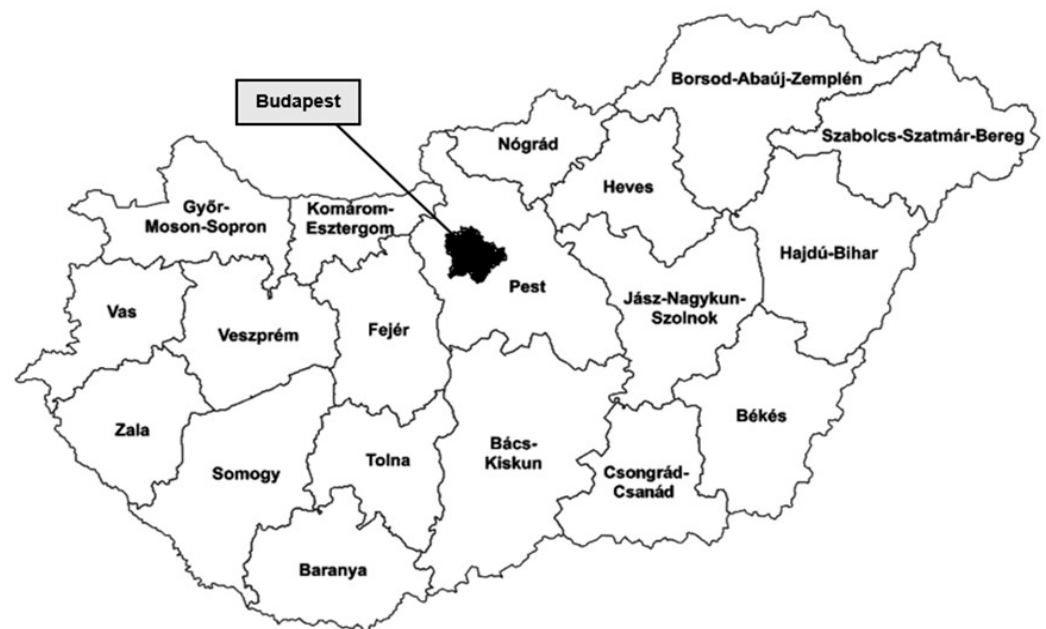


Figure 1. Geographical distribution of the sample.

Sample characteristics: Mothers averaged 32.42 years (SD = 4.56), and fathers averaged 36.19 years (SD = 4.32). The per capita household income averaged EUR 523 (SD = 82.76). Children were on average 5.06 years old (SD = 1.33) at participation, with a mean age at diagnosis of 27.3 months (SD = 3.11). Table 2 shows other characteristics of the sample.

Table 2. Distribution of parents' sociodemographic data.

Demographics	Category	Distribution Percentages (Frequency)
Residence	Village	27.58% (16)
	City	37.93% (22)
	County seat	34.48% (20)
Number of Children	1	56.89% (33)
	2	32.75% (19)
	3	8.62% (5)
	4	1.72% (1)

Table 2. Cont.

Demographics	Category	Distribution Percentages (Frequency)
Mother's education	Elementary school	12.06% (7)
	Vocational school	22.41% (13)
	High school	44.82% (26)
	University	20.68% (12)
Father's education	Elementary school	8.62% (5)
	Vocational school	34.48% (20)
	High school	44.82% (26)
	University	12.06% (7)
Single parent	Yes	31.03% (18)
	No	68.89% (40)
Net monthly income per capita	Less than EUR 405	18.96% (11)
	EUR 405–540	50.00% (29)
	EUR 541–675	13.79% (8)
	EUR 676–810	10.34% (6)
	More than EUR 810	6.89% (4)

2.3. Data Collection

The interview guide was developed through a literature review and the biopsychosocial framework, refined through expert consultation with three specialists in autism and family studies, and iteratively adjusted during research team meetings. Semi-structured interviews were chosen to balance comparability across participants with flexibility for parents to elaborate on their experiences [54,55]. All interviews were conducted by two doctoral-level researchers trained in qualitative interviewing, using a standardised protocol. Five pilot interviews were conducted to refine question clarity and sequencing [56,57].

Interviews were conducted in person, by telephone, or via online video conferencing, with a duration ranging from 45 to 80 min. Thematic areas covered: child background and diagnostic process; current motor development activities and challenges; preferred movement forms; impact of motor development on communication and social relationships; supports in family and home contexts; individually planned interventions; parental goals; environmental barriers and facilitators affecting motor participation; and community resources shaping family experiences.

2.4. Data Analysis

We employed thematic content analysis following established guidance for qualitative health and disability research [56,57]. The coding process involved: (a) verbatim transcription; (b) independent coding by two researchers; (c) codebook refinement through consensus meetings; (d) preliminary theme development; (e) iterative theme refinement; and (f) validation against original transcripts. Each coding decision was documented in an audit trail; regular peer debriefings were held to challenge interpretations, and member checking was conducted by presenting selected findings to participants [58]. Nvivo 15 software was used for systematic coding and theme management [59].

Quantitative pattern analysis: Alongside thematic development, we applied descriptive statistics (counts, proportions) to characterise variability across families, complementing rather than replacing qualitative interpretations [60]. Exploratory chi-squared tests were used to identify patterns warranting further attention; however, given that coded qualitative units do not represent independent observations in the statistical sense, these tests function as heuristic summaries rather than formal inferential procedures. From the

coded dataset, three interview-level indicators were derived: presence of at least one fine motor unit, at least one gross motor unit, and both. The final results report the proportion of interviews with ≥ 1 fine motor unit, ≥ 1 gross motor unit, and both.

2.5. Ethical Considerations

This study was approved by the University of Debrecen Research Ethics Committee of the Faculty of Economics and Business (GTK-KB 007/2024). Parents gave informed consent after receiving written and verbal information detailing the purpose, procedures, voluntary participation, and data handling. Withdrawal without justification was possible at any time. Interview data was anonymised and stored in coded form on password-protected systems accessible only to the research team. No data was shared with third parties; all materials will be destroyed after project completion.

3. Results

During this research, 58 parents raising preschool-aged children with autism spectrum disorder consented and participated in the interviews. The following results, based on in-depth interviews, identified motor differences, the advantages of early diagnosis specifically in relation to motor development outcomes, environmental and social factors influencing development, and the perceived effectiveness of motor development sessions within biopsychosocial contexts.

Summary of research questions and responses: the questions asked during this research and responses given are shown in Table 3.

Table 3. Motor development experiences based on parental perspectives., e.g., “Significance of early recognition = 48” means that 48 parents mentioned this topic from the sample (n = 58).

Research Focus	Response Category	Number of Respondents (n = 58)
1. Early diagnosis process and environmental context	Significance of early recognition	48
	Length and difficulties of the diagnostic process	28
	Observation of characteristic symptoms	45
	Positive experiences with professional cooperation	39
	Access to services and supports	52
2. Motor function differences and environmental influences	Fine motor difficulties affecting daily participation	42
	Gross motor problems impacting social activities	41
	Environmental barriers to motor development	35
	Adaptive strategies and environmental modifications	31
3. Early diagnosis advantages within support systems	Possibility of starting early development	47
	Mental preparation and family support	37
	Better access to therapeutic and educational programs	43
	Development of effective intervention strategies	21
4. Development interventions and environmental contexts	Choice of physiotherapy and motor development sessions	52
	Community-based programs and accessibility	38
	Family involvement in intervention programs	46
	Environmental modifications supporting development	29
5. Interconnected development across domains	Significant development in fine motor skills	46
	Progress in gross motor skills and balance	41
	Improvement in social skills and communication	41
	Environmental factors supporting holistic development	33

Table 3. Cont.

Research Focus	Response Category	Number of Respondents (n = 58)
6. Family experiences and community recommendations	Recommendations and advice for other parents	44
	Positive experiences with specific professionals	29
	Usefulness of parental community and support groups	36
	Advocacy for environmental and policy changes	22

3.1. Early Recognition and Diagnosis Within Family and Community Contexts

Parents noted that early recognition of developmental differences was critical for initiating timely intervention. A large majority (82.7%) perceived early diagnosis as associated with improved motor and social development, while 81% reported that it provided better access to development sessions tailored to their child's needs. Families described the diagnostic process not only as a medical step but also as a turning point that shaped subsequent opportunities for support.

Parents often contrasted experiences across different service settings. Families in urban areas described faster referral pathways and more specialised expertise, whereas those in rural regions highlighted long waiting times and limited professional availability. Two recurring themes were evident. First, the timing of diagnosis was decisive. Parents who obtained an early diagnosis described entering therapies during sensitive developmental periods, which they perceived as enhancing their children's progress. Second, the availability of professional and environmental supports strongly influenced how the diagnosis was experienced. Families encountering engaged paediatricians, therapists, or educators reported smoother transitions into intervention, while those facing fragmented services described the process as confusing and discouraging.

Parents also discussed the emotional significance of early recognition. For some, the diagnosis provided relief by validating long-held concerns and legitimising their advocacy within educational and healthcare systems. For others, however, the label intensified stress, particularly when immediate services were unavailable or when stigma from relatives or community members followed the diagnostic disclosure. This duality suggests that diagnosis functioned simultaneously as a gateway to potential resources and a source of new challenges.

As one parent explained, receiving the diagnosis "gave us direction and helped us select therapies. . . the most important factor was finding professionals who understood both our child's needs and our family situation."

(Participant 1)

3.2. Motor Function Challenges Within Environmental and Social Contexts

Seventy-two percent of parents reported fine motor differences, while an equal proportion highlighted gross motor difficulties. Parents noted that these difficulties were more evident in structured environments such as schools, where tasks like handwriting, tool use, or playground games demanded precision and coordination. In contrast, the same children often performed better at home or in supportive community programs, illustrating how context influenced the expression of motor abilities.

These were rarely described as isolated impairments; rather, they were framed as barriers to everyday participation when environmental supports were insufficient. Fine motor difficulties included problems with pencil grip, drawing, buttoning clothes, and manipulating small objects. Gross motor challenges often involved delayed walking

development, difficulties with running and jumping, balance issues, and reduced stamina during physical play. Parents frequently linked gross motor difficulties with broader participation restrictions, noting that when children tired quickly or could not keep up physically, they were more likely to withdraw from group activities.

Parents' accounts reflected how these difficulties limited both functional independence and social opportunities. Several described their child's frustration at being unable to keep up with peers during play, which discouraged participation and affected confidence. Parents observed that repeated experiences of exclusion sometimes reduced children's willingness to attempt motor tasks, leading to a cycle of avoidance. At the same time, many families noted that environmental adaptations transformed their children's experiences. Adaptive tools, modified group tasks, and supportive playgrounds often made the difference between exclusion and participation. Parents described how small adjustments, such as thicker pencils, modified scissors, or safe climbing structures enabled children to engage more fully. Community-based programs welcoming children with different abilities were highlighted as particularly valuable.

As one parent reflected, "Fine motor development was slow. . . but with adaptive tools and workspace modifications, he demonstrated much greater capability. The environment makes such a difference in what children can do."

(Participant 3)

3.3. Environmental Barriers and Facilitators

Parents described environmental conditions as decisive factors in shaping their children's motor development. Sixty percent identified barriers, most frequently citing inaccessible playgrounds, lack of safe community spaces, and limited adaptation in schools. Some parents contrasted rural and urban experiences: rural families often had outdoor space at home but lacked access to inclusive playgrounds or professional support, whereas urban families described services being available but public spaces being crowded and sometimes unwelcoming. Parents highlighted that social barriers were sometimes more discouraging than physical ones—a socially unsupportive environment made participation feel impossible even when equipment was available.

Half of the families reported encountering effective facilitators, including adaptive tools at home or in school, specialised equipment, and supportive teachers or therapists who adapted tasks to children's needs. Parents stressed that even small modifications—adjusted seating, adapted writing tools, or restructured play activities—could have a disproportionately positive impact. Families noted that such modifications also reduced their own stress as caregivers.

Two core dynamics emerged. First, exclusionary environments amplified motor challenges; when playgrounds lacked safe equipment or groups failed to provide adaptations, children were unable to practice essential skills. Second, when professionals collaborated with families to adapt environments, parents perceived that children's functional performance improved. Several parents described positive ripple effects: once children experienced success in one adapted environment, their confidence to try new activities grew.

As one parent explained, "The biggest challenge wasn't just his motor difficulties, but finding places where he could practice safely and with understanding. Many playgrounds aren't designed for children who move differently."

(Participant 18)

3.4. Effective Interventions Within Biopsychosocial Frameworks

Parents highlighted that interventions were most effective when embedded in real-life contexts and when families were active partners. Nearly 90% of families reported participation in physiotherapy or motor development sessions, and 79.3% indicated direct involvement in planning and implementation. Parents described this involvement as active collaboration with therapists in setting goals, practising skills at home, and adapting family routines. Some parents stressed that this collaborative approach reduced feelings of helplessness, contrasting it with experiences where professionals excluded them from planning.

Families consistently pointed out that interventions carried out in isolation often failed to produce lasting improvements. In contrast, context-sensitive approaches linking therapy to everyday environments were viewed as more successful. One recurring theme was generalisation: children could sometimes master a task in therapy rooms but fail to use the same skill in everyday situations. Interventions that bridged this gap—by embedding practice into shopping trips, playground games, or mealtime routines—were consistently seen as more meaningful. Parents valued programs situated in natural settings because they allowed children to practice motor skills in situations that mirrored real-life participation.

Several parents explained that successful interventions extended beyond the child, equipping family members with strategies to reinforce learning. When therapists included families as partners, parents felt empowered to create opportunities for motor practice in daily routines. Several families highlighted the role of siblings, who often became informal co-therapists.

As one parent summarised, “Motor development sessions really helped, but what made them work was that therapists included our family and showed us how to support development at home and in the community.”

(Participant 5)

For practitioners, these findings suggest that intervention effectiveness may be enhanced by: (a) embedding motor practice in naturalistic, socially meaningful contexts; (b) actively involving families in goal-setting and home-based reinforcement; and (c) facilitating peer interaction during therapy sessions.

3.5. Interconnected Development and Participation

Parents emphasised that motor development was rarely experienced in isolation but was closely intertwined with social, cognitive, and emotional domains. Seventy-one percent of respondents reported that improvements in motor skills coincided with visible gains in confidence, peer play, and group participation. These accounts suggested that progress in one developmental area often acted as a catalyst for growth in others.

Two themes became clear. First, motor skill improvements were strongly linked to enhanced opportunities for peer interaction. Parents described how the ability to climb stairs, join in games, or handle group materials created gateways for social inclusion. Second, families noted that the most transformative interventions integrated multiple domains simultaneously motor sessions in group settings provided practice not only in physical tasks but also in turn-taking, communication, and managing frustration.

As one parent explained, “As his motor skills improved, we noticed changes in his confidence and social participation. But it wasn’t just the motor skills—it was also having environments where he could succeed and other children who accepted differences.”

(Participant 24)

Not all families reported such positive spillover. A minority noted that motor progress did not automatically translate into smoother peer relationships, especially in environments

where groupmates lacked awareness or educators were unable to scaffold inclusion. This underscores that developmental interconnections are highly context-dependent.

3.6. Family Experiences and Community Recommendations

Parents described a wide spectrum of experiences with peer communities, professional relationships, and advocacy efforts. Most parents (76%) reported that they had offered advice to other families, sharing practical strategies or information about beneficial programs. These peer-to-peer exchanges reflected a sense of empowerment, as parents positioned themselves as active knowledge-bearers contributing to informal systems of support.

Evaluations of parental support groups were divided. While 62% found them useful, emphasising their role in providing understanding and belonging, the remaining parents expressed reservations, feeling that such groups could be overwhelming. This divergence suggests that the utility of parent networks depends on group structure, facilitation style, and individual family needs.

Professional experiences were equally mixed. Roughly half described positive collaboration with therapists, pedagogues and healthcare providers, highlighting empathy and consistent communication. Others reported negative encounters, including a lack of sensitivity or dismissive attitudes. This variability indicates that service quality reflects not only individual professional skill but also institutional culture and resource availability.

Advocacy activities were reported least frequently (38%). Many parents explained that limited time or competing family responsibilities prevented broader involvement, though some expressed interest in contributing more actively with clearer guidance.

As one mother reflected, *“The support group helped me understand that I’m not alone. Finally, someone truly understands what we’re going through.”*

(Participant 21)

3.7. Quantitative Patterns Within Qualitative Themes

Quantitative summaries complemented thematic findings by clarifying the scope of reported challenges; these are presented as heuristic indicators of pattern breadth rather than confirmatory statistical evidence. Table 4 shows that while only 12.1% of interviews contained exclusively fine or gross motor examples, 60.3% included both, indicating that parents typically described motor development in terms of overlapping domains.

Table 4. Frequencies of examples of fine motor, gross motor, and their co-occurrences in the interviews (n = 58).

Frequencies	Fine Motor Examples	Gross Motor Examples	Co-Occurrences of Fine and Gross Motor Examples
Absolute	7	7	35
Relative (%)	12.07	12.07	60.34

Table 5 highlights five specific motor and environmental challenges that were reported by a majority of parents: pencil grip and writing preparation, small object manipulation, running and jumping coordination, playground participation, and peer play participation. The chi-squared values are presented as exploratory pattern indicators only. Because coded qualitative units do not meet standard assumptions for inferential testing, they should be interpreted as descriptive summaries highlighting areas of relative consensus rather than as evidence of statistical significance.

Table 5. Motor function challenges and environmental influences.

Areas of Challenge	Specific Issues Identified	Parents Reporting	χ^2 (<i>df</i> = 1)	Environmental Factors
Fine motor skills	Pencil grip and writing preparation	42 (72%)	9.931 *	Adaptive tools availability
	Small object manipulation	39 (67%)	6.897 *	Workspace modifications
	Daily living activities	35 (60%)	2.483	Family support strategies
Gross motor skills	Running and jumping coordination	42 (72%)	9.931 *	Safe practice spaces
	Balance and stability	32 (55%)	0.621	Adaptive equipment access
	Playground participation	38 (66%)	5.586 *	Inclusive community programs
Social motor skills	Peer play participation	38 (66%)	5.586 *	Understanding environments
	Group activity coordination	29 (50%)	0.000	Professional support
Environmental barriers	Physical space limitations	35 (60%)	2.483	Community accessibility
	Social acceptance challenges	28 (48%)	0.069	Awareness and training
	Service access difficulties	31 (53%)	0.276	Policy and funding issues

Note: χ^2 values are reported as descriptive pattern indices only. Asterisks (*) mark comparatively larger χ^2 values within this table to aid readability and should not be interpreted as statistical significance. * $p < 0.05$.

These findings indicate areas of parental consensus on certain fine, gross, and social motor challenges while showing variability in others. Such variability suggests that environmental conditions and individual differences strongly shape developmental trajectories. The exploratory summaries suggest which challenges were most commonly reported across families, offering a descriptive overview that may help practitioners prioritise assessment targets (e.g., pencil grip, running/jumping coordination, playground and peer play participation) and anticipate environmental barriers when conducting intake or goal-setting.

4. Discussion

This study explored parental perspectives on the motor development of preschool-age children with autism spectrum disorder, applying a biopsychosocial lens to highlight the interaction of individual abilities, family resources, and environmental contexts. The findings indicate that motor development cannot be understood as isolated deficits but is deeply embedded in social and environmental systems.

Early diagnosis within supportive systems: Parents consistently valued early recognition, but their accounts revealed both advantages and limitations. Early diagnosis enabled access to targeted developmental programs and reduced uncertainty, echoing prior findings that early identification facilitates intervention [15,28,30,61]. However, diagnosis alone was not sufficient: families stressed that the benefits depended on timely access to supportive services and informed professionals. This duality highlights a gap often underemphasised in the literature—while early detection is widely promoted, its impact is constrained in contexts where service systems are under-resourced or fragmented [62]. Some parents also described the diagnosis itself as stressful, leading to feelings of guilt or stigma. Thus, while early diagnosis is critical, its effectiveness is highly contingent on the quality, accessibility, and responsiveness of surrounding systems.

Motor development in environmental contexts: Parents highlighted differences in both fine and gross motor skills, particularly pencil grip, object manipulation, and balance. However, these challenges were rarely described as intrinsic limitations alone; rather, they were shaped by environmental affordances. Adaptive equipment, safe play spaces, and community inclusion often determined whether difficulties became barriers or manageable differences. This extends international findings on motor differences in autism spectrum disorder [63–67] by demonstrating how parents perceived that environmental modifications can mitigate these difficulties in daily participation. Parents also noted variability in

professional expertise, echoing concerns in the literature about inconsistent training in environmental adaptation [27,62]. Some educators successfully adjusted group routines, seating, and activity structures, whereas others lacked the resources or knowledge to do so. This contrast illustrates both the promise and the systemic constraints of professional practice.

Biopsychosocial interactions in participation: Consistent with prior studies [9,13,26,33,36,50,52,68], parents reported that improvements in motor function coincided with gains in confidence, peer interactions, and school participation. These accounts reinforce the theoretical utility of the ICF framework in capturing cross-domain effects of motor development. Our findings add nuance by illustrating how family practices (e.g., adapting household routines) and community attitudes (e.g., acceptance by peers) were perceived by parents as mediators of participation.

Effective interventions within comprehensive frameworks: Parents described physiotherapy, sensory integration, music therapy, and animal-assisted interventions as most successful when implemented in ecologically valid settings and in collaboration with families. These findings support international evidence on multidisciplinary, context-sensitive interventions [69–71], and highlight parents' preference for naturalistic approaches over isolated skill training. The implication is that effective intervention is not defined solely by modality but by how well it integrates individual, family, and community dimensions of the child's life.

Family experiences and community support: Parental narratives underscored the importance of peer support and professional relationships. Support groups were valued by some as sources of solidarity and practical advice, while others perceived them as stressful or irrelevant, echoing prior findings of variable utility of parental networks [35,45,51]. Professional experiences ranged from highly supportive to alienating, confirming that the quality of relational engagement remains as important as technical expertise.

Environmental and policy implications: Parents' recommendations for physical accessibility, inclusive programs, professional training, and systemic policy changes align with ecological models of disability that locate barriers not within the child but in the environment [30,36]. The descriptive summaries in Table 4 illustrate areas of parental consensus around five commonly reported challenges—pencil grip, small object manipulation, running and jumping, playground participation, and peer play—that may serve as practical reference points for screening and intervention planning.

Methodological reflection: The qualitatively led mixed-method design of this study illuminates parental experiences by combining thematic depth with quantitative pattern summaries. The qualitative component captured the complexity, context dependence, and emotional dimensions of families' accounts, while quantifying provided a transparent overview of how widely specific challenges were reported. This dual approach does not aim at generalisation through statistical inference but enhances transparency by showing the breadth of reporting across families. In doing so, it demonstrates how qualitative richness and quantitative description can complement one another in identifying both shared and divergent experiences—an approach particularly suited to exploratory research on understudied populations where hypothesis-testing designs would be premature.

5. Strengths and Limitations

This study presents several notable strengths. First, it is grounded in a national sample that reflects geographical diversity across Hungary, a context where research on motor development in autism spectrum disorder remains limited. Second, the sample size ($n = 58$) is relatively large for a qualitative study, providing a rich pool of parental perspectives while still allowing for in-depth thematic analysis. Third, the integration of qualitative and quantitative elements enhances methodological triangulation: thematic

interpretation captures the complexity of parental narratives, while exploratory frequency analyses provide a measure of consistency across families' reports. Fourth, by situating the findings within the International Classification of Functioning, Disability and Health (ICF) framework, this study links parental experiences to an established biopsychosocial model, thereby strengthening both conceptual coherence and international relevance.

Several limitations should also be acknowledged. This study relies exclusively on parental self-report data, which introduces potential recall and interpretation biases, particularly with respect to early diagnostic experiences. Importantly, all claims about developmental changes, intervention effects, and environmental influences reflect parental perceptions rather than independently verified outcomes; the design does not permit causal conclusions. The non-probability, purposive sampling design limits the generalisability of findings beyond the Hungarian context, and cultural specificity may shape how families interpret and respond to both motor challenges and available supports. Additionally, recruitment through a single parent organisation (ÉFOÉSZ) may have introduced selection bias, as families connected to advocacy networks may differ systematically from those without such affiliations; this limits the extent to which broader policy or system-level conclusions can be drawn. The cross-sectional nature of this study precludes conclusions about developmental trajectories or the long-term effects of interventions. Finally, although the integration of qualitative and quantitative elements increased depth, the statistical analyses were descriptive and exploratory rather than inferential, and should not be interpreted as confirmatory evidence.

These limitations point to future research needs. Longitudinal designs are required to trace how early diagnosis, environmental modifications, and family involvement influence participation outcomes over time. Comparative studies across countries could clarify which findings are culturally specific and which generalise more broadly. Pragmatic trials should test environmental and community-based interventions with outcomes extending beyond motor skills to include caregiver well-being and quality of life.

6. Conclusions

This study demonstrates that motor development in children with autism spectrum disorder is best understood within a biopsychosocial framework that recognises the interdependence of children's abilities, family resources, and environmental supports. Parents emphasised that early diagnosis was most beneficial when it served as an entry point to coordinated services, rather than a label without adequate follow-up.

Parents perceived interventions as most effective when they actively involved families as partners, were embedded in naturalistic environments, and prioritised participation goals beyond isolated motor tasks. These findings highlight key implications for policy and practice. First, therapist and educator training should prioritise environmental modification skills and strategies for family partnership. Second, inclusive community design—including accessible playgrounds, adapted educational settings, and supportive peer environments—emerges as critical to participation. Third, parental involvement should be recognised not merely as supplemental but as a central resource, with programs designed to equip families to co-create enabling environments.

Taken together, these implications suggest that successful intervention extends beyond therapy rooms: it requires systemic investments in professional development, inclusive community infrastructures, and sustained family partnerships to ensure that children with autism spectrum disorder can participate fully and meaningfully in everyday life.

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Disability Language/Terminology Positionality Statement: The authorship team comprises researchers in educational sciences and developmental studies with ongoing interests in family-centred approaches to understanding childhood disability and participation. This study is explicitly grounded in the International Classification of Functioning, Disability and Health (ICF) framework, which conceptualises disability as an outcome of interactions between individual characteristics and environmental factors rather than as a fixed individual deficit. Accordingly, we employ terminology that reflects this biopsychosocial orientation: we refer to “motor differences,” “motor challenges,” and “developmental delays” rather than exclusively deficit-based language, and we consistently frame motor difficulties in relation to environmental demands and supports. We use “children with autism spectrum disorder” (person-first language) throughout the manuscript, acknowledging that language preferences vary within the autism community. Our methodological approach centres parental perspectives as primary knowledge sources, recognising parents as experts on their children’s lived experiences and as active partners in intervention rather than passive recipients of professional guidance. We acknowledge the voluntary contributions of the 58 participating families and express respect for the diversity of their experiences, resources, and circumstances across different regions of Hungary. Throughout data collection and analysis, we endeavoured to treat all participants with dignity, equality, and autonomy, obtaining informed consent and safeguarding confidentiality. These commitments shaped how we conducted our interviews, interpreted our findings, and framed our conclusions regarding motor development and participation.

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