

Research article

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Typological Variants of the Development of Children Born After Assisted Reproduction, and Their Family Environment Characteristics

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Abstract

Introduction. Due to the increased number of children born as a result of assisted reproductive technology (ART), there are contradictory data on their health and development. This underlines the need to identify the developmental trajectories of these children and the system of factors that contribute to them, specific for each developmental stage. **Aim:** To identify the variants of physical and psychological development of children born after ART, as well as the characteristics of their family environment during the early preschool age. **Methods.** The participants were 220 families (mothers, fathers and 4-year-old children): 80 families with induced conception (ART), 130 families with natural (spontaneous) conception (NC). Methods were based on the questionnaires used in TEDS and QLSCD, translated into Russian: Parent-Administered and Parent-Reported PARCA; short version of the MacArthur Communicative Development Inventory; assessment of preschool children's behaviour BEH; «Your Child at Home»; «Your Child's Health»; «Scale of Lack of Money for Essentials»; short version of the «Household Food Security Scale»; «Job Satisfaction»; assessment of stress and fatigue; assessment of anxiety; assessment of the relationship with the child»; short version of the Dyadic Adjustment Scale. **Results.** In ART and NC families 3 developmental variants were identified: «Balanced» (ART: 33%, NC: 41%), «Risk of imbalance» (ART: 42%, NC: 19%), «Risk of developmental and behavioural problems» (ART: 24%, NC: 40%). For ART group, these variants were different only in mothers' relationship with the child, for the NC group – in all types of family

characteristics. **Discussion.** In NC families most aspects of family functioning are related to children's behaviour and development, in ART families – only maternal attitude to the child. The results underline the need for individual psychological support and correction.

Keywords

ART, IVF, induced pregnancy, mental development, physical development, preschool age, family environment, family relations, financial situation, parent-child relations

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Introduction

According to the statistical data, there is an increase in the number of children conceived through assisted reproductive technology (ART). Since 1978, more than 10 million children have been born using ART worldwide (ESHRE, 2022). In Russia, the statistics is available for 1995-2020, and during this period more than 333.5 thousand children were born after ART (RAHR, 2020). Currently, there is a great research interest in the development of children conceived through ART, and a large amount of contradictory data on the impact of ART procedures on these children's health and mental development are available. Some researchers argue that there is no direct relationship between the ART procedures and the development of children, and these children are not significantly different from children conceived spontaneously in terms of physical (Malyshkina, Matveeva, Filkina, Ermakova, 2019; Punamäki et al., 2019), cognitive (Farhi et al., 2021), emotional and social development (Pechenina, 2016). Other studies reported an increased risk of prenatal problems (Mikheeva, Penkina, 2014), adverse perinatal outcomes (Qin et al., 2016), delayed physical and mental development (Solovyeva, 2014; Djuwantono, Aviani, Permadi, Achmad, & Halim, 2020) and mental and physical disorders (Barbuscia, Myrskylä, & Goisis, 2019; Rissanen, Gissler, Lehti, & Tiitinen, 2020; Wang, Yu, Chen, Luo, & Mu, 2021). It should be noted that these data are mostly cross-sectional, cover only few developmental stages and do not assess the relationship between the physical and mental development of children conceived through ART. Most research is focused on perinatal outcomes and

early childhood (Iakashvili, Samchuk, 2017; Samoilova et al., 2021), fewer studies describe the preschool, primary school or older children (Farhi et al., 2021).

In order to overcome the contradictions described above and observe the developmental variants and trajectories of children conceived through ART, it is important to identify the factors that contribute to the development children at each developmental stage (Keshishyan, Tsaregorodtsev, Ziborova, 2014). The contribution of psycho-social factors (factors of the family environment) to the development of children has been studied mostly on a sample of children not selected according to the type of conception. Psychological factors included marital relationships (Sychev, Kazantseva, 2017; Garriga & Pennoni, 2022), parental mental states (Rigato et al., 2020; Thiel et al., 2020; Sutin, Strickhouser, Sesker, & Terracciano, 2022), the quality of parent-child relationships and parenting strategies (Golovey, Savenysheva, Engelhardt, 2016; Sethna et al., 2017). As social factors, the financial and economic situation of the family (Cooper & Stewart, 2021), the professional employment of parents and their job satisfaction (Savenysheva, Zapletina, 2019; Cho & Ryu, 2022) were highlighted.

Thus, currently, there is a lack of data on the relationship between family factors and the development of children conceived through ART. ART families are mostly studied during the early stages of children's postnatal development, which does not provide a holistic view on potential risk factors and resources specific to each developmental stage. The typological approach can allow to study the complex system of relationships between various aspects of development (McNamara, Selig & Hawley, 2010) and determine the aims and targets of personalized psychosocial support.

Methods

The aim of the study was to identify the variants of physical and psychological development of children born after ART, as well as the characteristics of their family environment during the early preschool age.

Hypotheses: 1) Based on the characteristics of the mental and physical development of preschool children conceived through ART, typological variants can be identified, that are different from the developmental variants of children conceived spontaneously; 2) Typological variants of the development of children conceived with ART and spontaneously, differ in the characteristics of the family environment.

Participants

The analysis was performed on the data collected when the children were 4 years old as a part of the Prospective Longitudinal Interdisciplinary Study of Child Development (PLIS): 220 families (mother, father and child) participated: 80 families who conceived a child through ART, 130 families who conceived a child spontaneously (natural pregnancy, control group, NC).

Methods

The data were collected using research booklets based on the methods used at the longitudinal studies TEDS (Twins Early Development Study) and QLSCD (Quebec Longitudinal Study of Child Development). The translation was performed according to the International Test Commission (ITC) requirements. Using the quartile values, the levels were determined for each scale ([Q1; Q3]): low level - from the minimum to Q1, average (normative) - from Q1 to Q3, high - from Q3 to the maximum.

Mental and physical development of children:

1) Intellectual development: "Parent-Administered PARCA" and "Parent-reported PARCA" (interactive tasks: generalization skills ($\alpha = 0.9$, ART: [9; 13]; NC: [10; 14]), hand-eye coordination ($\alpha = 0.8$, "Draw a figure" ART: [4; 6]; NC: [5; 6]; "Draw a man" ART and NC: [5; 9]), logical reasoning ($\alpha = 0.7$, ART: [6; 11]; NC: [6; 10]), receptive vocabulary ($\alpha = 0.6$, ART and NC: [7; 8]); questionnaire for conceptual knowledge assessment ($\alpha = 0.7$, ART: [10; 13]; NC: [9; 13]); the "Speech" questionnaire (short version of the MacArthur Communicative Development Inventory, adapted by S. Petrill et al., 2004), and questionnaire for parents "What your child can say?" that allowed to assess whether the speech is developed according to the age-appropriate norms ($\alpha = 0.7$, ART: [16; 19]; NC: [15; 19]);

2) Behaviour and emotional development: "Your child's behaviour" (BEH; Cote et al., 2017) (scales: hyperactivity ($\alpha = 0.6$; ART and NC: [2.5; 5]), prosocial behaviour ($\alpha = 0.7$; ART and NC: [5.71; 8.57]), physical aggression ($\alpha = 0.7$; ART: [1.67; 4.17]; NC: [0.83; 3, 33]), inattention ($\alpha = 0.6$; ART and NC: [3.33; 5]), "Your child at home" (TEDS) (scales: conduct problems ($\alpha = 0.6$; ART: [2; 4]; NC: [1; 4]); emotional problems ($\alpha = 0.6$; ART: [2; 5]; NC: [2; 4.83]); shyness ($\alpha = 0.6$; ART and NC: [1; 3])

3) Physical development: "Your child's health" (total score for health problems, $\alpha = 0.6$, ART: [1.75; 5]; NC: [2; 6]); "Your child's nutrition" (total score of feeding difficulties: refusal to eat, poor appetite, etc., $\alpha = 0.6$, ART: [4; 9]; NC: [5; 8]).

Family environment:

1) Socio-economic characteristics: "Scale of Lack of Money for Essentials" (index of financial satisfaction, $\alpha = 0.80$; ART and NC: [15; 16]); Scale "Feeling of instability caused by lack of food" (short version of "Household Food Security Scale" (Blumberg et al., 1999) adapted by the QLSCD research group): Financial instability index ($\alpha > 0.65$, ART: [0; 1]; NC: [0; 0.75]); "Job Satisfaction" scale (Job Satisfaction Index, $\alpha = 0.87$, ART: [11; 16.5]; NC: [10; 16]).

2) Psychological characteristics: Scale "Assessment of stress and fatigue" (QLSCD): Level of stress and fatigue; $\alpha = 0.72$, ART: mothers: [5.75; 9]; fathers: [6; 8]; NC: mothers: [6; 9]; fathers: [5; 8]; "How You Feel" scale (developed by J. Séguin and M. Freeston for the study of SantéQuébec (1997) (general level of anxiety, $\alpha = 0.88-0.91$; ART: mothers: [6; 18]; fathers: [2; 13]; NC: mothers: [4; 19.5]; fathers: [0; 10.25]); "Your relationship with the child" (QLSCD): 3 scales - "Positive attitude" (joint activities, verbal ways of behaviour

correction, ART: mothers: [12.25; 17]; fathers: [12; 16.25]; NC: mothers: [12; 17]; fathers: [10; 16]), "Coercive attitude" (anger, irritability, physical punishment, ART: mothers: [4; 9]; fathers: [2; 7]; NC: mothers: [4; 9]; fathers: [3; 7]), "Consistent parenting" (execution of the promised punishment in case of misconduct, disobedience of the child, ART: mothers: [9; 14]; fathers: [9; 14,25]; NC: mothers: [11; 15]; fathers: [10; 15]) ($\alpha = 0.74-0.75$); Scale "Your marital relationship" (short version of the Dyadic Adjustment Scale adapted by Sabourin, Valois, Lussier, 2005): Index of marital relationship, in both groups in mothers and fathers $\alpha = 0.69-0.85$; ART: mothers: [20.25; 26]; fathers: [16; 19], NC: mothers: [21; 27]; fathers: [15; 19].

Statistical data analysis was performed in the IBM SPSS Statistics 26: descriptive statistics, internal consistency (α -Cronbach) and normal distribution (Kolmogorov-Smirnov test, for all scales the distribution was non-normal) assessment, non-parametric criteria for comparative analysis (Mann-Whitney test for two groups, The Kruskal-Wallis test for three groups), hierarchical cluster analysis (between-groups linkage method).

Results

In each group (ART, NC) typological variants of children's development were identified based on the characteristics of their mental development, behaviour, emotional development, health, feeding difficulties.

Typological developmental variants of preschool children born after ART

In the ART group, 3 variants of child development were identified (Figure 1). The first included 33% of children, the second - 42%, the third - 24% (values are rounded to the whole numbers). Significant differences between the variants of child development were found for all measures ($*p < 0.05$; $**p < 0.01$), except for the generalization skills: hand-eye coordination ("Draw figures", $H = 7.80^*$; "Draw a human", $H = 9.94^*$), logical reasoning (Puzzles, $H = 20.21^{**}$), receptive vocabulary ("Looking at the pictures", $H = 12.02^{**}$); conceptual knowledge ($H = 15.26^{**}$), speech development ($H = 10.13^*$), prosocial behaviour ($H = 10.11^*$), hyperactivity ($H = 18.83^{**}$), inattention ($H = 8.71^*$), physical aggression ($H = 10.88^*$), conduct problems ($H = 11.09^{**}$), emotional problems ($H = 11.99^{**}$), shyness ($H = 21.13^{**}$), health problems ($H = 12.52^{**}$), feeding difficulties ($H = 11.55^{**}$). Effect size of the significant pairwise comparisons (r) was 0.30 to 0.65.

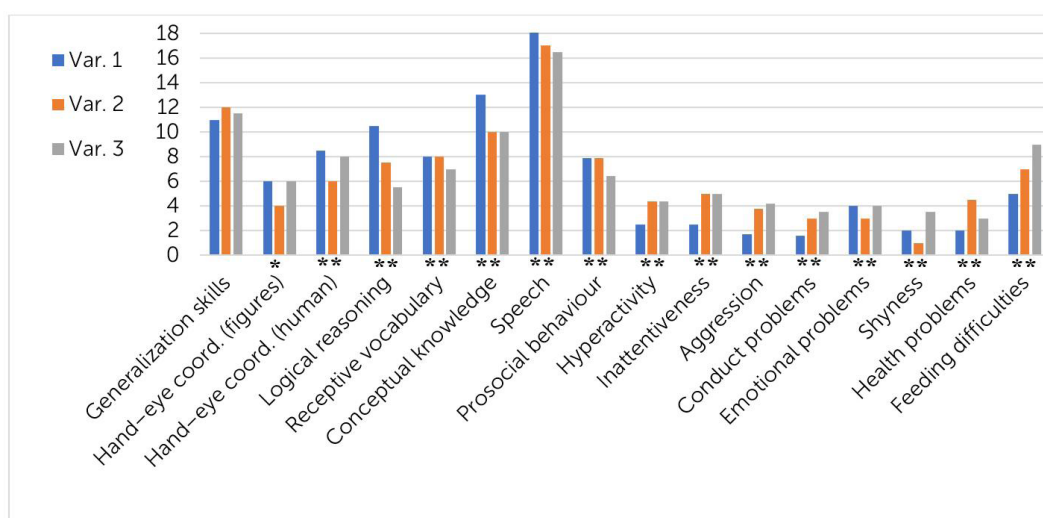
The children of the first typological variant ("Balanced"), compared with the children of the second ("Risk of imbalance") and the third ("Risk of developmental and behavioral problems") variants, had the highest level of logical reasoning ($Me = 10.5$), conceptual knowledge ($Me = 13$), lowest hyperactivity ($Me = 2.5$), inattention ($Me = 2.5$), aggression ($Me = 1.7$) and conduct problems ($Me = 1.58$). Compared with the second variant, they had a higher level of hand-eye coordination ("Figures": $Me = 6$, "Human": $Me = 8.5$), fewer health problems ($Me = 2$). Compared with the children of the third variant, they demonstrated a

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higher level of logical reasoning (Me = 10.5), speech development (Me = 18.5), prosocial behaviour (Me = 7.86), lower shyness (Me = 2) and feeding difficulties (Me = 5). Conceptual knowledge and hand-eye coordination were at the upper boundary of average group values; hyperactivity and aggression - at the lower; the levels of inattention and conduct problems were below average.

Figure 1

Development and health of preschool children conceived through ART based on their typological variants



Note: The comparison was conducted between three groups: * $p < 0,05$; ** $p < 0,01$

The children of the second typological variant ("Risk of imbalance"), compared with the children of the first and third variants, had the lowest level of hand-eye coordination ("Figures": Me = 4, the lower boundary of average group values) and the highest level of health problems (Me = 4.5), the average level of logical reasoning (Me = 7.5). Compared with the children of the first variant, they completed the "Draw a man" task less successfully (Me = 6), had a lower level of conceptual knowledge (Me = 10, the lower boundary of average group values), higher hyperactivity (Me = 4.48), inattention (Me = 5, upper boundary of average group values), physical aggression (Me = 3.75), conduct problems (Me = 3). Compared with the children of the third variant, they demonstrated a higher level of receptive vocabulary (Me = 8, the upper boundary of average group values), speech development (Me = 17), prosocial behaviour (Me = 7.86), lower emotional problems (Me = 3), shyness (Me = 1, lower boundary of average group values) and feeding difficulties (Me = 7).

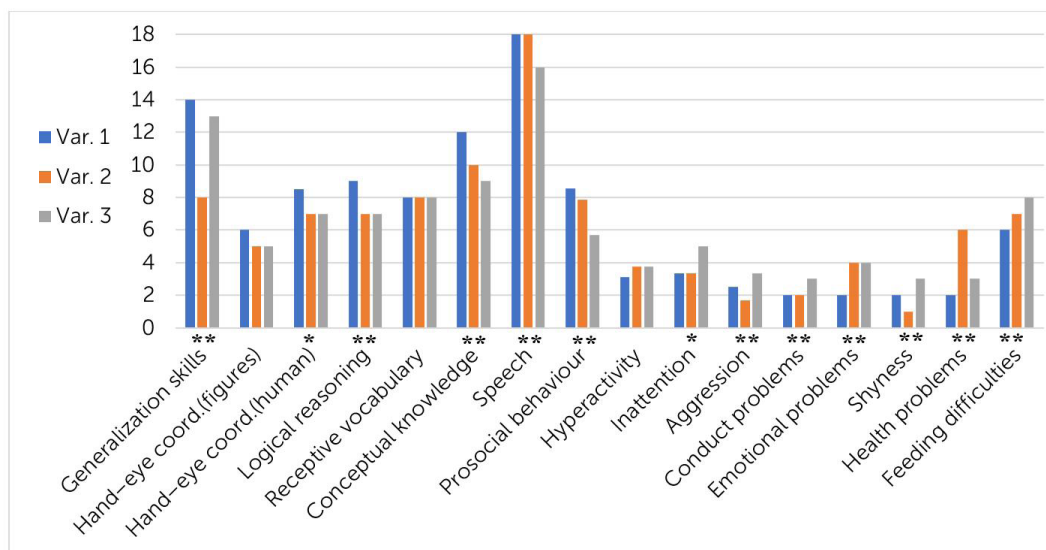
The children of the third typological variant (“Risk of developmental and behavioural problems”), compared with children of both variants, had the lowest level of logical reasoning (Me = 5.5, lower than average group values) and receptive vocabulary (Me = 7, lower boundary of average group values), speech development (Me = 16.5), prosocial behaviour (Me = 6.43), higher shyness (Me = 3.5, above average) and feeding difficulties (Me = 9, upper boundary of average group values). Compared with the first variant, they had a lower level of conceptual knowledge (Me = 10, lower boundary of average group values), higher hyperactivity (Me = 4.38), inattention (Me = 5, upper boundary of average group values), aggression (Me = 4, 17, upper boundary of average group values), conduct problems (Me = 3.5). Compared with the second variant, they demonstrated a higher level of hand-eye coordination (“Figures”, Me = 6, upper boundary of average group values), higher emotional problems (Me = 4), fewer health problems (Me = 3, low values).

Typological developmental variants of preschool children conceived spontaneously

In the control groups, three typological variants were also identified. 41% of children belonged to the first variant, 19% - to the second, 40% to the third (figure 2).

Figure 2

Development and health of preschool children conceived spontaneously based on their typological variants



Note: The comparison was conducted between three groups: * $p < 0,05$; ** $p < 0,01$

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Significant differences between the variants of children's development were revealed for all measures, except for the task "Draw figures", receptive vocabulary and hyperactivity (* $p < 0.05$; ** $p < 0.01$): generalization skills ("Find a pair", $H = 24.76^{**}$), hand-eye coordination ("Draw a person", $H = 7.33^*$), logical reasoning ("Puzzles", $H = 11.53^{**}$), conceptual knowledge ($H = 28, 21^{**}$), speech development ($H = 13.26^{**}$), prosocial behaviour ($H = 38.21^{**}$), inattention ($H = 6.44^*$), physical aggression ($H = 10.60^{**}$), conduct problems ($H = 16.59^*$), emotional problems ($H = 17.31^{**}$), shyness ($H = 26.75^{**}$), health problems ($H = 12.94^{**}$), feeding difficulties ($H = 19.80^{**}$). Effect size of significant pairwise comparisons (r) was 0.22 to $r = 0.61$.

The children of the first typological variant ("Balanced"), compared with the children of the second and third variants, had the highest level of logical reasoning ($Me = 9$), prosocial behaviour ($Me = 8.57$, upper boundary of average group values), the average level of shyness ($Me = 2$). They had the lowest level of emotional problems ($Me = 2$, lower boundary of average group values), health problems ($Me = 2$, lower boundary of average group values). Compared with the children of the third variant, they demonstrated a higher level of conceptual knowledge ($Me = 12$) and speech development ($Me = 18$), lower inattention ($Me = 3.33$, lower boundary of average group values), aggression ($Me = 2.5$), conduct problems ($Me = 2$), feeding difficulties ($Me = 6$).

The children of the second typological variant ("Risk of imbalance"), compared with the children of the other variants, had lower generalization skills ($Me = 8$), the lowest level of shyness ($Me = 1$, the lower boundary of average group values), and the highest level of health problems ($Me = 6$, upper boundary of average group values), the average level of prosocial behaviour ($Me = 7.86$). Compared with the children of the first variant, they had lower hand-eye coordination ($Me = 7$) and logical reasoning ($Me = 7$), higher emotional problems ($Me = 4$). Compared with the children of the third variant, they demonstrated higher conceptual knowledge ($Me = 10$), speech development ($Me = 18$), lower aggression ($Me = 1.67$) and conduct problems ($Me = 2$), lower feeding difficulties ($Me = 7$).

The children of the third typological variant ("Risk of developmental and behavioural problems"), compared with children of the first and third variants, had the lowest level of conceptual knowledge ($Me = 9$, lower boundary of average group values), speech development ($Me = 16$), prosocial behaviour ($Me = 5.71$, lower boundary of average group values), average level of health problems ($Me = 3$), higher aggression ($Me = 3.33$, upper boundary of average group values), conduct problems ($Me = 3$), shyness ($Me = 3$, upper boundary of average group values), feeding difficulties ($Me = 8$, upper boundary of average group values). Compared with the first option, they had lower level of logical reasoning ($Me = 7$), higher inattention ($Me = 5$, upper boundary of average group values) and emotional problems ($Me = 4$), compared with the second variant - higher generalization skills ($Me = 13$).

Differences in measures of family environment between the typological variants of children's development

The results of the comparative analysis are presented in Table 1.

Table 1

Differences in social-psychological characteristics of families between the children of three typological variants

Measures	Var.	ART			NC		
		Me	Min-max	Signi- ficant diffe- rences (r)	Me	Min-max	Signi- ficant differen- ces (r)
Index of financial satisfaction	1	16.00	8.00-16.00		16.00	8.00-16.00	
	2	16.00	12.00-16.00		16.00	9.00-16.00	1>3* (0.29)
	3	15.50	8.00-16.00		15.00	10.00-16.00	
Stress and fatigue (M)	1	6.00	2.00-11.00		6.00	3.00-12.00	1<2** (0.39)
	2	8.00	4.00-12.00		8.00	3.00-10.00	
	3	7.00	4.00-10.00		8.00	1.00-12.00	1<3* (0.26)
Stress and fatigue (F)	1	8.00	4.00-11.00		6.00	2.00-12.00	1<2* (0.27)
	2	6.00	1.00-10.00		8.00	3.00-11.00	
	3	6.00	5.00-9.00		8.00	1.00-11.00	1<3* (0.24)
Anxiety (M)	1	11.00	0.00-50.00		8.00	0.00-38.00	1<3** (0.34)
	2	9.50	0.00-54.00		9.00	0.00-41.00	
	3	13.50	0.00-18.00		17.00	0.00-53.00	2<3* (0.25)

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Measures	Var.	ART			NC		
		Me	Min-max	Signi- ficant diffe- rences (r)	Me	Min-max	Signi- ficant differen- ces (r)
Anxiety (F)	1	6.00	1.00-28.00		4.00	0.00- 26.00	
	2	6.00	0.00- 35.00		7.00	0.00- 59.00	1<3* (0.25)
	3	4.00	0.00- 35.00		7.00	0.00- 46.00	
Positive parenting (M)	1	17.00	10.00- 20.00		15.00	10.00- 20.00	
	2	15.00	7.00-18.00	1>3* (0.37)	16.00	6.00- 20.00	
	3	13.00	7.00-19.00		15.00	7.00- 20.00	
Coercive parenting (M)	1	4.50	1.00-10.00		6.00	0.00- 13.00	
	2	8.00	4.00-14.00	1<2** (0.47)	7.00	1.00- 13.00	1<3* (0.29)
	3	5.50	9.00-12.00		8.00	0.00- 16.00	
Consistent parenting (M)	1	13.50	6.00-19.00		13.50	5.00- 19.00	
	2	11.00	5.00-17.00	1>2* (0.31)	12.00	5.00- 17.00	
	3	9.50	6.00- 20.00		12.00	5.00- 20.00	
Positive parenting (F)	1	13.00	6.00- 20.00		14.00	3.00- 20.00	
	2	14.00	8.00- 18.00		11.50	7.00- 18.00	1>3* (0.24)
	3	14.00	9.00-19.00		13.00	5.00- 18.00	

Measures	Var.	ART			NC		
		Me	Min-max	Signi- ficant diffe- rences (r)	Me	Min-max	Signi- ficant differen- ces (r)
Marital relations (M)	1	23.00	14.00- 31.00		26.00	11.00- 31.00	1>2*
	2	23.50	12.00- 29.00		23.00	9.00- 31.00	(0.26)
	3	23.50	17.00- 29.00		24.00	12.00- 31.00	1>3* (0.28)
Marital relations (F)	1	17.00	10.00- 21.00		18.00	7.00- 21.00	1>2*
	2	17.00	14.00- 21.00		16.50	5.00- 21.00	(0.27)
	3	16.50	12.00- 21.00		17.00	9.00- 21.00	

Notes: Me – median. r – effect size; * $p < 0.05$; ** $p < 0.01$; M – mother. F – father. Only measures that were significantly different between the groups are presented.

In the ART group, significant differences between the three variants of child development with an average effect size were observed for 3 characteristics of the maternal attitude to the child: positive, coercive and consistent (all values were within the normal range). Differences in other maternal and paternal characteristics were non-significant. Mothers of ART children included in the first developmental variant ("Balanced") demonstrated the most favourable attitude towards the child, compared with the mothers of children who belonged to the second ("Risk of imbalance") and third ("Risk of developmental and behavioural problems") variants. Their attitude towards the child was more consistent, with less expression of a coercive attitude, than that of mothers whose children were at risk of imbalance. Compared with mothers of children at risk of developmental and behavioural disorders, their parental attitude was more positive.

In the NC group, the differences were significant for: the index of financial satisfaction, stress and anxiety of mothers and fathers, coercive maternal attitude, positive paternal attitude, index of marital relations measured in mothers and fathers (Table 1). Mothers of children with a "Balanced" developmental variant, compared with the mothers of children with a risk of developmental and behavioural disorders, were more satisfied with their financial situation, showed a less coercive attitude towards the child; both parents

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had lower stress and anxiety. Fathers of such children, compared with fathers of children at risk of developmental and behavioural disorders, were more positive towards the child; compared with the fathers of children at risk of imbalance, they were more satisfied with marital relations. Parents of these children had the lowest stress level, and the mothers of these children had the highest level of marital satisfaction, compared with the parents of children belonging to other variants.

Parents of children with the "Risk of imbalance", compared with parents of children with a "Balanced" variant, had a higher stress level, and mothers' anxiety was lower than that of children at risk of developmental and behavioural disorders. Parents were less satisfied with marital relations; father's level of marital satisfaction was at the lower boundary of average values.

Mothers of children at "Risk of developmental and behavioural problems" were characterized by the highest level of anxiety, low satisfaction with the financial situation (at the lower boundary of average values). Parents experienced higher stress than parents of children with a balanced developmental variant, mothers were less satisfied with marital relations and showed a more violent attitude; fathers showed a less positive attitude towards the child and were more anxious.

Discussion

The present study allowed us to identify the typological variants of children conceived through ART and spontaneously, based on their mental and physical development, and to analyze the characteristics of the family environment specific to each variant. These data add to the results of previous comparative studies investigating mental and physical development of children conceived through ART, and provide the insight into the developmental trajectories of children in relation to the factors that contribute to them during early preschool age.

Based on the cluster analysis, 3 typological variants of children's development were identified in both groups. Despite several differences, the general specifics was similar between the groups. However, the proportion of children was different. In the main group, 33% of children belonged to the «Balanced» variant, 42% of children were at risk of the imbalance (high level of health problems, inconsistent cognitive development), and 24% of children had a risk of developmental and behavioural problems (less favorable cognitive development and higher level of behavioural and emotional problems). In the control group, an approximately equal proportion of children belonged to a balanced variant (41%) and a variant with a risk of developmental and behavioural problems (40%). Only 19% could be characterized as children with the risk of imbalance. A relatively high rate of the NC children with «Risk of developmental and behavioural problems» can be explained by the fact that in children of this developmental variant the scores for all scales were within the normal range. In ART children with the risk of developmental and

behavioural disorders, the level of logical reasoning was lower than the average for the sample, therefore, the percentage of children belonging to this variant was low.

This result highlights the need to monitor the development of children conceived through ART, since a significant proportion of them were at risk of imbalance in various aspects of cognitive development, behaviour and physical health. The category with the highest risk was also identified, characterized by the least favorable cognitive development and the most pronounced behavioural and emotional problems. The results may partially explain the contradictory data on the development of children conceived through ART. It should be noted that for most children from all developmental variants, most measures were within the normal range, which allows us to speak about the tendency and a potential target for psychological and pedagogical correction, but not about the pathological development.

For each typological variant, specific characteristics of the family environment were identified. In the control group, the differences were found in all studied areas family process (satisfaction with the financial situation, mental state of parents, attitude towards the child, marital relations). In the main empirical group, differences were observed only in the maternal attitude towards the child, which could be both the cause and a consequence of certain characteristics of the child. Mothers of balanced children of the main empirical group, on average, showed a more positive attitude towards the child, compared with mothers of children of other developmental variants. This manifested in the higher quality and amount of time mothers spent with their children. The maternal attitude to such children was more consistent than the attitude towards the children of other typological variants. On average, mothers of such children created more precise and structured rules, maternal reactions were more predictable. Also, mothers of children with a balanced developmental variant showed less coercive parenting than mothers of children at risk of imbalance or developmental and behavioural disorders.

In families with ART, adverse outcomes of the child were mostly related to the behavioural aspect of parenthood, but not with its emotional aspect and marital well-being. Previously, mothers using ART were showed to have greater involvement in parenting, which may also explain the differences in maternal behaviour associated with variants of child development (Fata, Tokat & Uğur, 2021; Paterlini et al., 2021). The absence of differences in the mental well-being and marital relations of parents can be explained by the high value of a children in such families, which is independent of their behaviour and development (Yakupova, 2015). When development and behaviour of the child differs on average from other children of this age, but is not pathological, the family environment does not actively react to these symptoms. In addition, this may be associated with the suppression of negative emotions (Gameiro et al., 2011). In contrast, the emotional well-being of the parents in the control group was significantly associated with the well-being of their children's cognitive development and behaviour. Parents of children with the most balanced development had the lowest level of stress and anxiety, and the highest quality of marital relations. In contrast to the ART group, there were fewer correlations

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with parenting. Mothers' level of positive and consistent parenting did not differ between developmental variants, but, as in the ART group, mothers of children with the risk of developmental and behavioural disorders showed a more coercive attitude towards their children than mothers of children with balanced development. An interesting result is the absence of differences in fathers' scores between variants of children in the ART group, which requires further investigation. This may be related to both the characteristics of ART families and the limitations of the study, since information about the children's behaviour was collected only from mothers.

Conclusion

In both groups, 3 typological variants of the development of children were identified: "Balanced", "Risk of imbalance", "Risk of developmental and behavioural problems". In families with natural conception, most of the family environment characteristics were different between the typological groups. In ART families, the differences were significant only for the maternal behaviour towards the child. The results underline the need for further longitudinal investigation of psycho-social factors of such children's physical and mental development. Also, the data indicate the importance of individual strategies of comprehensive support for ART families aimed at prevention of negative psychological consequences.

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Conflict of Interest Information

The authors have no conflicts of interest to declare.