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ORIGINAL RESEARCH

Why Do Migrant Children Have Poorer Mental Health Compared to Urban Children? A Network Analysis Approach

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Introduction: Although mobility has been identified as a significant risk factor adversely affecting mental health and well-being, the mechanisms underlying this association remain insufficiently understood. Unlike traditional linear regression approaches, this study applies network analysis to systematically explore how multiple family risk factors collectively affect problem behaviors in migrant and urban preschoolers.

Methods: A total of 1,469 children (500 urban, 959 migrant) and their parents were recruited. Network analysis examined interrelationships among family risk factors and compared risk networks between migrant and urban children. Latent profile analysis identified general and high-risk migrant groups based on problem behaviors, and network analysis explored unique risk patterns in high-risk migrant children.

Results: Three key factors—household chaos, maternal punishment, and maternal executive function—proved central in shaping both internalizing and externalizing problems. Importantly, paternal influences played a more significant role within migrant families, while maternal influences were more salient in urban families. Furthermore, among migrant families, high-risk children exhibited risk networks that were densely clustered around mother- and father-centered "risk networks" independently, yet demonstrated lower overall network connectivity, suggesting a more fragmented pattern of family risk dynamics.

Discussion: These findings highlight the importance of parental roles, differing social contexts, and cumulative risk in understanding child subjective well-being.

Keywords: problem behaviors, networks analysis, migrant children, paternal role

Introduction

China's rapid economic development and urbanization have led to a substantial increase in rural-to-urban migration, with children accompanying their parents into city environments and becoming part of the migrant population. According to the latest population census data in China, the number of migrant children aged 0–7 is 71.09 million, with the highest proportion among all age groups.[1] These preschool migrant children often encounter distinct challenges such as unstable living conditions, inadequate social support, and cultural adaptation pressures. Their well-being—encompassing both physical and mental health—can be undermined by these adversities.[2] Drawing upon ecological systems theory and the cumulative risk model, existing research points to the critical role of family factors in shaping child development outcomes.[3,4] Not only do cultural backgrounds influence parenting styles but environmental stressors, parental mental health, and co-parenting practices also collectively affect children's social-emotional functioning.[5,6] Despite growing interest in migrant children's well-being, few studies have systematically investigated how multiple family risk factors interact to influence preschoolers' behavioral and emotional problems. Most existing studies on migrant children's well-being have used traditional linear regression methods, focusing on the influence of single factors and overlooking the complex interactions among family risk factors.[7] This study addresses this gap by employing network analysis to

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compare the family risk networks of urban and migrant preschool children, further distinguishing between general migrant and high-risk migrant groups.

The Role of Family Factors in Shaping Children's Well-Being

From an ecological systems perspective, the family, as the core microsystem for child development, plays a crucial role in shaping children's well-being.[3] Compared to urban children, migrant children's families often face multiple challenges, such as high economic pressure, unstable living environments, and insufficient parent–child interactions, which can directly impact their well-being.[7–9] According to previous studies,[10,11] family-related factors that influence children's well-being can be categorized into three main domains: family cultural risks, family environmental risks, and family relationship risks.

Family cultural risks are a macro system that influences children's development, and parental cultural values are closely related to children's mental health. As migrant families transition from rural to urban areas, parents often face cultural adaptation challenges (urban orientation vs rural orientation). Research has shown that parents with a rural orientation tend to emphasize traditional values, collectivism, and obedience to authority.[12,13] This cultural orientation may provide migrant children with emotional support and a sense of security, but it may also limit their autonomy and personal development, thereby reducing their well-being.[14] In contrast, urban-oriented parents are more focused on individualism and self-actualization, and they tend to adopt more open and child-centered parenting approaches, which can enhance children's self-esteem and social adaptation.[5,15] However, for migrant families, the conflict between parents' cultural orientations may lead to inconsistent parenting strategies, which can negatively impact children's mental health.[16]

Family environmental risks, including household chaos, family executive function environment, and marital relationship quality, are also important factors influencing migrant children's well-being. Noisy living environments and frequent residential changes can disrupt children's daily routines, affecting their sleep quality and emotional states.[17] These environmental stressors may indirectly impact children's well-being by influencing the harmony of family interactions and parents' psychological states.[6] The family executive function environment reflects the overall functional operation of the family. Families with higher executive function typically have clear rules and effective time management, which can help children develop good self-control and task completion abilities, thereby enhancing their well-being.[18] However, in migrant families, the limitations of parents' own executive functioning may lead to a lack of stable family operation mechanisms, adversely affecting children's well-being.[19] Furthermore, the quality of the marital relationship is a key factor influencing children's well-being. Supportive spousal interactions can significantly enhance children's emotional security and social adaptation.[20] In contrast, marital conflicts can negatively impact children's emotions and behaviors through emotional transmission mechanisms, and this effect may be further amplified by economic pressure and social isolation in migrant families.[21]

Family relationship risks, including parental executive functioning, co-parenting, parental burnout, parenting behaviors, and parent–child relationship quality, constitute the third important dimension influencing migrant children's well-being. The dual pressures of parenting and living can lead some parents to experience parental burnout, a state characterized by emotional exhaustion, lack of parenting enjoyment, neglect of children's emotional needs, avoidance of parenting activities, and reduced parenting self-efficacy.[22] Parental burnout not only has severe negative consequences for parents but also affects parent–child relationships and children's problems behavior.[23] Research has shown that a positive parent–child relationship can provide emotional support and a sense of security, promoting children's emotion regulation and social adaptation abilities, while conflictual parent–child relationships can negatively impact children's mental health.[24] In migrant families, the reduced quality of parent–child relationships due to parents' busy work schedules, and the unmet need for emotional support, are important reasons for the decline in children's well-being.[25] Additionally, if parents are unable to support each other, negative co-parenting significantly increases the problem behaviors of left-behind children.[26] Furthermore, the widespread use of low-warmth and high-punishment parenting strategies in migrant families can further exacerbate children's externalizing problems (eg, aggression and attention deficits) and reduce their overall life satisfaction.[27,28] Most existing research on the relationship between parental risk factors and children's problem behaviors tends to treat parents as a single unit or considers fathers and mothers as two

independent individuals. However, family systems theory posits that the family is a complex, organized system in which members directly or indirectly influence one another. Interactions between any two members (eg, mother and child) can be affected by a third party (eg, the father), and these dynamic interactions shape children's development. Despite this, the majority of studies have primarily focused on mothers, with relatively little attention given to fathers—particularly in the context of migrant children.[28] In recent decades, China has undergone profound socioeconomic changes, leading to increased workforce participation among mothers and more active involvement of fathers in children's daily lives. Consequently, fathers have become partners rather than mere assistants in childrearing, and their role may be as crucial as that of mothers in supporting children's development.[29] Given these shifts, it is essential to simultaneously examine the contributions of both fathers and mothers to children's outcomes and to determine their relative importance in the behavioral development of migrant children.

The Need for a Systemic Approach: Network Analysis

Most existing studies on migrant children's well-being have used traditional linear regression methods, focusing on the influence of single factors and overlooking the complex interactions among family risk factors.[7] The cumulative risk model suggests that these risk factors often do not exist independently but rather influence children's well-being through multi-level, multi-path mechanisms.[4] For example, parental burnout and executive functioning can indirectly affect parenting strategies[30] and parent–child relationships,[31] further exacerbating children's problems behavior[32] and reducing their well-being. Therefore, exploring the systemic relationships among these factors is crucial for understanding the mechanisms underlying migrant children's well-being.

Network analysis, as an emerging method, provides a powerful tool for the systematic analysis of multidimensional factors. Unlike traditional univariate analyses, network analysis can visualize the complex relationships among family risk factors and identify the core nodes with the most significant impact on well-being.[33] Compared to cluster analysis and factor analysis, network analysis treats the relationships between variables as an integrated network structure, revealing the key characteristics of psychological concepts through the connections between nodes.[34,35] In the context of this study, the application of network analysis aims to elucidate the family risk networks associated with preschool migrant children's problem behaviors, and to identify the core risk and protective factors influencing their well-being.[36] By identifying key correlates and the structure of these risk networks, the analysis sheds light on why migrant children—especially those in high-risk groups—are more vulnerable to poor mental health and reduced well-being.

The Present Study

Despite growing research interest in migrant children's well-being, few studies have systematically examined how multiple family-related risk factors interact to influence preschoolers' behavioral and emotional problems.[4] Most existing research has relied on traditional linear regression methods, typically focusing on the influence of single, isolated factors while overlooking the complex interplay among multiple family risk factors.[7] Grounded in ecological systems theory, the cumulative risk model, and previous research,[10,11] the present study categorizes family-related factors into three main domains: family cultural risks, family environmental risks, and family relationship risks. Using network analysis, the study aims to compare the family risk networks associated with the problem behaviors of urban children and migrant children and to further explore the differences in family risk networks between general migrant children and high-risk migrant children. By constructing risk network maps, the study aims to identify the core risk nodes that influence children's well-being.

Specifically, the study has three objectives: 1) to compare the factors associated with problem behaviors between urban and migrant children; 2) to identify high-risk subgroups among migrant children using latent profile analysis, and then compare the family risk networks between general migrant children and high-risk migrant children; and 3) to provide a comprehensive understanding of the risk and protective factors for the mental health of urban children, migrant children, and high-risk migrant children, thereby informing interventions to promote the well-being of migrant children.

Methods

Participants

This study selects Shanghai as a representative city for research on migrant children, primarily because, as one of China's largest economic centers, it attracts a substantial number of migrant populations and features diverse social and economic backgrounds along with concentrated educational resources. The research includes a sample of 1,459 preschool children and their parents from 11 kindergartens across six districts in Shanghai, employing a convenience sampling method. The selection criteria align with the definition of migrant preschool children, specifically "under 7 years old, registered residence not in the inflow city, and having stayed in the inflow city for more than half a year." This ensures that the sampled migrant children are representative and can reflect the educational adaptation challenges and experiences faced by children from different regions and backgrounds. As shown in Table 1, a total of 1459 families of preschool children participated, including 959 migrant children and 500 urban children. There are 381 children in the first grade of preschool, 561 children in the second grade of preschool, and 517 children in the third grade of preschool. The average age of children is 51.35 months (SD = 18.05).743 boys, accounting for 50.9%, and 716 girls, accounting for 49.1%. Six hundred and ninety-two (47.4%) were only children, and 767 (52.6%) children had siblings. There are 304 mothers (20.8%) with junior high school or below, 331 mothers (22.7%) with a high school education, 327 mothers (22.4%) with a vocational education, 394 mothers (27.0%) with a bachelor's degree, and 103 people (7.1%) with a master's degree or above, 269 fathers (18.4%) with junior high school or below, 342 fathers (23.4%) have a high school education, 325 fathers (22.3%) have a vocational education, 381 fathers (26.1%) have a bachelor's degree, and 142 fathers (9.7%) have a master's degree or above.

Measure

Cultural Acculturation

Parents completed a Social and Cultural Acculturation Scale (SCAS).[12,13] The SCAS is a bi-dimensional scale, assessing variation in both original and new cultural orientations. The 20 items in the measure reflect adaptation to the urban culture and adherence to the rural culture in various aspects such as social contact, participation in cultural practices, a sense of

Table 1 Basic Information of Participants

Variable		n	Percent
Grade			
	First grade of preschool	381	26.1
	Second grade of preschool	561	38.4
	Third grade of preschool	517	35.5
Gender			
	Boy	743	50.9
	Girls	716	49.1
Sibling Status			
	Children without sibling	692	47.4
	Children with sibling	767	52.6
Mothers' Education			
	Junior high school or below	304	20.8
	High school	331	22.7
	Associate's degree	327	22.4
	Bachelor's degree	394	27.0
	Master's degree or above	103	7.1
Fathers' Education			
	High school	342	23.4
	Associate's degree	325	22.3
	Bachelor's degree	381	26.1
	Master's degree or above	142	9.7

belonging, and lifestyles (eg, "Do you think the city is your home?" "Are you satisfied with life in the city?" "How much do you think you belong to your rural community?" "How often do you contact your relatives and friends in your hometown through telephone or other means?"). This scale used a 5-point scale, ranging from 1 (not at all/never) to 5 (very much/almost all the time). Internal reliabilities were 0.87 for accommodation to urban culture and 0.82 rural culture.

Household Chaos

Mothers completed the Confusion, Hubbub and Order Scale (CHAOS)[37] as a measure of household chaos. This scale consists of 15 items rated on a 4-point scale (1 = definitely untrue to 4 = definitely true). Higher scores, averaged across all items, indicate higher levels of household chaos. This scale has been utilized in previous studies examining parenting and household chaos (eg, Coldwell et al[38]). The internal consistency was 0.89.

Home Executive Function Environment

The Home EF Environment (HEFE) scale[39] was used to assess the frequency of engagement in EF-specific activities in the home. The five items include: "I play games that require my child to stop, think, then act (eg, Red Light and Green Light)"; "I play memory games with my child"; "I encourage my child to engage in physical activity for at least 30 minutes per day"; "I play games with my child that require concentration and attention (eg, puzzles)"; and "I sing songs with my child that repeat and add on to early sections with words of motions (eg, She'll be coming around the mountain when she comes)." The internal consistency was 0.92.

Parents' Marital Quality

The perceived marital quality of parents was measured using the Dyadic Adjustment Scale (DAS).[40] The scale consists of 32 items, including 4 subscales: marital satisfaction (eg, "How often do you or your spouse argue?"), marital consistency (eg, "Important purposes, goals, and things"), marital cohesion (eg, "Do you and your spouse communicate ideas passionately and interestingly?"), and emotional expression (eg, "How do you express intimate feelings"). DAS is currently the most widely used scale for measuring marital adaptation, with parents reporting their own marital adaptation. The total score can be obtained by adding the scores of the four subscales, and the higher the total score, the better the marital adaptation. The internal consistency reliability coefficients of the marital adaptation scale reported by the father and mother in this study were 0.91 and 0.90, respectively.

Parents' Executive Function

The Chinese version of the Adult Executive Functioning Inventory (ADEXI) is used to assess parental executive function. The scale was developed by Holst and Thorell[41] and consists of 14 items. The scale is divided into two sub scales: working memory and inhibitory ability, which are self-reported by parents and scored on a 5-point scale (1 = "completely disagree" and 5 = "completely agree"). The higher the score, the better the performance of the corresponding component of executive function.

Co-Parenting

The Parents' Perceptions of the Co-parenting Relationship (PPCR) developed by Stright and Bales[42] was used to measure the perceived level of spousal support by fathers and mothers in their child rearing behavior. There are a total of 14 questions, divided into two dimensions: supporting collaborative parenting (eg, "when I discipline my children, my spouse will support me") and not supporting collaborative parenting (eg, "when I need my spouse's help in matters related to my child, he/she does not help"). Each dimension has 7 questions and is scored on a 5-point scale, with 1 indicating never and 5 indicating always. The internal consistency coefficients of father's and mother's are 0.87 and 0.88, respectively.

Parental Burnout

Parental Burnout Assessment (PBA) revised by Cheng et al[43] was used to assess parental burnout. The scale consists of 21 items and is scored on a 7-point scale, ranging from "0 = never" to "6 = every day". The higher the score, the higher the level of parental burnout. In this study, the Cronbach's alpha of father's and mother's was 0.92 and 0.95.

Parent–Child Relationship

The Child–Parent Relationship Scale (CPRS) developed by Pianta et al[44] and revised by Zhang and Chen[45] was used to measure the quality of parent–child relationships in young children. This scale consists of 30 items, including three dimensions: parent–child intimacy, parent–child conflict, and parent–child dependence. It uses a 1–5 five point scoring system, ranging from 1 "strongly disagree" to 5 "strongly agree". The internal consistency coefficients were 0.89 and 0.80, respectively.

Parenting Behavior

This study used the parenting style questionnaire developed by Robinson et al[46] to measure parents parenting behavior. This study adopts two sub dimensions, warmth and punishment, based on existing theoretical foundations. The warmth dimension includes 7 items such as "I express sympathy when a child is hurt or frustrated" and "I express love by hugging or kissing the child". The punishment dimension includes 3 items such as "I punish the child by leaving them alone without (or with little) explanation" and "I punish the child by depriving them of privileges without (or with little) explanation". The internal consistency coefficients were 0.79 and 0.78.

Problem Behaviors

Strengths and Difficulties Questionnaire (SDQ)[47] measures the adaptive behaviors and social reciprocity of children aged 4–16 years. It consists of five subscales: Pro-social behavior, conduct problems, hyperactivity, emotional problems, and peer problems. Conduct problems and hyperactivity constitute externalized problem behaviors, while emotional problems and peer problems constitute internalizing problems. The internal consistency coefficients were 0.79 and 0.78.

Procedure

The survey data for this study were collected through the largest online survey platform in China, "Questionnaire Star". Prior to data collection, the research protocol was approved by the Institutional Review Board of University. The participants were parents from 10 preschools in Shanghai. During the data collection process, the researchers first introduced the study purpose to the preschool teachers, who then disseminated the research information to the children's parents. Interested parents were invited to participate in the subsequent survey. Before the formal survey, participants were asked to provide informed consent. Participation was completely voluntary, and participants could withdraw at any time. Teachers distributed the survey link to parents through class group chats. As a token of appreciation, parents received a personalized parenting style report after completing the questionnaire. This report helped parents understand their own behavioral characteristics in child-rearing and provided relevant educational advice to support their parenting practices. Parents were also informed that they could contact the research team if they encountered any issues during the parenting process and seek further assistance and support.

Data Analysis

To address the potential for common method bias due to the self-report nature of the data, Harman's single-factor test was conducted.[48] The results showed that the maximum factor explained 18.61% of the variance, well below the 40% critical threshold, indicating that common method bias was not a serious concern in this study.

To understand the family risk networks of migrant and non-migrant children, the study employed network analysis to estimate the family network structures associated with the problem behaviors of non-migrant and migrant children. To explore the potential subgroups of problem behaviors among migrant preschoolers, latent profile analysis was conducted using internalizing and externalizing problems as the observed variables. Based on the latent profile analysis classification, network analysis was further used to elucidate the differences in the family risk networks between general migrant children and high-risk migrant children. It is important to note that this study employs a cross-sectional design, which limits causal inferences regarding the relationships between family risk factors and problem behaviors. While the networks estimated in this study reveal associations between variables, they cannot determine the direction of causality.

The primary analytical approach employed in this research was network analysis, which has gained widespread application in psychological research in recent years.[33] The specific analysis strategy involved the following steps: First, a graphical Gaussian model was used to estimate the partial correlation network among the variables.[33] During the network estimation process, the LASSO (Least Absolute Shrinkage and Selection Operator) regularization technique was employed to sparsify the network and reduce the likelihood of false-positive connections.[49] Specifically, the EBICglasso method was used with the Extended Bayesian Information Criterion (EBIC) to select the optimal lambda parameter (tuning parameter = 0.5), balancing network sparsity and model fit. Second, the Fruchterman-Reingold algorithm was used to visualize the network, with positive associations represented by blue lines and negative associations by red lines, where the line thickness reflects the strength of the relationship. Third, centrality indices were calculated for each node, including betweenness centrality (reflecting the node's intermediary role), closeness centrality (reflecting the node's average distance to other nodes), strength centrality (reflecting the node's connection strength), and expected influence (reflecting the node's overall impact).

Finally, to ensure the reliability of our findings, we conducted a comprehensive bootstrap analysis with 1000 iterations using the case bootstrap method. This procedure evaluated both the accuracy of the estimated networks (edge weights) and the stability of centrality indices using the centrality stability coefficient (CS-coefficient).[33] For adequate stability, CS-coefficients should exceed 0.25, with values above 0.5 considered excellent.[33] We employed a "weighted" approach to account for edge strength and included "signed" edges to preserve both positive and negative relationships in our network analysis.

Results

Preliminary Analysis

As shown in Table 2, all factors in the family are significantly correlated with children's internalizing and externalizing problem behaviors. Internalizing problem behavior and externalizing problem behavior are positively correlated with each other.

Network Analysis of Problem Behaviors Between Urban and Migrant Children

To identify the core influencing factors of problems behavior, we compared network models for urban children (n = 500) and the migrant children (n = 959) (see Figures 1 and 2). Both networks were characterized by high accuracy and stability (see eFigures 1 and 2). The network model for urban and migrant children was highly dense, comprising 210 edges (see Figures 1 and 2). The network for urban children contained 82 non-zero edges, while the migrant children's network contained 88 non-zero weighted edges. The global strength (or density) was greater in the network of migrant children than urban children (8.66 vs 8.39).

As shown in Figure 1 and 2, household chaos, maternal punishment, and maternal executive function emerged as the core factors influencing preschool children's internalizing and externalizing problem behaviors in migrant and urban children. Specifically, internalizing problems were positively associated with maternal punishment ($\beta urban$ = 0.140, $\beta migrant$ = 0.164) and household chaos ($\beta urban$ = 0.110, $\beta migrant$ = 0.105), and negatively associated with maternal executive function ($\beta urban$ = −0.043, $\beta migrant$ = −0.146). Externalizing problems were also positively associated with maternal punishment ($\beta urban$ = 0.108, $\beta migran_t$ = 0.158) and household chaos ($\beta urban$ = 0.109, $\beta migran_t$ = 0.050), and negatively associated with maternal executive function ($\beta urban$ = −0.048, $\beta migrant$ = −0.035).

However, family factors influencing problem behaviors differed between migrant and urban children for specific types of problem behaviors. For internalizing problem behaviors, paternal co-parenting (β = −0.010), paternal punishment (β = 0.035), and paternal parenting burnout were positively associated only with internalizing problems in migrant children. In contrast, mother–child relationships (β = −0.022), maternal warmth (β = −0.019), and marital relationships (β = −0.007) were negatively associated only with internalizing problems in urban children.

For externalizing problem behaviors, paternal executive functions (β = −0.021), paternal warmth (β = −0.016), paternal punishment (β = 0.033), paternal co-parenting (β = −0.019), and maternal parenting burnout (β = 0.005) were

Table 2 Correlation Analysis of Major Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1.MCP	–																				
2.FCP	0.39**	–																			
3.MW	0.41**	0.22**	–																		
4.MP	−0.41**	−0.19**	−0.22**	–																	
5.FW	0.23**	0.30**	0.26**	−0.16**	–																
6.FP	−0.21**	−0.29**	−0.08**	0.25**	−0.22**	–															
7.MB	−0.34**	−0.15**	−0.13**	0.28**	−0.11**	0.22**	–														
8.FB	−0.19**	−0.24**	−0.07*	0.14**	−0.26**	0.55**	0.32**	–													
9.FCR	0.13**	0.14**	0.14**	−0.03	0.48**	−0.06*	−0.09**	−0.17**	–												
10.MCR	0.16**	0.06*	0.25**	−0.07**	0.16**	−0.01	−0.06*	−0.01	0.23**	–											
11.MEF	0.31**	0.21**	0.27**	−0.25**	0.15**	−0.22**	−0.44**	−0.24**	0.09**	0.08**	–										
12.FEF	0.22**	0.29**	0.11**	−0.15**	0.25**	−0.44**	−0.25**	−0.59**	0.16**	0.05	0.27**	–									
13.MUO	0.23**	0.14**	0.29**	−0.22**	0.20**	−0.11**	−0.20**	−0.11**	0.12**	0.22**	0.33**	0.17**	–								
14.MRO	0.21**	0.13**	0.18**	−0.12**	0.17**	−0.12**	−0.24**	−0.12**	0.15**	0.22**	0.25**	0.13**	0.62**	–							
15.FUO	0.18**	0.23**	0.20**	−0.15**	0.35**	−0.20**	−0.10**	−0.27**	0.26**	0.13**	0.18**	0.32**	0.53**	0.29**	–						
16.FRO	0.16**	0.22**	0.08**	−0.07**	0.30**	−0.18**	−0.13**	−0.27**	0.26**	0.11**	0.11**	0.26**	0.28**	0.36**	0.64**	–					
17.HC	−0.51**	−0.23**	−0.29**	0.38**	−0.17**	0.20**	0.31**	0.14**	−0.05*	−0.12**	−0.28**	−0.18**	−0.26**	−0.22**	−0.19**	−0.12**	–				
18.HEFE	0.26**	0.14**	0.35**	−0.14**	0.21**	−0.09**	−0.17**	−0.04	0.16**	0.41**	0.20**	0.10**	0.29**	0.31**	0.17**	0.11**	−0.22**	–			
19.MR	0.52**	0.43**	0.20**	−0.27**	0.16**	−0.16**	−0.23**	−0.15**	0.14**	0.11**	0.24**	0.21**	0.20**	0.15**	0.20**	0.19**	−0.43**	0.13**	–		
20.IP	−0.31**	−0.14**	−0.21**	0.40**	−0.15**	0.20**	0.19**	0.16**	−0.04	−0.09**	−0.31**	−0.17**	−0.17**	−0.09**	−0.13**	−0.05	0.36**	−0.19**	−0.20**	–	
21.EP	−0.38**	−0.22**	−0.31**	0.40**	−0.15**	0.18**	0.22**	0.15**	−0.07**	−0.09**	−0.28**	−0.17**	−0.16**	−0.15**	−0.12**	−0.11**	0.36**	−0.16**	−0.22**	0.52**	–

Note. $p^* < 0.05$; $p^{**} < 0.01$;

Abbreviations: MUO, Maternal urban orientation; MRO, Maternal rural orientation; PUO, Paternal urban orientation; PRO, Paternal rural orientation; HC, Household chaos; HEFE, Home executive function environment; MR, Marital relationship; MCP, Mothers' Co-Parenting; FCP, Fathers' Co-Parenting; MEF, Maternal executive function; MB, Maternal burnout; MW, Maternal warmth; MP, Maternal punishment; MCR, Mother-child relationship; PEF, Paternal executive function; PB, Paternal burnout; PW, Paternal warmth; PP, Paternal punishment; FCR, Father-child relationship.

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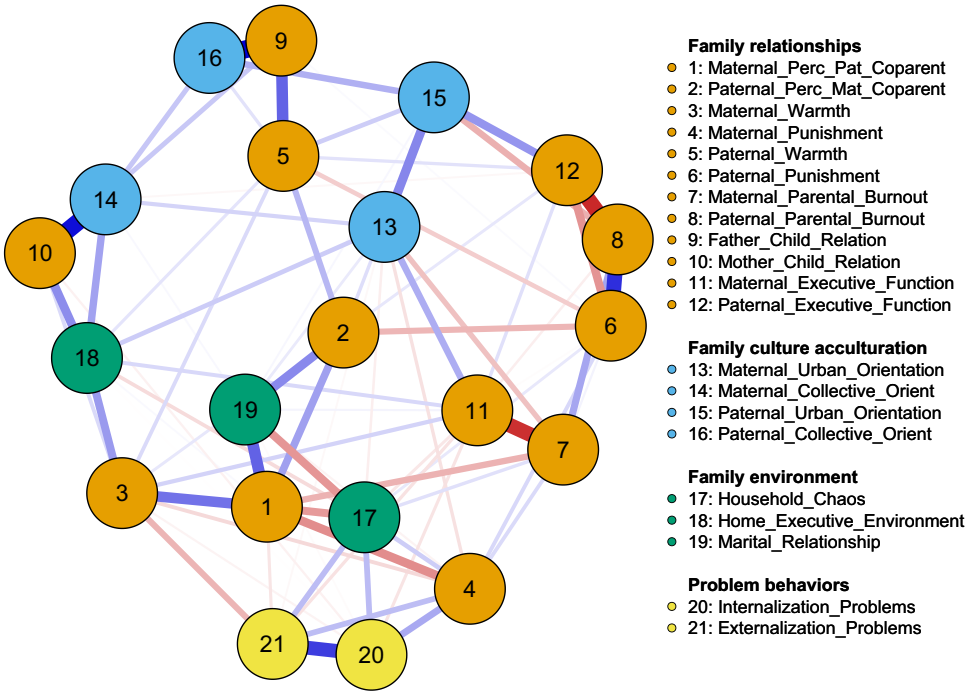

Figure 1 Family network analysis of problem behaviors among urban children.

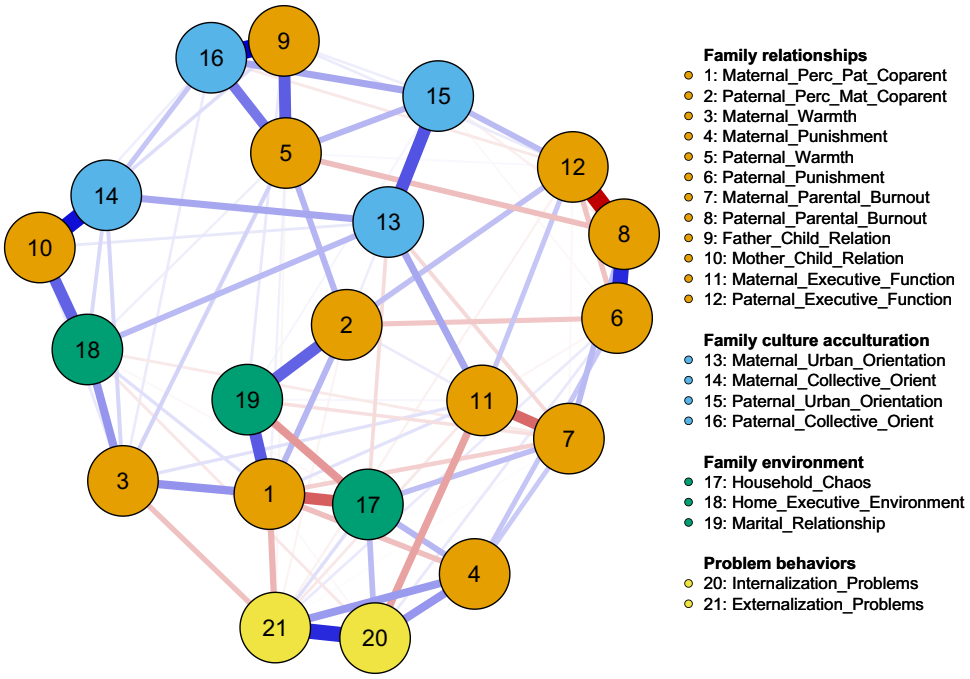

Figure 2 Family network analysis of problem behaviors among migrant children.

positively associated only with externalizing problems in migrant children. Conversely, maternal urban orientation (β = −0.011) was negatively associated only with externalizing problems in urban children.

Latent Profile Analysis of Problem Behaviors in Migrant Children

To explore the potential subtypes of problem behaviors among migrant preschool children, latent profile analysis (LPA) was conducted using internalizing and externalizing problems as observed variables. Models with 1 to 3 latent classes

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were tested, and the model fit indices are presented in Table 3. Among the tested models, the three-class model did not achieve a significant Lo-Mendell-Rubin (LMR) likelihood ratio test, suggesting that the two-class model was a better fit. Furthermore, the two-class model had a higher entropy coefficient, indicating higher classification accuracy. Considering the model fit indices and classification reliability, the two-class model was selected as the final model.

As shown in Figure 3, Class 1 (referred to as Group 1) scored higher than Class 2 on both internalizing and externalizing problem behaviors. As such, Class 1 was labeled the "risk group" comprising 118 children, and Class 2 was labeled the "general group" comprising 841 children.

Network Analysis of Family Factors Between Risk and General Migrant Children

To identify the core influencing factors of problems behavior, we compared network models for risk group (n = 118) and general group (n = 841) (see Figures 4 and 5). Both networks were characterized by high accuracy and stability (see Figures 3 and 4). The network model for risk and general group was highly dense, comprising 171 edges. The network for the general group contained 78 non-zero edges, while the risk group network contained 25 non-zero weighted edges. The global strength (or density) was greater in the network of general group than risk group children (7.50 vs 4.11).

As shown in Figure 4, in the general group, significant positive correlations were observed among paternal cultural identity, maternal cultural identity, paternal values, and maternal values. These variables were also positively associated with the parent–child relationship, paternal warmth, maternal warmth, family executive function environment, and maternal executive functions, forming a beneficial cluster effect. Conversely, as shown in Figure 5, in the risk group, the variables were relatively independent, forming non-overlapping clusters or isolated chains of variables. For instance, the paternal cultural risk variables were not correlated with one another but instead formed their own individual clusters. Specific examples in risk group include:

Maternal Cluster 1: Maternal collective orientation → mother–child relationship → family executive function environment.

Paternal Cluster 1: Paternal collective orientation → paternal warmth→ father–child relationship.

Maternal Cluster 2: Maternal urban orientation→ maternal executive functions→ maternal parenting burnout.

Paternal Cluster 2: Paternal executive functions → paternal parenting burnout→ paternal punishment.

Discussion

Guided by family systems theory and the cumulative risk framework, this study integrates three domains of family risk factors—cultural, environmental, and relational—to examine their associations with preschool migrant children's problem behaviors. Through network analysis, we compared families of urban and migrant children, as well as families of general migrant and risk-group migrant children, to identify key family-level predictors of problem behaviors.

Key Findings

Our findings highlight three significant risk factors for both urban and migrant preschool children's mental health: household chaos, maternal punishment, and maternal executive function. Specifically, household chaos and maternal punishment displayed positive correlations with both internalizing and externalizing problems. Aligned with previous research, noisy or disorganized environments not only disrupt children's attention and cognitive development but can also indirectly shape negative parenting behaviors.[6,50] Moreover, maternal punishment undermines children's sense of

Table 3 Model Fit Indices for Latent Profile Analysis (N = 959)

Model	AIC	BIC	aBIC	Entropy	LMR	BLRT	Class (%)
1C	526.79	546.26	533.55	–	–	–	–
2C	**239.38**	**273.44**	**251.21**	**0.85**	**<0.001**	**<0.001**	**0.88/0.12**
3C	143.73	192.39	160.63	0.64	0.01	<0.001	0.52/0.41/0.07

Abbreviations: AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; ABIC, Adjusted BIC; LMRT, Lo-Mendell-Rubin Likelihood Ratio Test. Model 2 was the selected model.

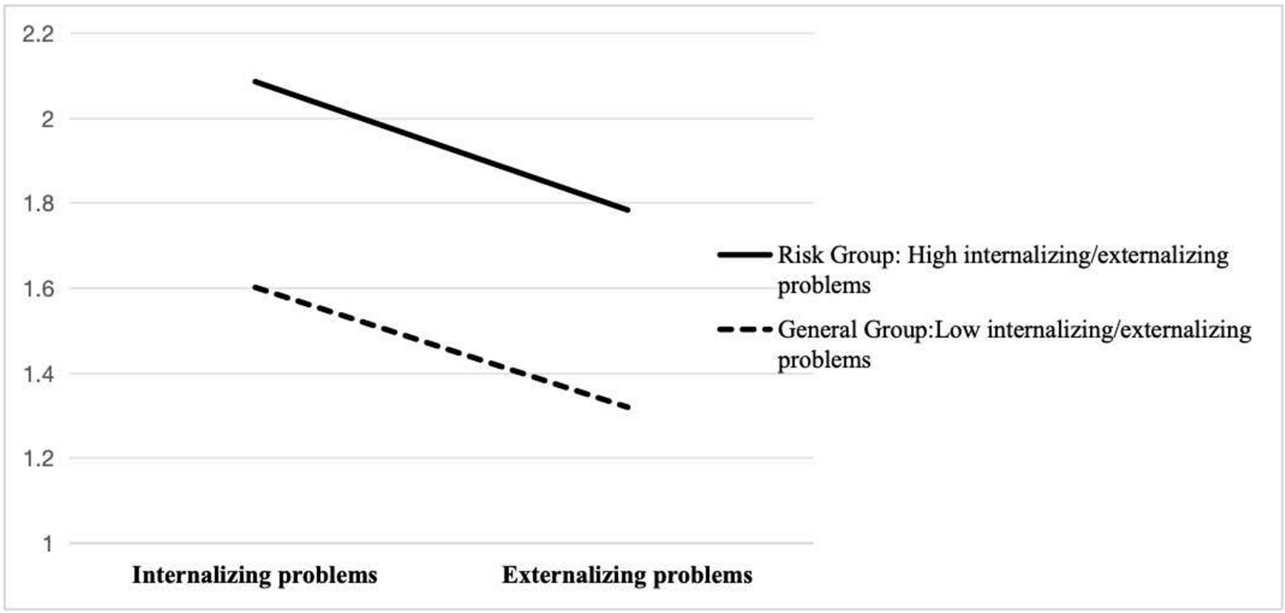

Figure 3 The two latent profiles of problems behavior among migrant children.

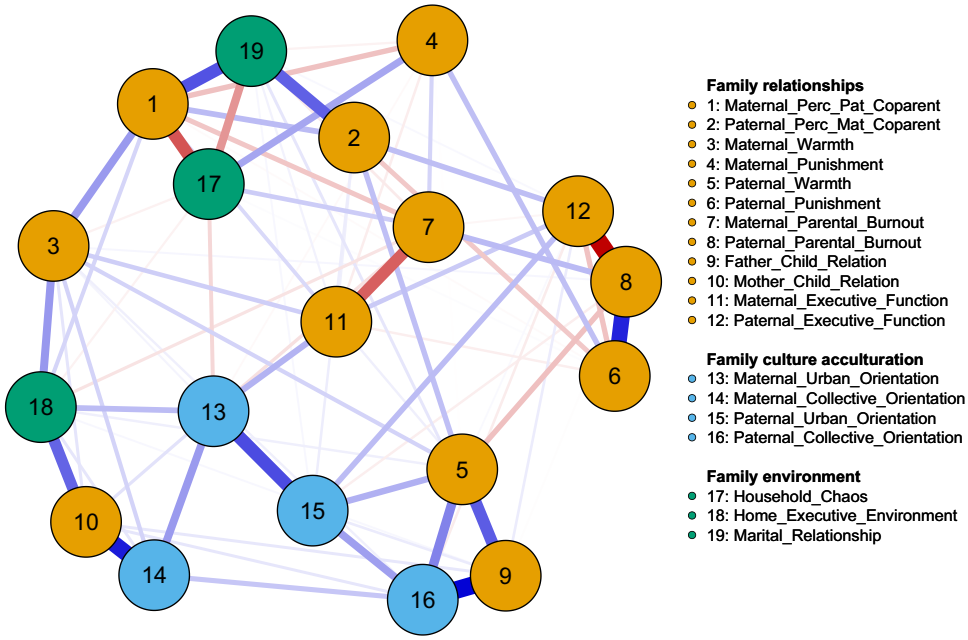

Figure 4 Family network analysis of general group among migrant children.

security, increasing anxiety, depression, and aggression.[51,52] These effects may be especially pronounced in migrant families with limited resources and social support.[53] By contrast, maternal executive functioning was negatively related to children's problem behaviors. Mothers who display stronger self-regulation and emotional control are better equipped to handle complex parenting challenges and to provide a supportive emotional climate.[54,55] Such a positive environment helps reduce children's internalizing and externalizing symptoms.[56–58] Conversely, mothers with poorer executive skills may respond to stress more emotionally, thereby transmitting negative affect to children.[59]

https://doi.org/10.2147/PRBM.S519806

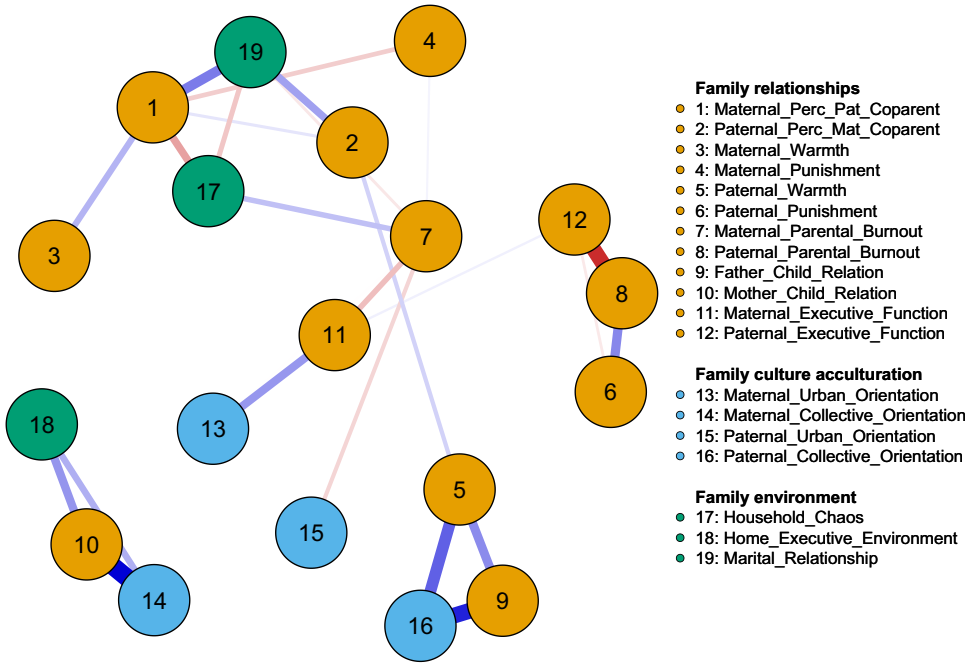

Figure 5 Family network analysis of risk group among migrant children.

Further analyses revealed differential influences of paternal and maternal roles in the family networks of migrant and urban children. For migrant children, paternal co-parenting, paternal punishment, and paternal burnout were significantly linked to externalizing problems, while paternal executive functioning, paternal warmth, paternal punishment, maternal co-parenting, and maternal burnout were significantly associated with internalizing problems. In urban families, mother–child relationships, maternal warmth, and marital conflict were uniquely related to externalizing problems, whereas maternal urban cultural orientation was significantly associated with internalizing problems. These variations underscore distinct social and economic conditions faced by migrant and urban families. In migrant families, fathers often bear heavier economic responsibilities and face heightened psychological stress, complicating their parenting role.[60,61] Under pressing financial constraints and social isolation, fathers may resort to negative strategies (eg, corporal punishment) more readily.[62,63] By contrast, non-migrant families generally benefit from more ample resources and stable family structures, rendering maternal roles more pivotal.[64,65] Urban mothers may have greater capacity to offer time, emotional support, and child-centered parenting, fostering children's emotional security and reducing internalizing symptoms.[5] However, maternal roles in urban families also appear more vulnerable to marital conflict, thereby affecting children's emotional well-being.[66]

When comparing general migrant children to those in the high-risk group, the latter's family network displayed lower overall density but higher clustering. Notably, fathers and mothers each formed tightly interlinked "risk clusters." For fathers, reduced executive functioning, paternal burnout, and punitive behaviors appeared closely connected, reflecting how economic strains and life stressors in migrant contexts might diminish paternal emotional regulation.[51,59] Similarly, maternal rural orientation, mother–child relationships, and the family's executive functioning environment formed another closely knit cluster. Mothers struggling to reconcile traditional rural values with modern urban parenting demands may experience heightened stress, negatively influencing family dynamics and parenting practices.[67]

In contrast, general migrant families exhibited a more dispersed network with moderate interconnections, indicative of better functioning. Environmental pressures on high-risk migrant families are likely more severe, potentially triggering greater sensitivity to one another's parenting practices.[68,69] Misalignment in parenting strategies may exacerbate children's maladjustment,[70,71] and parents' limited executive functioning along with high levels of burnout can directly impair children's mental health via affective spillover.[59,72] Hence, a tightly clustered "risk network" can magnify adverse

influences on children's psychological development, culminating in more severe internalizing and externalizing issues.[73,74]

Moreover, it was found that among the high-risk group for behavioral problems in migrant children, the influencing factors from fathers and mothers appeared as distinct clusters, but the correlation between the two was relatively weak. This phenomenon may be attributed to the nature of migration among parents, where typically only one parent, often the father, migrates to urban areas for work, while the other parent remains behind.[13] This extended separation can lead to shifts in the cultural values and orientations of both parents, with each adapting to different environments and social contexts. Thus, in the context of urban migrant children, the father's and mother's influencing factors cluster separately due to their distinct experiences and roles in the migration process. Fathers may be more focused on economic provision and work-related influences, while mothers may grapple with their dual roles of caregiver and growing economic contributor. The lack of significant correlation between mother and father influences may indicate that their perspectives and responses to parenting are shaped more by their individual circumstances than by a shared cultural orientation, reflecting the complexities of modern migration dynamics in China.[12]

Overall, household chaos, maternal punishment, and maternal executive function emerged as common risk factors for both migrant and urban preschool children's problem behaviors. Yet, the roles of paternal and maternal factors diverged between these populations, reflecting their distinct socio-economic and cultural contexts. For high-risk migrant children, tightly knit "risk clusters" underscore the compounded vulnerabilities faced by these families. These findings illuminate how complex family-risk networks influence preschool-aged children's mental health and highlight the importance of targeted interventions that bolster parental resources, emotional regulation, and supportive family environments.

Limitations

One limitation of this study concerns the representativeness of the sample. Although the study included both migrant and non-migrant children, the recruitment was constrained to a limited number of urban and migrant settings. Consequently, the findings may not generalize to broader populations of preschool children from different geographic locations or cultural backgrounds.

A second limitation is the cross-sectional design, which restricts the ability to infer causal relationships. Although the network analysis approach reveals complex associations among risk factors, it does not conclusively determine their temporal sequence. Longitudinal designs or experimental studies would be needed to clarify cause-and-effect pathways.

Third, the measurement instruments relied mainly on reports from parents and caregivers, raising the possibility of response biases. Social desirability or misunderstandings of questionnaire items could influence how participants rated themselves and their children. Future studies may benefit from integrating multiple data sources, such as teacher reports or direct observational measures of family interactions.

Finally, the scope of risk factors examined in this study was comprehensive but did not capture all possible influences on children's mental health. For example, broader socioeconomic and neighborhood-level factors might also shape children's behavioral outcomes. Future research could expand the family-related variables to include macro-level risks, thereby providing a more holistic view of migrant children's developmental ecology.

Theoretical Implications

First, the findings highlight the need to view child mental health outcomes through an ecological lens, reinforcing Bronfenbrenner's premise that children's development is nested within multiple interconnected systems. By using network analysis, this study underscores how parenting behaviors, family relationships, and contextual risks interweave to influence problem behaviors, suggesting that single-factor models may offer only a partial understanding of children's mental health.

Second, the observed differences between migrant and urban families offer new perspectives on the cumulative risk model. Specifically, while certain risks (eg, household chaos, maternal punitive discipline) appear universal, other factors (eg, paternal co-parenting, paternal punishment) become especially salient within migrant contexts. These nuanced distinctions enrich cumulative risk theory by demonstrating that the same risk factors can function differently depending on a family's migration or socioeconomic background.

Third, this research advances family systems theory by illustrating distinct "clusters" of maternal and paternal risk in families with varying levels of child problem behaviors. The formation of separate maternal and paternal clusters in high-risk migrant households reveals how spousal or co-parenting processes may become fragmented under stress. These insights extend theoretical models of the family system, highlighting the importance of examining paternal and maternal roles separately in certain high-risk contexts.

Practical Implications

From an intervention standpoint, one key implication is that reducing household chaos and promoting more positive maternal discipline strategies should be a priority for both migrant and non-migrant families. Educators, community agencies, and policy-makers can design parent training programs aimed at teaching effective behavior management and stress-reduction techniques.

A second practical implication involves supporting mothers' executive functioning, which appears to serve as a protective factor across different family contexts. Interventions that help mothers regulate their own emotions and strengthen problem-solving skills could mitigate children's externalizing and internalizing symptoms. This may include mindfulness-based programs, mental health support, and community resources to alleviate maternal stress.

Finally, for migrant families, culturally specific father-focused interventions are crucial. Targeted strategies are essential to enhance fathers' involvement. Suggested practices include developing culturally customized parenting programs that incorporate traditional Chinese activities and workshops designed to actively engage fathers in their children's education. Additionally, raising awareness and promoting positive father role models can transform the perception of fathers as mere financial providers. To address the unique challenges faced by fathers in migrant contexts, such as economic pressures and limited social support, it is vital to implement programs that focus on paternal mental health, stress management, and positive co-parenting techniques. Furthermore, maintaining father-friendly options like flexible participation times, online training, and culturally tailored counseling can significantly improve program engagement and effectiveness, ultimately benefiting children's overall development.

Conclusion

This study is pioneering in its application of network analysis to examine family risk networks associated with the mental health of preschool migrant children. By comparing migrant and non-migrant children, household chaos, maternal punishment, and maternal executive function as core factors contributing to both internalizing and externalizing problems. Notably, paternal influences were more pronounced in migrant families, while maternal influences were more salient in urban families. Among migrant families, high-risk children exhibited risk networks centered on both mothers and fathers, but with lower overall network connectivity, indicating a more fragmented pattern of family risk dynamics within this group. Furthermore, the contrasts observed between migrant and urban families, as well as between general-risk and high-risk migrant families, highlight the complex interplay of economic pressures, cultural orientations, and family functioning in shaping the mental health of preschool children. These findings underscore the need for tailored, father-based interventions that address the unique risk structures present in different family contexts, particularly for high-risk migrant children.

Data Sharing Statement

The datasets used or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Statement

The studies involving human participants were reviewed and approved by the Experimental Ethics Committee of the Shanghai Normal University (the ethical approval number is 2022040) and have been executed consistent with ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The participants provided their written informed consent to participate in this study.

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Disclosure

The authors report no conflicts of interest in this work.

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