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EXPERT STATEMENT

Motor Competence as Key to Support Healthy Development of 3- to 5-Year-Old Children: An Expert Statement on Behalf of the International Motor Development Research Consortium

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The first years of life are an optimal time for developing motor competence. However, the evidence regarding motor competence in early childhood is fragmented and needs to be clearly synthesized and presented. To establish effective evidence-based decision making in research, practice, and policy for the early years, this expert statement, on behalf of the International Motor

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Development Research Consortium, draws together what is currently known about 3- to 5-year-old children on (a) how skilled are children around the world, (b) the link between motor competence and healthy developmental outcomes, and (c) the capacity to improve children's motor competence through intervention. This expert statement presents a summary of recent evidence for each of these specific points, followed by recommendations for researchers, practitioners, and policymakers.

Keywords: motor skills, preschoolers, health

In 2015, the United Nations emphasized early child development as the basis of health and well-being across the lifespan, indicating it as a necessary component of their Sustainable Development Goals (UN, 2015). This endorsement provided a historic opportunity to justify the global implementation and scale-up of public policies and interventions to promote early childhood development (Britto et al., 2017), supporting the development of children in their first years of life, and enabling them to reach their developmental potential (World Health Organization, 2020).

Early childhood experiences work alongside genetic variations and epigenetic regulation to generate positive developmental trajectories, impacting health across the life course (Murgatroyd & Spengler, 2011). The early childhood years are an optimal time for developing motor competence (Berk, 2022), a fundamental component of lifelong health. Motor competence is a latent broad concept that reflects the degree of proficient performance in motor skills and the underlying mechanisms (e.g., quality of movement, motor control, and coordination; Robinson et al., 2015) and is a key enabler of children's daily life and engagement in physical activity (PA), games, play, and sports (Rudd et al., 2020). During childhood, motor competence has also been defined as children's proficiency in executing fundamental motor skills (FMS; Utesch & Bardid, 2019).

However, the evidence regarding motor competence in early childhood is fragmented, reflecting its complexity. Besides the clear epistemological divergence on how to define motor competence, its study in the early ages encompasses a challenge due to the rapid changes associated with children's growth process. Moreover, a wide range of motor competence assessment protocols, which produce diverse outcomes, and a variety of associated correlates to control are important aspects that make the process of evidence systematization challenging. Nonetheless, although difficult, the evidence regarding motor competence needs to be clearly synthesized and presented to support stakeholders in moving forward with children's motor development. To establish effective evidence-based decision making in research, practice, and policy for the early years, this expert statement, on behalf of the International Motor Development Research Consortium, draws together what is currently known about 3- to 5-year-old children on: (a) how skilled are children around the world, (b) the link between motor competence and healthy developmental outcomes, and (c) the capacity to improve children's motor competence through intervention. For each of these specific points, a summary of recent evidence is presented followed by recommendations for researchers, practitioners, and policy makers.

To substantiate this statement, the following procedures were adopted:

a. Literature search process: A systematic search in three databases (PubMed, Scopus, and Web of Science) for review studies (e.g., systematic reviews, meta-analyses) published in the last 5 years (from January 2018 to February 2023), in the English language, with a specific focus on the motor competence (specified as motor skill competence, gross motor skills, FMS, fundamental movement skills, or gross motor coordination) of typically developed 3- to 5-year-old children was conducted. Two experts identified a total of 51 narrative and systematic reviews/meta-analyses studies. Our strategy of searching existing reviews is acceptable (Haby et al., 2016) to provide a concise, targeted evidence assessment statement.

b. Literature review process: The 51 narrative and systematic reviews/meta-analyses studies were listed in the Supplementary Material S1, reviewed, and categorized as Topic 1 (i.e., how skilled are children around the world), Topic 2 (i.e., the link between motor competence and healthy developmental outcomes), or Topic 3 (i.e., the capacity to improve children's motor competence through intervention) based on their titles, abstract content, and main aim. For instance, all the studies that focused on an intervention, first presented a descriptive table in their results with children's scores in motor competence; however, these sorts of studies were categorized as Topic 3, and not Topic 1.

c. Original studies extraction: From the 51 narrative and systematic reviews/meta-analyses studies identified, the experts reviewed all the studies included in each review and extracted information from original research studies that were published in these reviews within the last 10 years (i.e., original research papers published between 2013 and 2023) which met the three topical areas of interest for the current statement. Exclusively for Topic 1, the search was restricted to studies that used the most recent two editions of the Test of Gross Motor Development (TGMD-2 and TGMD-3; Ulrich, 2018; Ulrich & Sanford, 1985). This review process resulted in evaluating evidence from 53 original research studies. The supplementary tables for each topic provide detailed information on each original study.

d. Summary of the evidence: The expert groups summarized the evidence from the 53 original studies published in the last decade on each topic. Then, further screening of the 53 studies was conducted by the expert group. For Topic 1, 15 studies were obtained (Supplementary Tables S1 and S2 in the Supplementary Material S2 [available online]), and percentile results for children's locomotor and ball skills were estimated (Supplementary Tables S3–S6 in the Supplementary Material S2 [available online]). For Topic 2, a total of 13 experimental or quasi-experimental and longitudinal studies were summarized (Supplementary Tables S7 and S8 in the Supplementary Material S2 [available online]), while for Topic 3, a total of 23 experimental and quasi-experimental studies (Supplementary Tables S9–S11 in the Supplementary Material S2 [available online]) were summarized. All studies' quality or risk of bias was reported in accordance with what was reported in the original systematic reviews/meta-analyses.

e. Recommendations: Based on the summarized evidence and on the authors' expertise, key recommendations were discussed and presented in the current statement.

The subsequent sections, based on the gathered information, provide an overview of the current understanding of motor competence in 3- to 5-year-old children and give recommendations for the future. Importantly, the systematic approach used in the current statement was implemented to inform the provided recommendations. The approach is distinct from a systematic review.

Topic 1—How Skilled Are Children Around the World

There is no universally standardized protocol to assess gross motor competence nor explicitly identified benchmarks of motor competence that children are expected to achieve worldwide. Nevertheless, the process-oriented (i.e., scores are based on how well movement is executed) TGMD-2 and TGMD-3 (Ulrich, 2018; Ulrich & Sanford, 1985) were selected for the current synthesis, as this protocol is one of the most commonly used among preschool children around the world (Klingberg et al., 2019). Including other assessments would have limited the opportunity for summarizing the evidence, as different protocols assess different components of motor competence (Barnett et al., 2022), although we acknowledge this also limits information to those who use this protocol. Scores derived from this protocol show good-to-excellent support for valid and reliable assessment in children and adolescents (Alison et al., 2018; Hulteen et al., 2020). Therefore, to report 3- to 5-year-old children's motor competence values, we focused on exploring studies comprising sample sizes of at least 100 children, in order to provide scope for better representation that detailed described children's motor competence scores in terms of locomotor and ball skills by age and sex, and assessed exclusively using the TGMD protocol.

Of the 15 studies assessing 5,271 children, implemented in 10 countries, with quality evaluation ranging from medium to high, six were conducted in Europe, three in North America, three in South America, and three in Asia. No data were found on the large and densely populated African continent nor in Oceania. Most of the studies ($N = 11$) were representative of high-income countries, while four were from low-middle income countries (LMIC). Most of the studies assessed children using the TGMD-2 (Ulrich, 2000) with the exception of Valentini et al. (2017) who used the third edition. Sample sizes ranged from 109 (Kit et al., 2017) to 938 (Bardid et al., 2016) participants. Supplementary Tables S1 and S2 in the Supplementary Material S2 (available online) detail the studies' characteristics.

Considering that (a) the TGMD-2 norms (Ulrich, 2000) were derived from American children and, therefore, may not be appropriate to represent children's motor competence around the globe and (b) data on age in months were not available for each of the studies incorporated in the reviews, and it was not possible to process the data reported in the studies with the TGMD-2 or -3 normed scores. As such, we assessed how skilled children were in locomotor and ball skills by estimating developmental percentiles using the mean and *SD* of the available data. For seven studies conducted in Belgium, Portugal, Brazil, Myanmar, Canada, South Korea, and Poland, percentile scores for TGMD locomotor and ball scores

were estimated by age (3, 4, and 5 years) and sex (Supplementary Tables S3 and S4; Supplementary Figures S1 and S2 in the Supplementary Material S2 [available online]). Percentiles were also estimated for two studies, conducted in the United States and Taiwan that described motor competence levels only according to the child's age (Supplementary Table S5; Supplementary Figure S3 in the Supplementary Material S2 [available online]), and for seven studies conducted in the United Kingdom, Brazil, Belgium, and the United States that presented data only based on sex (Supplementary Table S6; Supplementary Figures S4 and S5 in the Supplementary Material S2 [available online]).

In general, data from the 15 studies show high variability in locomotor skills and ball skills across studies, related to age and sex. Nonetheless, a tendency for older children to be more proficient than younger children and for boys to display greater proficiency in ball skills than girls was detected (Figure 1). While it is tempting to report differences across countries, caution is advised as lack of country representativeness was present in almost all the studies. Therefore, the observed apparent differences may be due to sample variation, and comparisons between and within countries are not recommended.

Topic 1 Summary

The evidence summarized in high-quality studies, conducted in four continents with diverse cultural and socioeconomic backgrounds, show a clear tendency for

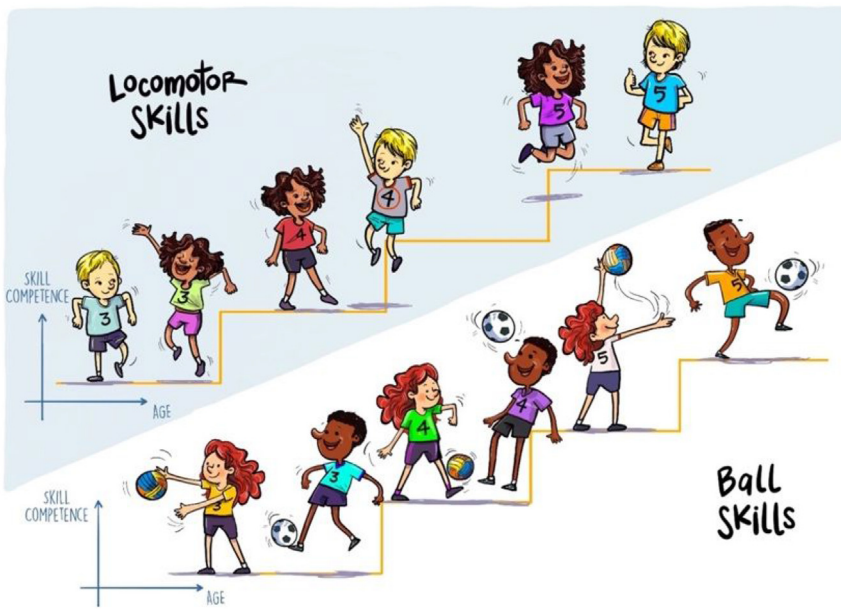

Figure 1 — Locomotor and ball skill competence for boys and girls according to age (signified on T-shirt).

older children to be more proficient than younger children in all the five studies that presented data by ages. Additionally, there is a general trend for boys to display higher proficiency in ball skills than girls in all six studies that presented data by sex, which does not appear to be reflected in locomotor skills. The evidence base is limited because there is a predisposition in the literature for studies to aggregate motor competence data across age ranges. In such cases, providing the mean motor competence score on an assessment for a 3- to 5-year-old sample is likely not helpful in understanding how skilled these children are, since motor competence rapidly changes during early childhood. Currently, while a considerable number of studies report motor competence scores for this age range, there is no way to ascertain how skilled 3- to 5-year-old children are, as the TGMD-2 and -3 normative data on motor competence for this age are lacking in several countries. Differences in socioeconomic characteristics, culture, family beliefs, physical education (PE) curriculum, and opportunities to practice motor skills are addressed in the literature, and these different motor trajectories could be the results of the variability observed across studies of different countries, but also across studies within the same country. It is also important to note that children living in LMIC or in specific contexts are still underrepresented, and previous concerns have highlighted this disparity in children's research-based evidence (Draper et al., 2022).

Topic 2—The Evidence Linking Motor Competence to Healthy Developmental Outcomes

Different motor competence assessment approaches and protocols incorporating fine motor skills or balance (e.g., Peabody Developmental Motor Scales—2; Movement Assessment Battery for Children—2; Bruininks-Oseretsky Test of Motor Proficiency) have been used to explore the link between motor competence and healthy developmental outcomes in 3- to 5-year-old children. For this portion of the summary, 13 studies conducted in Europe (i.e., Italy, England, Spain, Switzerland); North America (i.e., Canada, United States, Mexico); and Oceania (i.e., Australia) using a variety of motor assessments were summarized (N = 14,374). No study was found from Africa and South America, and only one study was conducted in a LMIC (i.e., Mexico). Some studies used experimental designs (N = 6; Supplementary Table S7 in the Supplementary Material S2 [available online]), while others used observational, longitudinal designs (N = 7; Supplementary Table S8 in the Supplementary Material S2 [available online]). The studies that explored motor competence as an independent variable and other health and development-related outcomes are highlighted below. Detailed information of the summarized studies is presented in Supplementary Tables S7 and S8 in the Supplementary Material S2 (available online).

Experimental Studies

Four experimental or quasi-experimental studies, ranging from weak to high quality, combined motor and cognitive interventions and investigated varied outcomes. Alesi et al. (2020) conducted a 10-week intervention (60 min/day,

3×/week) involving motor and cognitive exercises and showed improvements in some aspects of Italian children's literacy skills (such as linguistic comprehension, oral expression, and metacognition), but not others (such as premathematics skills). Bedard et al. (2017) implemented a 10-week (60 min/week) intervention (motor skills, free play, and reading) and improved some aspects of Canadian children's literacy (print-concept knowledge) but not others (uppercase letter recognition). Callcott et al. (2015), in an academic year Australian intervention (30 min/day, 5×/week) with three arms (literacy, movement, and integrated literacy and movement) and a control group, demonstrated that the combined intervention positively impacted children's literacy outcomes. Duncan et al. (2017) showed that a 6-week (20–30 min/day, 2×/week) intervention combining movement and storytelling impacted English children's naming vocabulary scores more than the arm focused on movement only.

Hudson et al. (2021) focused only on gross and fine motor competence to assess its effects on other outcomes after an 8-week (30 min/day, 2×/week) intervention in the United States. The results demonstrated increases in some aspects of executive function and numeracy skills but not others, such as working memory. Another 16-week mastery-oriented motor skill intervention (45 min/day, 3×/week) conducted by Miller et al. (2023) measured American children's self-regulation outcomes. The authors highlighted that the intervention improved behavioral self-regulation but not cognitive self-regulation. Figure 2 illustrates

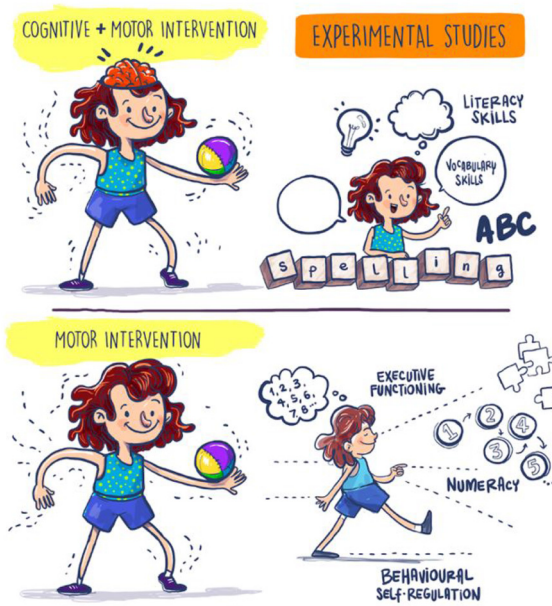

Figure 2 — Experimental evidence of the link between motor competence and healthy developmental outcomes.

the experimental evidence of the link between motor competence and health developmental outcomes.

Longitudinal Studies

Four longitudinal studies investigated aspects of cognition about motor competence with conflicting results; all studies were reported to have high quality or no bias. Wang et al. (2014) observed that gross motor skills of American children at 3 years old did not predict language performance 2 years later, whereas Osorio-Valencia et al. (2018) reported that in 3-year-old Mexican children, these skills predicted verbal abilities and memory at age 5. Escolano-Pérez et al. (2020), when assessing 5-year-old Spanish children, reported no prediction of gross motor skills on academic competence at the beginning of primary school. Gu et al. (2018) reported that locomotor skill performance predicted American children's cognitive function 1 year later.

Four longitudinal studies investigated PA or fitness as an outcome, primarily 1 year later. Gu (2016) reported that locomotor skills of U.S. children at age 5 years (approx.) predicted light, moderate to vigorous, and vigorous PA 1 year later. Similarly, Gu et al. (2018) reported that motor competence variables at 5 years old (approx.) predicted moderate to vigorous PA and sedentary behavior of American children one academic year later. A longitudinal study conducted by Schmutz et al. (2018) reported that among 4-year-old Swiss children, motor skills predicted total PA, moderate to vigorous PA, and sedentary behavior 1 year later. For fitness, the longitudinal American study by Vlahov et al. (2014) reported that motor skills at 5 years old (approx.) predicted fitness 11 years later, but ball skill performance was more predictive of overall physical fitness than locomotor skills. Figure 3 illustrates the longitudinal evidence of the link between motor competence and health developmental outcomes.

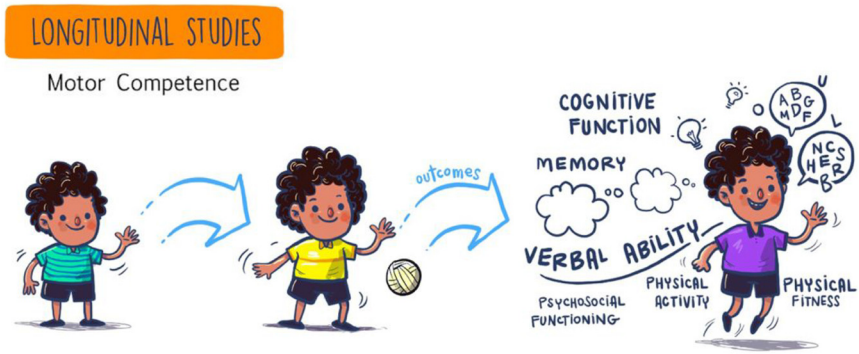

Figure 3 — Longitudinal evidence of the link between motor competence and healthy developmental outcomes.

Topic 2 Summary

Literature on motor competence and healthy developmental outcomes in this age group is emerging. Studies related to this topic are therefore hard to compare due to the different experimental protocols being tested and the broad nature of cognitive, physical, and socioemotional outcomes that have been assessed. There seems to be some evidence for motor skill + cognitive interventions positively impacting cognitive outcomes (four out of four studies), and motor skill interventions' impact on cognitive outcomes (two out of two studies), but the evidence varies on the components of motor competence impacting, and on exact cognitive outcome impacted. It is also not clear what is the "best" type of intervention (not to mention the optimal dose or structure); that is, whether it is better, for instance, to combine a movement intervention with cognitive content, if wanting to elicit a greater impact on cognitive outcomes. In the reviewed studies, there was no evidence for movement skill interventions impacting outcomes such as PA. Nonetheless, although longitudinal studies show mixed results (i.e., positive or no association) regarding motor competence as predictor of cognitive outcomes, there is also longitudinal evidence to support the relationship between motor competence with PA and fitness.

Topic 3—The Capacity to Improve Children's Motor Competence Through Intervention

Experimental and quasi-experimental designs have been conducted to investigate the impact of 23 interventions on motor competence (as a dependent variable) for 5,620 children 3–5 years old in 10 countries, using different protocols that assess both gross and fine motor competence. Most of the studies ($N = 18$) were evaluated to have medium to high quality or low to moderate risk of bias; only five were evaluated as with weak quality or 40%–50% of risk of bias.

FMS Interventions

Interventions focusing on FMS were addressed in 12 studies, providing intervention for 1,435 children from Italy, the United States, Canada, Switzerland, and Australia. Most of the studies ($N = 6$) were reported to have good to high quality or low risk of bias (Alesi et al., 2020; Altunsöz & Goodway, 2016; Bedard et al., 2017; Bellows et al., 2017; Jones et al., 2016; Palmer et al., 2019). Four studies were evaluated as having a moderate risk of bias (Johnson et al., 2019; Mulvey et al., 2020; Robinson et al., 2016, 2017), and only two with a weak quality or high risk of bias (Bellows et al., 2013; Donath et al., 2015). The interventions, ranging from 5 to 36 weeks, were conducted mainly by trained teachers using different strategies, such as FMS stations (Johnson et al., 2019; Palmer et al., 2019), integration of FMS with movement concepts (Bellows et al., 2017), or games (Hashemi et al., 2015; Jones et al., 2016). Some interventions were conducted adopting previously established evidenced-based protocols—mastery climate (Johnson et al., 2019; Palmer et al., 2019; Robinson et al., 2016, 2017), *SKIP* —successful kinesthetic instruction for preschoolers (Altunsöz & Goodway, 2016; Mulvey et al., 2020), Get Movin' with Mighty Moves (Bellows et al., 2013, 2017), and JUMP (Jones et al., 2016) programs. Fidelity indexes were provided only in

four studies conducted in the United States (Bellows et al., 2017, 2013; Johnson et al., 2019; Palmer et al., 2019).

Most of the studies (10 out of 12) reported increases in different aspects or domains of motor competence, depending on the protocol used to assess it. Nonetheless, differences in children's sociocultural background, teacher strategies, and intervention dose must be recognized when interpreting the results. Several studies also reported positive secondary outcomes, such as increased language skills (Alesi et al., 2020) and gender integration relationships (Mulvey et al., 2020). Other studies also assessed PA levels; however, no benefits were reported (Bellows et al., 2013, 2017; Jones et al., 2016; Palmer et al., 2019). Detailed information is available in Supplementary Table S9 (see Supplementary Material S2 [available online]).

PA Interventions

Five interventions focused on PA as an independent variable. Two studies were categorized with high quality (Bonvin et al., 2013; Piek et al., 2013), two with medium quality or low risk of bias (Roth et al., 2015; Wasenius et al., 2018), and only one with weak quality (Klein et al., 2015). The lack of fidelity measures was consistent in these studies. The PA interventions were implemented over 24–44 weeks of intervention and conducted by general, trained teachers and researchers (Piek et al., 2013), preschool teachers (Bonvin et al., 2013; Klein et al., 2015; Roth et al., 2015), or childcare providers and parents (Wasenius et al., 2018). The interventions involved 3,519 children from Switzerland, Germany, Australia, and Canada. Two studies had a previously established protocol in the literature, namely the Animal Fun program (Piek et al., 2013) and the Youp'là Bouge (Bonvin et al., 2013). The other interventions included instructed active lessons combining FMS with games (Klein et al., 2015; Roth et al., 2015) and creative play (Wasenius et al., 2018). Parents were enrolled in one intervention (Bonvin et al., 2013; Klein et al., 2015; Roth et al., 2015; Wasenius et al., 2018). Mixed results were presented regarding the capacity of PA interventions to improve children's motor competence: three interventions reported increases in overall motor competence (Klein et al., 2015; Piek et al., 2013; Roth et al., 2015); one intervention showed improvements only in locomotor skills (Wasenius et al., 2018), while the other reported no differences in motor competence (Bonvin et al., 2013). Though the effect sizes depend on the intervention program proposed and the outcome assessed, four out of five studies reported some improvement on children's motor competence as a result of the intervention proposed. Decreases in body mass index as a secondary outcome were reported in one study (Klein et al., 2015) but not in another (Bonvin et al., 2013). No changes in PA were reported in the two studies that addressed this secondary outcome (Piek et al., 2013; Roth et al., 2015). Detailed information of the studies is available in Supplementary Table S10 (see Supplementary Material S2 [available online]).

Active Play, PE, and Exergaming Interventions

Three interventions focused on active play, being two medium quality or low risk of bias studies (Adamo et al., 2016; Foulkes et al., 2017), and one weak quality study

(Tortella et al., 2016). The interventions were conducted by trained instructors for 316 children in Canada (Adamo et al., 2016), United Kingdom (Foulkes et al., 2017), and Italy (Adamo et al., 2016; Foulkes et al., 2017; Tortella et al., 2016). The duration of the programs varied from 6 to 24 weeks. The interventions were conducted at schools or playgrounds, using different resources (cards, booster sessions, and activities pack) and equipment to enrich the children's opportunities to play. The instructors ensured that the children were active and moving. Two studies reported increases in locomotor skills (Adamo et al., 2016), ball skills, and balance (Tortella et al., 2016), while one study reported no change in motor skills (Foulkes et al., 2017). Increases in PA levels as a secondary outcome were reported for Canadian children (Adamo et al., 2016), and when considering fine motor skills as the secondary outcome, no increase was reported for Italian children.

PE teachers implemented one intervention to enrich the PE curriculum for 90 Iranian children; the quality of the study was acceptable. The protocol focused on applying the SPARK (Sports, Play, Active, Recreation for Kids) program for 8 weeks (45 min/day, 3×/week) (Mostafavi et al., 2013), and the results reported improvements in children's motor competence.

Two studies with low risk of bias implemented exergames for children in the United States (Fu et al., 2018; Gao et al., 2019). The interventions were provided to 130 children over periods of 8 (Fu et al., 2018) and 12 weeks (Fu et al., 2018; Gao et al., 2019), and used GoNoodle, Adventure to Fitness, and Cosmic KidsYoga games in the Nintendo Wii & Xbox Kinect to improve children's motor skills. Both studies reported increases in motor competence and PA levels.

Results presented in the abovementioned interventions highlighted that two out of three active play interventions, one PE intervention, and two out of two exergaming interventions reported increases in some aspects of children's motor competence, though the effect sizes reported depend on the intervention program proposed and the outcome assessed. Detailed information is available in Supplementary Table S11 (see Supplementary Material S2 [available online]). Figure 4 summarizes the information presented in motor competence intervention studies.

Topic 3 Summary

The literature on intervention studies to improve children's motor competence has grown remarkably over the last 10 years, with different intervention approaches being tested. The great majority of the studies were classified as medium to high quality studies. The sample size varied considerably and concern regarding the external validity of the findings needs to be recognized. The length (5–44 weeks) and the dose (60–300 min/week) of the interventions varied across countries and approaches, which makes it difficult to confirm the optimal protocol to be used.

Most of the interventions were conducted in preschools or childcare centers by trained teachers and parents. All interventions were diverse and rich in strategies to enroll children and in several cases, their families. There is evidence that interventions positively impact overall motor competence or some components of children's motor competence. Interventions using FMS (13 out of 15 studies), PA approaches (four out of five), and active play (one out of two) positively impacted motor competence and secondary outcomes, such as PA levels, language skills, metacognitive skills, gender integration, and body mass index.

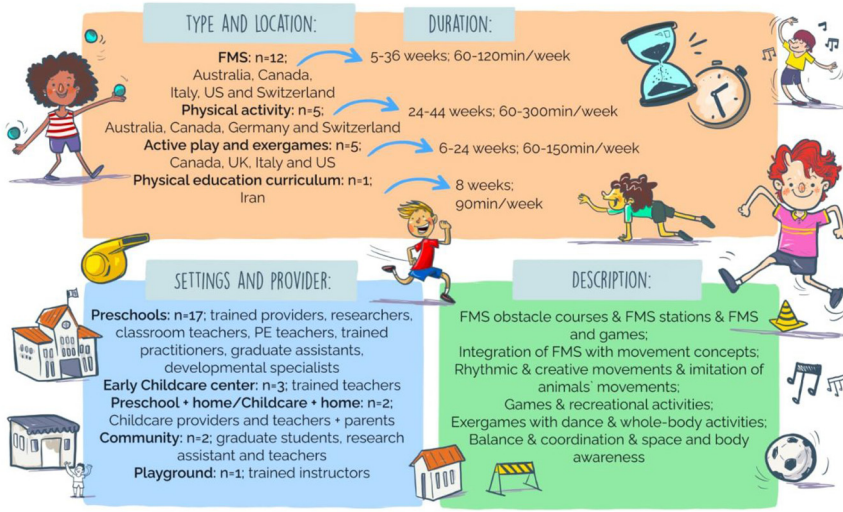

Figure 4 — Description of the intervention studies to improve children's motor competence. FMS = fundamental motor skills; PE = physical education.

Similarly, the implementation of PE curriculum enrichment and exergames interventions, employing different resources and equipment was effective in increasing children's motor competence and PA levels. These interventions successfully enhanced children's opportunities to participate in structured motor activities and games or to use technology. Although the studies have provided information to build upon existing knowledge, with innovative approaches to foster children's motor development, important limitations need to be pointed out: (a) the lessons' structure (i.e., how to organize and distribute activities) and optimal dose of the interventions needs to be further addressed (Ma et al., 2021) to provide robust evidence of children's improvements; (b) evidence of fidelity measures is also crucial to advance knowledge but was lacking in most studies; and (c) diverse effect size magnitudes, varying from null to high effect sizes, were reported, and the effectiveness of the interventions proposed are dependent on the domain of motor competence assessed and the secondary outcomes reported.

Besides, only one intervention was conducted in an LMIC, Iran, even though children from LMICs often face more exposition to risk factors, show motor delays, and have inadequate access to movement programs (Santayana de Souza et al., 2023).

Recommendations

a. Global observatories focusing on motor competence for holistic development in this age group are needed. Surveillance data should use standard methods to provide more comprehensive information relating to motor competence in 3- to 5-year-old children, while also including underrepresented countries and

economies, ethnic minorities, and considering the different geographical, cultural, and social contexts in which motor development occurs around the globe. Such evidence is essential to ensure that the studies are culturally sensitive to differences and to better understand how developmental processes unfold within countries and cultures. This knowledge could lead to more robust findings, increasing the possibility of data generalization.

b. Researchers are encouraged to present data for both boys and girls and specific ages in months for groups of 3-year-olds, 4-year-olds, and 5-year-olds, in addition to any aggregation of data when reporting results of motor competence studies. While the available evidence relating to motor competence in 3- to 5-year-olds suggests that the development of motor competence results in positive outcomes, the aggregation of these data into broad categories of age does not enable any consensus in terms of what levels of motor competence might be expected for children at specific ages.

c. Practitioners should be aware that girls should be as encouraged and stimulated as boys to engage in ball skills activities, while respecting their personal interests and cultural background. Encouraging girls to acquire skills used in diverse settings enhances their opportunity to play games and sports, and increases their self-confidence in their own abilities. In the long run, it helps society to overcome traditional gender stereotypes by promoting gender equality from an early age.

d. For researchers and practitioners, there is a considerable number of evidence that interventions, especially those focused on improving FMS, can enhance motor competence for children 3–5 years old in specific contexts and samples. However, there is insufficient robust consensus to make definitive claims on any optimal structure or dose of intervention. There is also a need for more process documentation and clarity on the training and resources to support the delivery of such interventions in varied settings, in order to scale-up the different tested programs, ensuring their external validity across different cultural backgrounds.

e. Researchers must ensure that full details of intervention programs, including contextual factors potentially associated with children's motor competence (i.e., geographic location, socioeconomic status, cultural background/ethnicity/race, schools, and community resources) are disclosed. These factors are essential for practitioners to evaluate the applicability of the programs for their own context and the need to adapt, encourage replication of effective programs, build the evidence base, and advance the understanding of the mechanisms underlying motor competence and its related outcomes.

f. In general, studies show that we can improve children's motor competence and that there is evidence for motor skill interventions positively impacting several cognitive outcomes. Thus, decision makers in national governments and research funding bodies need to prioritize the development of motor competence as a pathway for holistic development of 3- to 5-year-olds, focusing on long-term effects on health care and education. Classroom teacher training on motor competence development, early childhood curriculum prioritizing motor competence as a daily part of the curriculum, and training with parents

about how to support their child's motor competence are important aspects to sustainable scale-up of motor competence as key to support for children's healthy development.

g. In LMICs, 250 million children under 5 years old are at risk of not reaching their developmental potential. Decision makers should be aware of investing in providing scientific evidence in these countries. Researchers in high-income countries should aim to develop collaborative projects with researchers in LMICs to support the production of evidence aligned with the United Nations Sustainable Development Goals. This could contribute to the development of children's skills, overall health, and well-being and may help to reduce disparities across high-income countries and LMICs.

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