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Teachers' perception on physical activity promotion in kindergarten children in China: a qualitative study connecting social-ecological model

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Abstract

Background Globally, the majority of kindergarten-aged children face obesity issues and insufficient physical activity (PA) engagement. Regular PA participation can provide various health benefits, including obesity reduction, for kindergarten-aged children. However, limited studies have investigated the factors influencing kindergarten-aged children's PA engagement from the perspective of their teachers. This qualitative study aimed to identify factors that could help promote PA among kindergarten-aged children from teachers' perspectives, including facilitators, barriers, and teachers' recommendations.

Methods Fifteen kindergarten teachers (age range: 28–50 years; mean age: 38.53 years) with teaching experience ranging from 2 to 31 years (mean: 16.27 years) were recruited from Shanghai municipality, Henan, and Jiangsu provinces in China. One-on-one semi-structured interviews were conducted via face-to-face ($n=7$) or telephone ($n=8$) to gather insights into factors influencing PA promotion among kindergarten-aged children. The interviews were audio-recorded, transcribed, and analyzed using a constant comparison approach based on grounded theory, which involved open, axial, and selective coding processes.

Results The study revealed mutual theoretical support between themes and the social-ecological model (SEM), as factors identified in the study are distributed at various levels of the SEM. Twelve factors were identified at four levels of the SEM: (1) intrapersonal level (children's personality and skills), (2) interpersonal level (family, peers, and teachers' influence), (3) organizational level (school environment and resources, opportunities for kindergarten teachers' training and children's PA, design and organization of PA, and PA that children need), (4) community level (family-school partnerships).

Conclusion Various factors at different levels can influence kindergarten-aged children's PA. The study's findings revealed that these factors are distributed across the first four levels of SEM, with the majority being at the organizational level. These multilevel findings are expected to assist in developing and implementing more effective

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PA interventions for kindergarten-aged children. Future research is warranted to identify strategies for promoting PA among kindergarten-aged children at the policy level of the SEM.

Keywords Physical activity, Kindergarten children, Perceptions, Social ecological model

Background

Physical activity (PA) is a critical human behavior that can prevent noncommunicable diseases, maintain a healthy body weight, and improve psychological health [1]. Conversely, physical inactivity is one of the leading causes of mortality globally [2]. A higher level of PA can promote cognitive and motor development, improve psychosocial and cardiometabolic health, and reduce obesity in kindergarten-age children [3, 4]. PA begins to establish in early childhood (aged 0–5.9 years) and continues to track into middle childhood (aged 6–12 years) [5]. PA in early childhood can predict PA in youth and adulthood [6]. In other words, early childhood (e.g., kindergarten) is a foundational stage, and establishing PA habits during this period can lead to sustained PA into adulthood. Additionally, research showed that promoting PA in kindergarten-age children enormously benefits their current and future health [3, 5]. The World Health Organization recommends that children aged 3 to 4 years worldwide accumulate at least 180 min of PA daily, including at least 60 min of moderate to vigorous PA [2].

Despite the many benefits of PA, the majority of kindergarten-age children globally still did not meet recommendations [7]. For instance, in Brazil and Portugal, only 40.0% and 28.6% of kindergarten-aged children achieved PA recommendations, respectively [8, 9]. In Beijing, China, 65.4% of kindergarten-aged children met the PA recommendation, while in Hunan, China, the proportion was only 22.3% [10, 11]. These statistics indicated that the majority of kindergarten-aged children's PA was insufficient in China, which has approximately 47.139 million children in kindergartens [12]. Moreover, the prevalence of obesity or overweight issues among kindergarten-age children is a growing concern. Globally, the proportion of children under the age of 5 who were overweight increased modestly from 4.8% in 1990 to 5.9% in 2018 [13]. In 2020, a report from the National Health Commission of the People's Republic of China revealed that over 10% of children under the age of 6 were obese or overweight [14]. Considering the prevalence of obesity is inversely related to PA in kindergarten-age children [15]. Promoting PA among kindergarten-age children is imperative to reduce obesity or overweight rates.

Research using ActiGraph accelerometry tracked PA patterns of kindergarten-age children throughout the day and found significantly lower activity levels on school days compared to weekends/holidays during the 8:00 to 17:00 time period [16]. The research findings underscored the importance of promoting kindergarten-aged

children's PA in the school setting to prevent obesity [16]. Schools play a vital role in fostering PA due to the considerable time children spend there, providing critical environments and resources such as equipment and structured activities led by teachers [17, 18]. Teachers are organizers and significant contributors to kindergarten-aged children's PA at school [19]. Their substantial time spent with children can enable them to develop profound insights into children's behavior and the factors that influence it. Hence, understanding the factors teachers perceive as contributing to enhancing PA in kindergarten-aged children is crucial for effective promotion strategies.

Qualitative methods have proven highly effective in revealing profound insights into individuals' distinctive experiences, which quantitative methods may not fully capture [20]. Previous studies have explored various factors that influence young children's PA [21–29], such as children's characteristics (e.g., self-efficacy, preferences, and health) [21, 22], teachers' beliefs [21], parental involvement [23], parent-caregiver partnership [24], available space, facilities and material [25], dress [26], and outdoor activities [27–29]. While several studies have explored various perspectives, including those of parents and childcare center staff, limited attention has been paid to exploring the teacher-perceived factors influencing kindergarten-aged children's PA participation [25, 30]. Sansolios et al. used observation and focus group interviews to gather insights from children, parents, and teachers on PA in kindergarten. The findings from teachers highlighted teachers' increasing workload and stress posed challenges to health-promoting initiatives such as PA interventions and underscored the necessity for PA interventions to be supported by necessary resources and management commitment [30]. De Craemer et al. conducted twenty-four focus groups to explore teachers' and parents' perceptions of children's PA in preschool settings (e.g., preschool or kindergarten) [25]. Their findings revealed that teachers perceived facilitators of children's PA, including available facilities, ample space, stimulating materials, and gym room availability, while staff shortages and playground safety were viewed as barriers [25].

Given the alarming prevalence of obesity and insufficient PA engagement among kindergarten-aged children, identifying the factors that could help promote PA in this demographic is imperative. However, there is limited research investigating these factors from the viewpoint of teachers. Understanding the factors that teachers perceive can help devise effective promotional interventions,

Table 1 Participants demographics ($n = 15$)

Demographics	Frequency (n)
Age:	
< 35 years old	5
35–45 years old	7
> 45 years old	3
Area:	
Shanghai	6
Henan	7
Jiangsu	2
Years of teaching experience:	
< 10 years	5
10–20 years	5
> 20 years	5

given their significant role and substantial time with kindergarten-aged children in the school setting. Therefore, this qualitative study aimed to explore these factors through teachers' perspectives. Specifically, it explored (i) the facilitators and barriers influencing kindergarten-aged children's PA engagement and (ii) teachers' recommendations for promoting their PA.

Methods

Study design

A qualitative study was conducted, which has shown to be highly effective in revealing profound insights into individuals' experiences [31]. The study was approved by the Ethics Committee at the Shanghai University of Sport (102772019RT034).

Participants

15 participants were recruited from kindergartens across Shanghai municipality ($n=6$), Henan ($n=7$), and Jiangsu provinces ($n=2$), China, in November 2021. Purposeful sampling was used to recruit participants at each kindergarten who could provide valuable and detailed information on promoting kindergarten-aged children's PA. The inclusion criteria to ensure the collection of useful and detailed insights from experienced teachers were: (1) teaching kindergarten-aged children PA, and (2) at least two years of teaching experience. Voluntary participation was ensured as an ethical consideration during the recruitment of participants. The content of the study was introduced to the participants for their approval. All participants signed the informed consent form. A total of 15 teachers (female=100%) aged 28~50 (mean=38.53) were recruited to participate in the study, with experience ranging from 2 to 31 (mean=16.27) years of teaching (Table 1).

Data collection

One-on-one semi-structured interviews via face-to-face ($n=7$) and telephone ($n=8$) were conducted by a research

Table 2 Interviews script

Questions and prompts
What do you think about children's physical activities at present? (Prompt: FITD)
How do you plan and organize physical activity for children? (Prompt: FITD)
If you could change one thing here to get children involved in more physical activity, what would it be?
What kind of physical activities do you think children need more at this stage? (Prompt: FITD)
What role do you think teachers play in promoting physical activity in children?
What factors do you think affect children's participation in physical activity?

Note: FITD refers to the dimensions of physical activity, including frequency, intensity, type, and duration

team from the Shanghai University of Sport, including six master's students and two doctoral students. Interviews took place in a comfortable and undisturbed place of kindergarten or at the university of the interviewers and lasted an average of 31.3 min. Before the interviews, a script focused on questions and prompts relating to the barriers, facilitators, and recommendations for promoting kindergarten-aged children's PA was developed (Table 2). Besides, participants were informed about the aim of the interviews and asked permission to audio record the interviews, and all participants consented to the recording. During the interviews, the participants provided their demographics (e.g., age and years of teaching experience), and then a script of open-ended questions was used to obtain the teachers' perceptions. Data collection ended when data saturation was reached, that is, participants gave no more new information. After the interviews, the interviewers transcribed the audio recording verbatim, and the interviews were anonymized to protect the participants' privacy. The first author repeatedly reviewed the transcripts to confirm the accuracy and invited participants to review the transcript for verification.

Data analysis

Data analysis was carried out by following the principles of grounded theory, adopting a constant comparison approach across open, axial, and selective coding processes [32]. All transcripts and audio recordings were constantly reviewed to help us better understand the interviewees' perceptions. Sections of transcripts relevant to children's PA, including facilitators, barriers, and teachers' recommendations for PA promotion, were extracted. During open coding, similar sections were grouped together and then coded. Subsequently, subcategories connected between codes were created through axial coding by constantly comparing codes. In the final stage of selective coding, we further compared

subcategories and discovered their apt alignment with the social-ecological model (SEM) framework.

SEM posits that factors influencing human behaviors are determined at multiple levels: Intrapersonal, involving individual characteristics (e.g., gender, attitudes, and skills); Interpersonal, encompassing social relationships and social support systems (e.g., friends, family, and teachers); Institutional/organizational, comprising social institutions with their structures and norms (e.g., schools, home, workplace); Community, involving relationships among organizations, institutions, and informal networks within defined boundaries, (e.g., partnerships between organizations and neighborhood characteristics); And public policy, which includes governmental and organizational policies, laws, and regulations (e.g., national, and local laws and policies) [33, 34]. The model assumes that individuals and the environment in which they exist are constantly interacting and shaping each other [33, 35]. Interventions at multiple levels are most effective in behavior change [36]. SEM offers a multiple-level framework to conceptualize these factors [37]. Over the years, it has been widely adopted in many qualitative studies related to PA in different age groups [22, 37–41].

Throughout the analysis, memos were recorded to enhance the depth and rigor of interpreting the findings. The first and third authors coded all transcripts independently and discussed disagreements until a consensus was reached. Additionally, the derived themes underwent rigorous scrutiny by the second and fourth authors. The first author ensured transparency by sharing all transcripts, codes, and themes with them, minimizing the risk of oversight or bias. The final list of themes was determined when four researchers reached an agreement.

Results

The study revealed mutual theoretical support between themes and the SEM, as identified factors influencing PA in kindergarten-aged children involve four levels of SEM: intrapersonal, interpersonal, organizational, and community (Fig. 1). We extracted the salient text passages and translated them into English as exemplar quotes for themes. Each exemplar quote was followed by the participant’s identification and quote numbers. Exemplar quotes to illustrate codes and subcategories are presented in Table 3.

Intrapersonal level

Children’s personality

Six out of fifteen teachers described children’s personalities as timid, shy, and introverted, obstructing their PA engagement. For example, children with this personality were afraid to participate in activities such as jumping in a pit or hanging on a horizontal bar with both hands (Table 3, quotes 1–3).

Children’s skills

Four teachers expressed that children’s poor skills can influence their abilities to be active and hinder them from interacting or cooperating with other children. They explained that children with poor coordination faced challenges completing games with other children, which caused them to give up activities easily (Quote 4). They emphasized that children’s physical fitness was constantly decreasing, which made them unable to do activities and were prone to sick. As a teacher stated, “Child’s physical fitness is constantly declining, he/she can’t run or walk, and he/she gets sick when he/she moves.” (Quote 5).

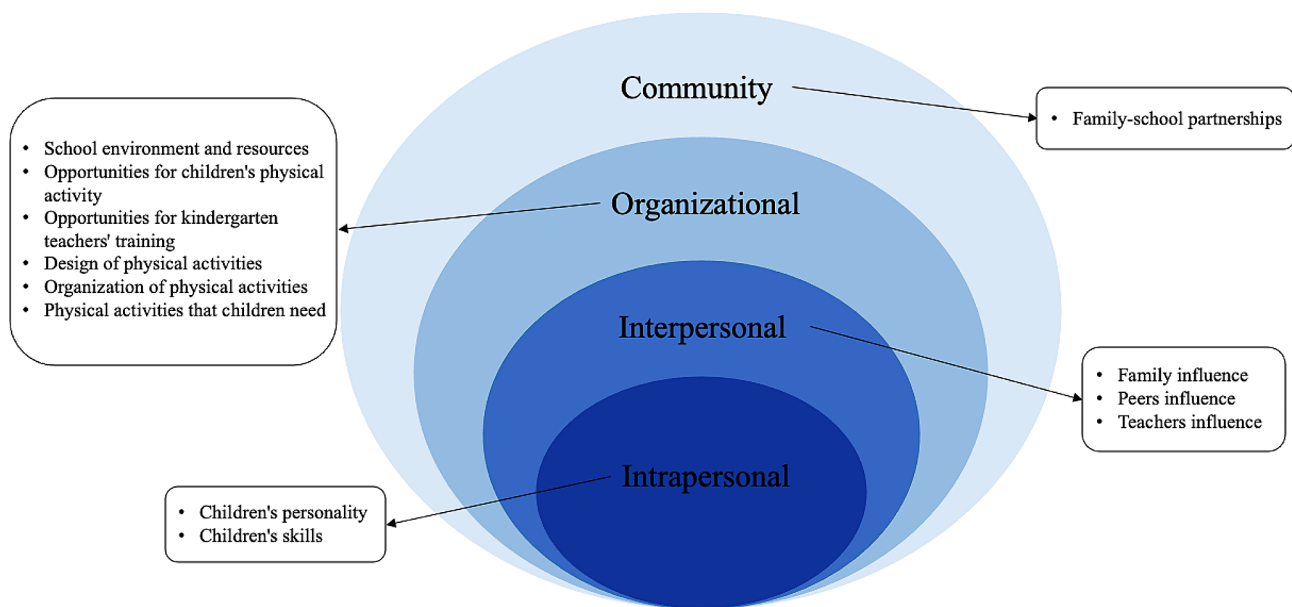


Fig. 1 A social-ecological model for promoting physical activity in kindergarten children

Table 3 Exemplar quotes by codes and subcategories

Subcategories	Codes	Quotes
Children's personality	Introverted	"Children are active and playful by nature, and children like to participate in sports very much. But personality can affect a child's physical activity, some children are introverted and prefer to be quiet. He/she may be afraid of challenging activities."(T13; Q1)
	Shy	"For a shy child, in fact, for him/her, it is more of a fear."(T3; Q2)
	Timid	"Some children are quite timid about physical activities. For example, there is a sand jumping pit in our backyard, and then the horizontal bar hanging from both hands, they are particularly afraid."(T11; Q3)
Children's skills	Poor coordination	"Some children have poor coordination with the rhythm, they can't control the rhythm of the bamboo pole by singing nursery rhymes with other children. He/she can't play with them, so he/she gives up."(T5; Q4)
	Poor physical fitness	"Child's physical fitness is constantly declining, he/she can't run or walk, and he/she gets sick when he/she moves."(T15; Q5)
Family influence	Parents' attitude toward physical activity	"Parents do not pay attention and think that sports activities are optional. The main thing is that children can learn more knowledge."(T15; Q6) "If parents themselves love sports, there must be parent-child activities. Some of their parents may pay more attention to this aspect, so they will be more inclined to organize or take their children to participate in these activities."(T2; Q7)
	Grandparents' and parents' doting on children	"In some families, there is only one child, and the child will be more spoiled. For example, if the child exercises a lot, the child will say that I am so tired today, and I don't want to move anymore."(T9; Q8) "Parents and grandparents tend to spoil children, afraid of some safety factors, and some actions are not allowed for children to try."(T6; Q9)
Peers influence	Peers interaction	"We also have interaction between students and students. Children teach children, find a playmate with relatively strong ability, not all of them with poor ability, you two to cooperate."(T5; Q10)
Teachers influence	Teachers' involvement in physical activity	"We can play together with children, it will stimulate their sports atmosphere."(T2; Q11) "Like child who is not so fond of sports, we have to drive him/her more, accompany him/her to do it, so that he/she will not feel insecure."(T9; Q12)
	Teachers' encouragement	"There is also appropriate encouragement, the teacher's language encouragement, and rewards. For example, in the game, you have a little flower, and draw a five-star on the blackboard."(T13; Q13) "Encouragement for some children, motivating them to challenge. There must be an encouragement for those who are more fearful."(T2; Q14)
	Teachers' attitudes toward physical activity	"I think I love sports, and I want all children to learn to exercise."(T12; Q15) "I think one of the biggest promotions is to make children more confident, bold, lively and dare to challenge, because this may be a point that we cannot breakthrough in education and teaching, but through sports, we may be better to develop it."(T3; Q16)
	Teachers' quality	"A more responsible teacher will arrange for the children to complete the running and jumping today, there will be warm-up and all the normal activities... it is my purpose not to give up any child, this is what I think you should do as a teacher."(T13; Q17) "If you are not professional, child is at most just running and playing. We invite outside coaches to take basketball and physical fitness classes, and children like them, because the teachers invited outside are more specialized, they have their own teaching methods, and they are more passionate."(T9; Q18) "How to scientifically arrange children's physical activities, most kindergarten teachers have no idea."(T14; Q19)
	The responsibilities of teachers during physical activity	"First, teachers lead by example, teachers are like setting a standard, you have to do well, then can influence the children."(T9; Q20) "If there is something inappropriate during the activity, we will also randomly intervene to guide the children in the right direction."(T8; Q21) "Teachers should protect children in activities to avoid unnecessary injuries caused by sports."(T13; Q22) "The safety problem is more serious now, the teachers do not dare to let go. Because of the pressure of the family, they have strong legal awareness, and it is normal for children to bump into each other before. If they fall now, we may get a lawyer's letter."(T6; Q23) "There are also frail or obese children will receive targeted individual care."(T4; Q24) "Teach students according to their aptitude. We should be good at observing each child. Some children are naturally active, and some children are simply quiet."(T10; Q25)

Table 3 (continued)

Subcategories	Codes	Quotes
School environment and resources	Teachers' gender	"Increase the ratio of male teachers because there is still a difference between female teachers and male teachers. Maternal instinct will subconsciously feel that this is a bit dangerous, to avoid unexpected things, thereby preventing students from activities."(T1; Q26) "Kindergarten teachers are basically more female teachers. In terms of professionalism and boldness in carrying out sports activities, they may not be more professional than male teachers."(T7; Q27)
	Facilities	"We used to make our own sports equipment in kindergarten, but it was easy to break. The kindergarten is now buying [brand name] sports equipment, which is a specialized sports equipment for children."(T13; Q28) "The class is generally divided into bold and timid children. Bold child is not satisfied with some simple equipment and likes to play some more challenging things that attract her/him."(T4; Q29)
	Finance	"We see that other kindergartens have specialized physical education teachers. We have thought about it before but considering the cost."(T12; Q30) "For the use of facilities, I think our kindergartens have been improving, but public kindergartens are affected by funds, and some things are difficult to be approved."(T13; Q31)
	Space	"The kindergarten is too small, it can only meet some daily teaching, sports activities are greatly affected, some sports equipment has no place to put it at all."(T10; Q32) "We wanted to do some ball games, like basketball and soccer. However, due to the limitations of the venue, it has not been possible to carry out."(T11; Quote 33)
	Weather	"It's too cold, children wear more clothes, it's not convenient to exercise for a long time."(T7; Q34) "Weather may be one of the biggest distractions. On rainy days, we may switch from outdoors to indoors, which is a big change in the venue"(T3; Q35) "Sometimes it's smog, we can't go out."(T6; Q36) "When the sun is shining, the child will play an outdoor exercise."(T4; Q37)
	Opportunities for kindergarten teachers' training	Lack of teacher training
Requires teacher training		"Professional teachers should be invited to conduct some training for kindergarten teachers."(T7; Q40)
Opportunities for children's physical activity	COVID-19 impact	"During the pandemic, children have to take turns to leave school, so the time for the end of sports is earlier."(T7; Q41) "If there was no pandemic, we often hold a parent-child sports meeting every semester."(T8; Q42)
	Other activities impact	"A short day in kindergarten is full of courses in art, literacy, mental arithmetic, crafting and more. It is difficult to ensure the outdoor activity time."(T15; Q43)
Design of physical activities	Diversity and attractiveness	"Has the content achieved diversity and attractiveness, and can it stimulate kid's interest in participating in our sports activities? When we carry out sports activities, kids prefer gamified and contextualized activities. If our teachers can create a strong atmosphere, it may greatly stimulate kids to participate."(T8; Q44) "We will compete in small groups to increase their interest."(T11; Q45)
	Avoid pure skill training	"If they just run for a long time, the children will be more tired and boring."(T9; Q46)
	Planned	"Each age group and each class should have their own sports plan, but I have seen other class activity teachers who may let the children play by themselves, which may have no purpose."(T12; Q47)
	Age-appropriate activities	"The design of sports activities should conform to the laws of children's physical and mental development."(T8; Q48) "The activities plan is formulated following the guidelines for the kids aged 3 to 6, which is based on the age of the child and is quite comprehensive."(T11; Q49) "If the difficulty is too high, he/she may not be able to complete it, which may inhibit the enthusiasm of the child."(T8; Q50)
	Step by step	"I will guide him/her step by step from the easiest to the hardest."(T12; Q51)
	Lay the foundation for the future	"In the case of the big class, they are about to enter the primary school, and the primary school requires skipping rope, so from the big class, we must teach the children to gradually change from never skipping rope to speeding up skipping rope."(T9; Q52)

Table 3 (continued)

Subcategories	Codes	Quotes
Organization of physical activities	Children autonomy	"We will target children who are weak in skipping rope and will ask the children's willingness. Today we have this group activity. If you are particularly willing to skip rope, we will have teachers specially to teach children how to skip."(T12; Q53) "When we organize regional sports, we focus more on the autonomy of children in sports. We will provide them with some high-structure materials and low-structure materials in the region. As for how they do it, it is entirely up to them to decide." (T3; Q54)
	Adequate physical activity time	"Each link is very compactly arranged, 8:10 to 9:00, 9:00 to 9:20, and 9:20 to be here. In fact, more time should be given to children, so that they can fully play and go to experience."(T5; Q55) "Our kindergarten sports activities are carried out relatively well. Children spend at least two hours of outdoor activities every day."(T12; Q56)
	Sports-appropriate clothing	"Children in our kindergarten seldom wear skirts, because it is not convenient for sports, we are basically all wear sports pants and sports shoes, including our teachers who rarely wear skirts, because they have to exercise with the children."(T5; Q57) "The adultization of children's clothing limits children's range of activities."(T14; Q58)
	Monitor the intensity of physical activity	"We will bring the heart rate belt to the child, which is to monitor the amount of exercise of the child at any time."(T5; Q59) "We will pay attention to the intensity of exercise. We usually check whether his/her face is red or not, and touch the places on his/her back that are prone to sweating. Another one is to measure the heartbeat."(T6; Q60)
	Simple and interesting organization	"Keep the language as simple as possible when organizing, stimulate young children's interest in physical activities through interesting explanations and demonstrations to keep them engaged, when we are playing a game, we make some simple rules."(T10; Q61)
	Physical activities that children need	Outdoor activities
Ball games		"The principal also wants to carry out soccer, ball game, soccer is to let the children participate in the whole people."(T13; Q63)
Rhythmic activities		"Integrate performance into upper and lower body movement, and songs guide actions, so that children's games can be more interesting."(T14; Q64)
Physical activities that develop fundamental movement skill and physical fitness		"Kindergarten children should set their movements based on their physical and mental characteristics, and also cover this whole-body movement. The learning of various motor skills is required."(T2; Q65) "I think today's children need more activities to improve their physical fitness, because our children are relatively lack of exercise."(T10; Q66)
Family-school partnerships	Family-school cooperation	"Emphasizes collaboration with families. For example, our kindergarten will regularly hold parent-child games or fun games for our big class."(T8; Q67) "I think the most important thing is for parents to cooperate and understand. I think it is a double benefit. If your parents are like this now, I think it is very strange. Teachers dare not let their children exercise."(T6; Q68)
	Family-school communication	"We can also promote the methods and content of sports activities to parents through different forms, so that it can be carried out at home."(T8; Q69) "Some children never like sports, so I will communicate with the parents and ask them to help motivate the children to move."(T9; Q70)

Note: T=Teacher, Q=Quote

Interpersonal level

Family influence

Ten teachers mentioned the family influencing their children's PA. Parents' attitude toward PA directly impacts their children's PA participation. They reported that some parents did not prioritize their children's PA, instead focusing on their cultural knowledge (Quote 6). Conversely, parents who valued PA and engaged in it themselves positively influenced their children's PA participation (Quote 7). Additionally, they highlighted that overindulging by parents and grandparents can hinder children's PA. It influenced children's perseverance to be active, as spoiled children can be hesitant to or quickly

abandon exercise when tired (Quote 8). They felt parents and grandparents were overly protective, preventing children from participating in activities due to safety concerns (Quote 9).

Peers influence

A few teachers ($n=3$) reported that peer interaction was conducive to children's PA. They can help and learn from each other during PA (Quote 10).

Teachers influence

All teachers ($n=15$) stated their influence on children's PA. They emphasized the positive impact of teachers'

involvement and encouragement in motivating children to engage in PA. Teachers' active engagement can stimulate children's enthusiasm and create a vibrant atmosphere (Quote 11). This was especially beneficial for inactive children, as teachers can motivate and accompany them during activities (Quote 12). Teachers' encouragement could take various forms to encourage children to participate in PA, such as providing verbal praise and tangible rewards like stickers (Quote 13). Teachers highlighted the importance of encouraging and praising timid children (Quote 14).

In addition, teachers mentioned how personal factors such as their attitudes toward PA and teaching quality influenced children's engagement in PA. They noted that teachers who have a preference for PA or believe PA offered benefits were more inclined to motivate their students to engage in it (Quote 15–16). Teachers characterized by responsibility and professionalism adeptly organize purposeful and effective activities (Quote 17–18), while less experienced teachers struggled to organize PA scientifically, resulting in less successful outcomes (Quote 19). They emphasized the pivotal role of teachers in developing children's PA and further explained several key responsibilities. These included serving as role models (Quote 20), ensuring proper movement guidance (Quote 21), safeguarding children from accidents while avoiding excessive overprotection, which could inadvertently limit children's PA opportunities (Quote 22–23), and implementing personalized teaching methods tailored to each children's abilities and circumstances (Quote 24–25).

Lastly, teachers suggested increasing the proportion of male teachers in kindergarten, given the predominance of female teachers in such settings (Quote 26–27). They observed specific differences between male and female teachers, noting that female teachers were more likely than male teachers to be overly cautious about potential PA-related risks and accidents (Quote 26). Additionally, it appears that certain biases against female teachers existed, perceiving them as less competent in PA than their male counterparts, as one teacher remarked, "Kindergarten teachers are basically more female teachers. In terms of professionalism and boldness in carrying out sports activities, they may not be more professional than male teachers" (Quote 27).

Organizational level

School environment and resources

Thirteen teachers highlighted the significance of the school environment and resources in influencing children's PA. This included facilities, available space, financial resources, and weather conditions. Regarding facilities, teachers emphasized the importance of having specialized and diverse options. Specialized facilities

were preferred over handmade ones, as the latter tended to break easily (Quote 28). Diverse facilities allowed children to select activities based on their preferences (Quote 29). The lack of specialized and varied facilities was partly due to financial constraints, as teachers mentioned that inadequate funding limited the availability of professional teachers and specialized facilities (Quote 30–31). Furthermore, teachers voiced concerns regarding limited space for children's activities, leading to difficulties accommodating certain facilities (Quote 32). This constraint also affected the feasibility of PA, which required more space, such as basketball and soccer (Quote 33).

Additionally, teachers noted the influence of weather conditions on children's PA engagement. Inclement weather, such as rain, smog, or extreme cold, hindered outdoor activities (Quote 34–36), whereas favorable weather conditions stimulated children's outdoor activities participation (Quote 37).

Opportunities for kindergarten teachers' training

Four teachers pointed out the need for kindergarten teachers' training. They suggested providing training opportunities to improve their skills. They explained that currently, most teachers rely on self-learning through the Internet and other teachers' courses (Quote 38–39). They expressed a desire for formal training initiatives, such as inviting professional physical education instructors to provide instruction for them (Quote 40).

Opportunities for children's physical activity

Four teachers expressed concerns regarding children's opportunities for PA. They reported that COVID-19 restrictions and other kindergarten activities have impacted children's PA opportunities (Quote 41–43). Due to COVID-19, children experienced reduced playtime as they had to wait in line to leave kindergarten (Quote 41), and parent-child activities could not be held (Quote 42). Additionally, the teachers observed that kindergarten schedules filled up with activities like art, literacy, and crafting, making it challenging to allocate sufficient time for outdoor activities (Quote 43).

Design of physical activities

All teachers advocated designing PA that captures children's interests and adheres to scientific principles. Attractiveness, achieved through gamification, contextualization, competition, and activity diversity, can stimulate children's enthusiasm for PA (Quote 44–45). Conversely, pure skills training was seen as less engaging for children (Quote 46). Additionally, the design of PA should consider scientific principles, including planned, age-appropriate, step-by-step, and lay the foundation for the future (47–52). Specifically, PA should be planned before starting children's PA (Quote 47), consistent with

children's developmental stages and national guidelines while maintaining a suitable level of difficulty (Quote 48–50), progressively guiding children through varying levels of difficulty (Quote 51), and establishing a foundation for future transitions (Quote 52). Teachers mentioned that considering the transition from kindergarten to primary school, kindergarten children in large classes should be adapted to the PA of primary school in advance (Quote 52).

Organization of physical activities

Participants ($n=15$) highlighted several factors that were conducive to children's PA when organizing it. These factors encompassed empowering children's autonomy in PA, allowing them to choose activities based on personal preferences (Quote 53–54), ensuring sufficient playtime for children's adequate exercise (Quote 55–56), providing sports-appropriate clothing for both children and teachers to enhance participation comfort (Quote 57–58), monitoring children's PA intensity through methods such as heart rate belts and observing physical indicators (e.g., faces color and sweat levels) (Quote 59–60), and adopting simple and interesting organization methods, such as simple language and activity rules, and engaging demonstrations (Quote 61).

Physical activities that children need

Thirteen teachers suggested activities promoting PA in children, including outdoor activities, ball games, rhythmic activities, and activities that enhance fundamental motor skills and physical fitness. They advocated for increased exposure to nature, urging against confining children to indoor environments (Quote 62), promoting participation in collaborative ball games to foster peer interaction (Quote 63), incorporating rhythmic activities infused with music and dance elements to captivate children's interest (Quote 64). Moreover, in light of children's skills and physical fitness deficiencies, teachers highlighted the need for activities to enhance their fundamental movement skills and physical fitness (Quote 65–66).

Community level

Family-school partnerships

Seven teachers mentioned the importance of fostering effective communication and cooperation between families and schools. They proposed strategies for family-school collaboration to promote children's PA participation. These strategies involved jointly organizing sports events such as parent-child games (Quote 67) and schools disseminating PA methods and content to families, encouraging PA at home (Quote 69). Teachers also emphasized the need for families to support and understand the school's initiatives and join teachers to motivate

children to participate in PA (Quote 68, 70). For example, one teacher expressed, "I think the most important thing is for parents to cooperate and understand. I think it is a double benefit. If your parents are like this now, I think it is very strange. Teachers dare not let their children exercise." (Quote 70).

Discussion

This study explored factors influencing PA among kindergarten children from teachers' perspectives. Twelve factors identified span four levels of SEM: intrapersonal level (children's personality and children's skills), interpersonal level (family influence, peers influence, and teachers influence), organizational level (school environment and resources, opportunities for kindergarten teachers' training, opportunities for children's PA, design of PA, organization of PA and PA that children need) and community level (family-school partnerships). These findings bolstered SEM's assertion that human behaviors are shaped by factors across multiple levels [33]. While SEM posits five levels of influence, in this study, teachers perceived influences up to the first four levels, excluding policy considerations, aligning with previous research trends in which people often overlooked policy impacts on children's PA [29, 34].

Intrapersonal level

On the intrapersonal level, factors influencing kindergarten-aged children's PA included children's personalities and skills. Participants reported several personality traits that hindered children from engaging in PA, such as shyness, introversion, and timidity. This result is similar to the finding in Canada [22], showing that children's personalities (e.g., shyness and anxiety) negatively influenced their preferences for PA. This finding also reinforces the discovery of a longitudinal study showing that active kindergarten-aged children were less likely to be shy or introverted [42]. Additionally, evidence indicated that PA might help promote desirable personality trait stability and change in young children due to its health, cognitive, and social benefits [43]. PA seems vital for kindergarten-aged children who are introverted and timid because PA can benefit their personality growth. Personality is an intrinsic driver of engagement in PA in kindergarten-aged children [41, 44]. It might influence children's preferences for PA [22]. Therefore, caregivers (e.g., teachers and parents) should pay more attention to these children and motivate them to participate in PA to compensate for their lack of intrinsic motivation.

Children's poor skills hindered the promotion of PA among Chinese kindergarten-aged children in our study, which is consistent with the findings in Australia [45]. Participants mentioned that kindergarten-aged children with lower skill levels were unable to play with

other peers and had difficulty completing PA. This might explain why kindergarten-aged children with lower skill levels were more likely to be sedentary than children with higher skill levels [46]. However, both reserved personalities and low-skilled children were more likely than other children to develop sedentary habits that can lead to poor health. Based on these facts, interventions tailored to these groups are recommended for improving their PA levels.

Interpersonal level

We identified that family, peers, and teachers could influence PA among kindergarten-aged children on the interpersonal level. Teachers expressed that parents' attitudes toward PA were necessary for their children's PA. Parents who valued or preferred PA positively impacted their children's PA. Conversely, parents who viewed PA as optional and more appreciative of their children's academic performance negatively affected their children's PA. In the concept of Chinese parents, children's educational performance was significant, even in early childhood [47]. Research showed that parents' pressure for academic success reduced their children's PA participation [48]. Thus, it is crucial to change this concept of parents and increase their emphasis on PA. One possible way to achieve this is to generalize the benefits of PA for kindergarten-aged children's social-emotional development to parents [49], as research reported that contemporary Chinese parents considered the social-emotional development of kindergarten-aged children to be more important than academic performance [50].

Moreover, participants indicated that grandparents' and parents' dotting hampered kindergarten-aged children's PA, especially in families with only one child. This result may be because only children were more likely to be spoiled and appeared less interested in PA than multi-sibling children [51]. However, this phenomenon might improve because China published the third-child policy to encourage bigger families in 2021 [52].

Peers' interaction was a facilitator for kindergarten-aged children's PA from teachers' perceptions, which aligns with findings in many studies on parent's and kindergarten-aged children's perceptions [29]. Research indicated that the presence of friends significantly boosted children's PA levels, resulting in over double the number of kindergarten-aged children opting for highly active environments compared to those playing alone [53]. As a result, PA that requires peer interaction, such as group games, should be encouraged to promote kindergarten-aged children's PA levels.

Teachers are primary promoters of PA for children in kindergarten. This study identified several teacher factors that influenced PA among kindergarten-aged children. In terms of teachers' behavior, teachers' participation in PA

and their encouragement can improve children's PA, consistent with many studies [34, 54–56]. Regarding teachers' cognition, teacher attitudes such as preferring PA and believing it beneficial to children's health and development helped promote children's PA. Research revealed that teachers translated their beliefs into actions that, in turn, can affect kindergarten-aged children's behaviors [57]. Thus, improving teachers' beliefs about PA emerges as a potential strategy to promote kindergarten-aged children's PA.

Regarding teachers' characteristics, teachers mentioned the need to increase the proportion of male teachers in kindergarten. Since different genders of caregivers had different effects on children's PA [58], children need access to both female and male teachers. However, according to statistics from the Ministry of Education of the People's Republic of China in 2020, men accounted for only 2% of full-time kindergarten teachers in China [59]. Hence, hiring more male teachers at kindergartens is required to facilitate children's PA in China.

Participants also suggested some responsibilities for teachers in promoting kindergarten-aged children's PA, such as setting a role model, observing children's differences, teaching children according to their aptitude, and protecting them. Notably, excessive protection by teachers may inadvertently hinder children's PA levels. This overprotection often arose from parental pressure, as teachers expressed the fear of potential injury-related consequences, such as lawsuits from children's parents, leading them to restrict children's PA. This restriction could reduce children's PA and deprive them of opportunities for emotional, intellectual, and social development [60]. Therefore, addressing parental risk perceptions is imperative to alleviate this overprotection, enabling teachers to provide a broader range of activities for kindergarten-aged children.

Organizational level

On the organization level, teachers recognized that environment and resources (i.e., space, facilities, finance, and weather) were the key factors impacting the implementation of PA among children in kindergarten settings, adhering to findings in many previous studies [28]. They reported that bad weather (e.g., too cold, smog, and rain) could hinder PA engagement in kindergarten-aged children, while sunny weather did the opposite. Similarly, several qualitative and quantitative studies have demonstrated that weather was both a facilitator and a barrier to PA in kindergarten-aged children [29, 61, 62]. Research reported that inclement weather was negatively associated with moderate to vigorous PA and positively related to sedentary behavior in kindergarten-aged children [62]. In regions with milder climates year-round, PA among kindergarten-aged children tended to remain unchanged

[63]. In contrast, studies conducted in areas with significant seasonal weather variation showed comparable PA fluctuations among kindergarten-aged children [29, 61]. Given these facts, the weather may significantly influence the PA of kindergarten-aged children in China, which has a wide range of latitudes and various terrain types, resulting in a complex climate [64]. Therefore, to prevent seasonal weather variations from hindering PA implementation among kindergarten-aged children, kindergarten could adopt weather-adaptive strategies such as indoor gyms, shaded playgrounds, and support services for children to regulate their body temperature, such as offering ginger tea or ice water.

Additionally, teachers emphasized the importance of providing PA training opportunities for themselves. Research indicated that PA training influenced preservice educators' knowledge and self-efficacy and was associated with better teacher promotion of PA in kindergarten-aged children [65, 66]. Also, teachers with PA training may have greater importance and personal responsibility for teaching PA to kindergarten-aged children than teachers without such training [67]. Thus, providing PA training opportunities for teachers in kindergarten may be an effective way to improve their quality and children's PA.

Regarding children's PA opportunities, teachers observed a decrease in opportunities for PA among children in kindergarten due to COVID-19 pandemic-related restrictions. Similarly, previous research showed that COVID-19 significantly impacted PA in kindergarten-aged children due to the loss of equipment, space, and curriculum enrichment opportunities [68]. In addition, teachers noted time constraints imposed by competing activities, such as arithmetic and crafting, further limited kindergarten-aged children's PA opportunities. To address this challenge, kindergartens should consider reorganizing activity schedules to ensure adequate time for children to engage in PA, aligning with the World Health Organization's recommendations for PA in kindergarten-aged children [2].

In the design and organization of PA, we also identified factors that are potentially beneficial in promoting PA among kindergarten-aged children. For the design of PA, our findings agree with a review, which recommended that competitions and role-playing games for kindergarten-aged children, as well as diverse, playful, and engaging PA, can help them reach target PA levels [55]. For PA organizations, adequate PA time and sports-appropriate clothing were recognized as facilitating PA in kindergarten-aged children, consistent with previous findings [23, 26]. Additionally, objective monitoring of kindergarten-aged children's activity intensity when organizing PA was also necessary, as it helped to design effective evidence-based programs and promote PA in kindergarten-aged

children [69]. Moreover, teachers reported that children's autonomy was essential when organizing PA. Support for autonomy was generally associated with more intrinsic motivation and more significant interest than control behaviors [70]. Previous evidence found that providing greater autonomy by choosing more PA options can lead to a 20.5% increase in young children's PA participation [71]. Accordingly, teachers and parents can give kindergarten-aged children more autonomy to increase their interest and motivation to participate in PA.

Furthermore, teachers advocated prioritizing outdoor activities, ball games, rhythmic activities, and activities fostering fundamental movement skills and physical fitness for kindergarten-aged children. Research showed that outdoor activity was one of the most consistently positive correlates of PA in kindergarten-aged children [72]. Ball games can increase social interaction [55] and thus benefit PA in kindergarten-aged children [29]. Rhythmic activities (e.g., dancing, rhythmic gymnastics, and exercising to music) were highly enjoyed among young children [73]. Higher skill levels can boost kindergarten-aged children's PA levels [45, 46]. Given this evidence, it is recommended that these activities be prioritized in kindergarten-aged children's PA initiatives. Schools should actively facilitate access to these activities, such as through organized soccer games and dance classes.

Community level

On the community level, findings showed that family-school partnerships can affect kindergarten-aged children's PA. Echoing existing literature, our findings emphasized the importance of family-school communication and collaboration to improve PA in kindergarten-aged children [24, 74–76]. Through insights from teachers, our research identified potential interactions that could foster PA in kindergarten-aged children, such as parents cooperating with schools to organize parent-child games and schools popularizing the methods and contents of PA to parents so that they can lead their children to PA at home or in the park. Because kindergarten-aged children primarily divide their time between home and school, parents and teachers play crucial roles in promoting children's PA. High-quality interactions between teachers and parents were expected to promote positive change in behavior for kindergarten-aged children [77]. Nonetheless, our participants have voiced challenges regarding parental cooperation and understanding of teachers, indicating a need to explore strategies for improving family-school partnerships to elevate PA participation in kindergarten-aged children.

Strengths and limitations

This study is the first to identify factors contributing to the promotion of PA among kindergarten-aged children from the perspective of teachers in China, adding to the limited existing literature. However, this study has several limitations. First, the participants are all female. There may be gender differences in teacher practice related to PA. Given that the proportion of full-time female kindergarten teachers in China is 98% [59], male kindergarten teachers are scarce in China. Thus, the high proportion of female samples does not introduce significant sample bias, nor does it significantly affect the accuracy of our results. Second, qualitative research tends to focus more on understanding the complexities and nuances of relationships between variables rather than establishing direct cause-and-effect relationships. Future research can complement qualitative findings with quantitative studies to explore causal relationships between identified factors and kindergarten-aged children's PA. Lastly, this study lacks insights into the policy-level implications of SEM on children's PA. However, most previous relevant studies have not addressed policy-level outcomes [29, 34]. Hence, future research may focus on the policy level of the model to devise strategies to promote kindergarten-aged children's PA.

Conclusion

This study identified multilevel-based factors that may help promote PA among kindergarten-aged children from teachers' perspectives. These factors were categorized into the intrapersonal level (children's personality and skills), interpersonal level (family, peers, and teachers influence), organizational level (school environment and resources, opportunities for kindergarten teachers' training, and children's PA, design and organization of PA, and PA that children need), and community level (family-school partnerships). These multilevel-based potential determinants of PA can aid in developing more effective PA interventions for kindergarten-aged children [36].

Abbreviations

PA	Physical activity
SEM	Social-ecological model
T	Teacher
Q	Quote

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Author contributions

YL provided databases for the research and guided the direction of the study. YHL was involved in every study process, drafted the first manuscript, and was responsible for the subsequent revision of each version. YRH contributed to the data collection. FYJ, YRH, and JY contributed to the data analyses and interpreted results. YL, FYJ, YRH, and JY reviewed and revised the manuscript. All authors read and approved the final manuscript.

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Data availability

Data from the study can be obtained through the corresponding author at a reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee at the Shanghai University of Sport (102772019RT034). Written informed consent was obtained from all participants before data collection. All research methods were carried out under the Declaration of Helsinki guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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