Journal of Motor Learning and Development, (Ahead of Print)
https://doi.org/10.1123/jmld.2021-0047

First Published Online: Jan. 25, 2022

Human Kinetics
EXPERT STATEMENT

Motor Competence Among Children in the United Kingdom and Ireland: An Expert Statement on Behalf of the International Motor Development Research Consortium

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The United Kingdom and Ireland have a well-established research base in motor competence (MC) research, ranging from reporting and monitoring levels of MC, developing assessment tools for MC, providing innovative curriculum and intervention design to support learning and development, as well as providing advocacy for particular groups, such as those with motor impairments. This expert statement, on behalf of the International Motor Development Research Consortium, draws together what is currently known about levels of MC in the United Kingdom and Ireland as well as current approaches to intervention in both countries. Subsequently presented are recommendations for researchers and practitioners to advance the field of MC for the benefit of children and youth in the United Kingdom, Ireland, and worldwide.

Keywords: child development, fundamental movement skills, intervention, youth

Motor competence (MC) represents a key enabler of children's physical activity (PA). MC is a critical aspect of development (Adolph & Hoch, 2019) as it enhances a child's capacity to participate meaningfully in play, games, and activities (Rudd, Pesce et al., 2020). Children with higher MC are more likely to be physically active during childhood, which in turn tracks into adolescence (Cohen et al., 2015; Foweather et al., 2015; Holfelder & Schott, 2014; Lai et al., 2014), prefacing positive trajectories of health (Barnett et al., 2021). Conversely, poor MC may have wide-reaching adverse effects on young children's physical,

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cognitive, social, and emotional development, and health (Leonard & Hill, 2014; Libertus & Hauf, 2017). The development of MC is also associated with positive trajectories of academic achievement (Harrowell et al., 2018), mental health (Lingam et al., 2012), and quality of life (Zwicker et al., 2013). Consequently, the development of MC is a key objective of physical education (PE) curricula in England (Department for Education, 2013), Wales (Department for Children, Education, Lifelong Learning and Skills, 2008), Scotland (Education Scotland, 2017), Northern Ireland (Council for Curriculum Examinations and Assessment, 2007), and the Republic of Ireland (Government of Ireland, 1999). Explicit reference is made to fundamental movement skills (FMS) and psychomotor development is recognized as one of PE's unique contributions to the whole curriculum (Council for Curriculum Examinations and Assessment, 2007; Department for Education, 2013).

In accordance with the suggestions of Newell (2020), we conceptualize MC as encompassing postural stability (e.g., balancing, twisting), locomotion (e.g., running, jumping), and object manipulation (e.g., grasping, handling, throwing, catching, tool use). Competency in the three motor skill categories is regarded as a prerequisite for functioning on a daily basis and for participation in PA or sport-specific activities (Stodden et al., 2008; Utesch & Bardid, 2019; Venetsanou & Kambas, 2011), while positively influencing children's future health (Clark & Metcalfe, 2002; Goodway et al., 2020). MC increases the likelihood of children and adolescents participating in different forms of PA throughout life (Lloyd et al., 2014; Utesch et al., 2018), although it is not naturally acquired (Hardy et al., 2010) but develops through instruction and practice (Holfelder & Schott, 2014; Logan et al., 2015; Xin et al., 2020).

The importance of PA for health and development is well established in the United Kingdom (Chief Medical Officers, 2019) and worldwide. Considerable efforts continue to be put in place to help children engage in PA for both acute and long-term benefit. However, there is continued concern that children may not be engaging in the level of PA that will confer these health benefits. In the United Kingdom, current data suggest that 44.9% of children aged 5–18 years met the Chief Medical Officer's guidelines of taking part in sport and PA for an average of 60 min per day, with nearly a third (31.3%) of English children engaging in less than 30 min PA per day (Sport England, 2021). Data from Wales suggest 51% of children (aged 5–17 years) meet the guidelines of 60 min PA per day, although when only adolescents are considered (aged 11–17 years), only 17% of children meet these guidelines (National Assembly for Wales, 2019). Likewise, parental report of children's PA levels in Scotland suggests that 69% of children (aged 2–15 years) met the PA guideline of 60 min per day (Secretary for Health and Social Care, 2020). This is allied with data on overweight and obesity for the United Kingdom which show that 9.9% of reception age children (aged 4–5 years) are obese, with a further 13.1% overweight. At age 10–11 (School Year 6), 21.0% are obese and 14.1% overweight (UK Parliament, 2021). Similarly, in Ireland, 13% of children meet the National PA guidelines of at least 60 min of moderate to vigorous PA every day (17% primary school pupils and 10% post primary school pupils; Woods et al., 2018), and 16% of children were classified as overweight and obese (O'Donnell et al., 2020). Consequently, the promotion of PA and efforts to reduce overweight and obesity in children remain key public health priorities in both the United Kingdom and Ireland.

The United Kingdom and Ireland have a well-established research base in MC, ranging from reporting and monitoring levels of MC, developing assessment tools for MC, providing innovative curriculum and intervention design to support learning and development, as well as providing advocacy for particular groups, such as those with motor impairments (Blank et al., 2019). This expert statement, on behalf of the International Motor Development Research Consortium, draws together what is currently known about levels of MC in preschool and school-aged children in the United Kingdom and Ireland, as well as current approaches to intervention in both countries. We present this as two key issues. For each issue, evidence is presented, followed by recommendations. Finally, general conclusions are made. Note that the current Expert Statement will refer to MC assessments in the context of different studies, but there is not the scope to provide a review of assessments within this expert statement. Readers are referred to Barnett et al. (2020) for further information about MC assessment in children and youth.

> Key Issue 1: The MC of children and adolescents in the United Kingdom and Ireland is concerningly low and does not currently provide a satisfactory foundation for children to build physically active lives. If schools, community sports, and healthcare systems do not focus on enhancing MC in children and adolescents, the potential long-term impacts of low MC, including higher rates of inactivity and poorer health and well-being, will likely create a significant social, health, and economic burden for the United Kingdom and Ireland.

Prior to establishing effective policy or practice, it is important to establish a current baseline for MC in children and adolescents. Without baseline data, evidence-based decisions cannot be made. The following section details what we currently know regarding preschool and school-aged children's levels of MC in the United Kingdom and Ireland.

Irish-Specific MC Levels

The development of MC is a core objective of the Irish Primary PE curriculum and features as a component of PE from infant classes to the end of children's primary school years (Government of Ireland, 1999). There is however, no explicitly stated benchmark of MC which children are expected to achieve within the curriculum. Empirical evidence from Irish children and adolescents broadly indicates inadequate levels of MC (Bolger et al., 2018; Farmer et al., 2017; Kelly et al., 2019; O'Brien et al., 2016a, 2016b; 2018). Such assertions are based on performance classification from MC assessment(s), often using United States norm data, rather than a distinct developmental stage where children are expected to perform to a given standard for the school curriculum. For example, a recent study of 2,098 children highlighted that just over 50% of Irish children, between the ages of 5 and 12 years, displayed proficiency across locomotor and object control skills as measured by the Test of Gross Motor Development-3 (TGMD-3; Behan et al., 2019). In this work, there was an increasing gradient of proficiency (determined by correct performance of all skill components in both TGMD trials) with increasing age where 25% of 5-year-olds were classified as proficient rising to 57% proficiency in 11- and 12-year-olds (Behan et al., 2019). The Irish PE curriculum explicitly states locomotor skills

(running, jumping, and travelling) and object control skills (throwing, sending, and receiving) as aspects of MC that children should be proficient in by the end of primary school. However, Philpott et al. (2020) reported that, by the end of their third year of secondary school (age 13–14 years), less than 40% of participants displayed proficiency in three locomotor skills (vertical and horizontal jump, skip), and less than 20% displayed proficiency in four object control skills (throw, strike, kick, and dribble), supporting concerns of stagnating development (Lester et al., 2017; Philpott et al., 2020). Further disconcerting trends were reported by Lester et al. (2017) who reported that less than 40% of Irish adolescents displayed proficiency in two locomotor skills (vertical and horizontal jump), and four object control skills (kick, dribble, strike, and throw), by 15–16 years of age. This is alarming as MC in these skills should have been developed by this point in life and adolescents should be applying these MC foundations in games, sport, and PA. The aforementioned data support concerns of stagnating development and collectively warn of delays in MC for this population (Lester et al., 2017; Philpott et al., 2020).

United Kingdom–Specific MC Levels

The National Curriculum for PE in England states that children should be mastering running, jumping, throwing, and catching, and using these skills effectively, in sports situations in Key Stage 1 (ages 5–7 years) and Key Stage 2 (ages 7–11 years), respectively (Department for Education, 2013). Work by Roscoe et al (2019) has documented generally poor levels of FMS development in English preschoolers. Research by Foulkes et al. (2015), and Morley et al. (2015), in preschoolers and 4- to 7-year-olds, respectively, also reported that mastery or proficiency in FMS does not meet National Curriculum targets with the exception of run, leap, and slide movements. Similarly, Duncan, Roscoe, Noon, et al. (2019) found that less than one-fifth of children aged 6–9 years have mastered the four key motor skills (run, jump, throw, and catch) identified by the PE National Curriculum and only ~25% of Year 2 and 3 pupils (6–8 years of age), respectively, were fundamentally competent in all four skills, as measured by the TGMD-2 (Duncan, Roscoe, Noon, et al., 2019). Moreover, Duncan et al.'s study highlighted that children attending schools in England, aged 6–7 years, are typically only at an elementary stage of motor skill development (i.e., where performance of skills is judged to be incorrect on two or more behavioral components of a skill). Furthermore, Lawson et al. (2021), in English 7- to 10-year-olds, and using the TGMD-2, reported that that no children, aged 7–10 years of age, achieved mastery in all skills assessed and over a quarter (27%) did not achieve mastery in any of the skills within the TGMD-2. Eyre et al. (2018) similarly identified overall "poor" FMS performance (via the TGMD-2) in English 5-year-olds and significantly poorer locomotor skill in English children from South Asian backgrounds, compared to their White and Black counterparts. Although there are fewer studies reporting levels of MC in Wales and Scotland, and none representing Northern Ireland, similar trends have been observed for Welsh 10- to 12-year-olds, using the Dragon Challenge assessment tool (Stratton et al., 2017), where 60% of children did not achieve the expected level of MC, and inequalities were observed by gender (girls scored lower), ethnicity (Asian children scored lower), and deprivation

level (children with free school meals scored lower; Stratton et al., 2017). Likewise, Scottish data from two studies with children aged 5–10 years and using gross motor quotient from the TGMD-2 reported that levels of MC were low with gross motor quotient in the 19th (Johnstone et al., 2017) and 26th (Johnstone et al., 2019) percentiles, respectively.

Children With Developmental Coordination Disorder

A separate body of literature has focused on children with motor impairments, particularly those with developmental coordination disorder (DCD), also known as dyspraxia, which is a condition affecting physical coordination. It causes a child to perform less well than expected in daily activities for their age and appear to move clumsily (Blank et al., 2019). Researchers from the United Kingdom have contributed to international recommendations on the diagnosis, assessment, and intervention for this condition (Blank et al., 2019). This is particularly important as prevalence of DCD is between 2% and 6% of children aged 6–18 years in the United Kingdom (Cleaton et al., 2020) and 5% and 6% of the child population in the Republic of Ireland (National Council for Special Education, 2020). Research from the United Kingdom has described the difficulties experienced by children with DCD in areas of postural control, locomotion, and in object manipulation (Cleaton et al., 2020). Comparative data on DCD from the Republic of Ireland are not available. Poor MC in children with DCD extends beyond sport and PE. Difficulties with hand control and manipulation skills are prevalent in this group and can have a negative impact on everyday tasks, such as eating and dressing (Dunford et al., 2005), as well as classroom-related tasks, including handwriting (Barnett & Prunty, 2021).

> Key Issue 2: Although there is evidence to suggest MC interventions can be effective, there is a need to invest in the development of MC beyond schools and PE. A systems and community-based approach to intervention is needed with links between school PE and community-based programs. This should be coupled with continued development of quality research and additional clarity in describing MC interventions in this area.

Despite the benefits of MC for health, the low levels of MC observed in children and adolescents from the United Kingdom and Ireland emphasize the need for interventions to improve MC. Evidence from a number of systematic reviews demonstrates that MC interventions are effective in improving MC levels in different populations, including children and adolescents (Collins et al., 2019; Eddy et al., 2019; Lai et al., 2014; Logan et al., 2012; Morgan et al., 2013; Strooband et al., 2020; Van Capelle et al., 2017; Wick et al., 2017), and clinical populations, such as those who are overweight/obese (Han et al., 2018), or have been diagnosed with DCD (Preston et al., 2017; Smits-Engelsman et al., 2018), intellectual disabilities (Maïano et al., 2019), and autism (Colombo-Dougovito & Block, 2019). Readers are referred to Foweather and Rudd (2020) and the above systematic reviews to examine the wider international evidence base on MC interventions.

Within the United Kingdom and Ireland, the number of published gross MC intervention studies has proliferated over the preceding decade. Table 1 presents an overview of published MC interventions developed in the United Kingdom and

Table 1 An Overview of Motor Competence Based Interventions Conducted in the United Kingdom and Ireland

Population (study), design	Country, sample	FMS measure	Intervention	Findings
Young children (Foulkes et al., 2017) Cluster RCT	England $N = 162$ 3–5 years; 47% female Low SES	12 skills CAMSP	Intervention schools received an activity cards resource pack and a 6-week local authority program aimed promoting active play and developing FMSs. The program involved training preschool staff to deliver 60-min weekly sessions and included post program support.	No significant differences between intervention and control participants on FMS outcomes.
Young children (Duncan, Cunningham, & Eyre, 2019) Cluster RCT	England $N = 74$ 3–4 years; 47% female	4 skills TGMD-2	The combined movement and storytelling intervention was centered on the children's book "The Gruffalo," with children taking on the role of one of the characters in each session (e.g., owl, mouse) and undertaking activities using related movement patterns. Each session started and ended with 5 min of storytelling. Sessions took place for 20–30 min twice weekly for 6 weeks and were delivered by movement trained researchers.	Children in the combined movement and storytelling group had significantly higher TGMD FMS levels immediately postintervention than children who participated in the storytelling only or movement only group. No group differences were found at 8 weeks postintervention. For the children who participated in the combined movement and storytelling condition, there was also higher language ability postintervention compared to children who participated in the storytelling only or movement only groups.
Children (Bryant et al., 2016) Quasi-experimental	England $N = 165$ 8–10 years; 53% female	8 skills Get skilled: Get active 2 skills Product measures	The 6-week intervention included a combination of circuits and dancing to music. The session took place within one PE lesson each week. Sessions included a warm-up and cooldown, and a mixture of instruction drills and circuit activities. The intervention was delivered by movement trained researchers.	Relative to CON, participation in the intervention significantly improved process-measured skills from pre- to postintervention, but not product measures.

(continued)

Table 1 *(continued)*

Population (study), design	Country, sample	FMS measure	Intervention	Findings
Children (Duncan et al., 2018) Cluster RCT	England $N = 94$ 6–7 years; 48% female	5 skills TGMD-2 4 skills Product measures	Ten-week integrated neuromuscular training program incorporated within a statutory PE lesson, lasting 30–40 min each week. The PE lessons included mobility focused warm-up exercises followed by developmentally appropriate resistance training, neuromuscular training, and motor development activities targeting locomotor and object control skills. Skill-specific feedback on the quality of each movement was provided. Sessions were delivered by the principal researcher with support from a primary school teacher.	Significant neuromuscular program intervention effect on TGMD FMS scores. Ten-meter sprint time, vertical jump, seated medicine ball throw, and standing long jump also significantly increased, relative to controls.
Children (Duncan et al., 2020) Cluster RCT	England $N = 124$ 6–7 years ($n = 66$), 10–11 years ($n = 58$); 46% female	5 skills TGMD-2 3 skills Product measures	Six-week version of the BWF Shuttle Time program incorporated within a statutory PE lesson. The Shuttle Time program was progressive, based on the exercises and activities specified by the BWF, and consisted of a warm-up section (10 min) and a main section (40 min) focused on development of the following: Balance, coordination, underhand throwing, catching, striking, running, jumping, and correct use of a racquet (to grip and swing). Sessions were delivered by the principal investigators with the assistance of a primary school teacher. Participants received skill-specific feedback on the quality of their movements within sessions.	In 6- to 7-year-olds, participation in the Shuttle Time program was associated with higher TGMD FMS scores postintervention and at 10-week postintervention. No differences were found for TGMD process scores in 10- to 11-year-olds. Improvements were found in intervention participants relative to CON for standing long jump and medicine ball throw.
Children (Eyre et al., 2020) Quasi-experimental	England $N = 39$ 5–6 years; 46% South Asian	7 skills CAMSP 3 skills Product measures	The combined movement and storytelling intervention was centered on the children's book "The Gruffalo," with children taking on the role of one of the characters in each session (e.g., owl, mouse) and undertaking activities using related movement patterns. Each session started with 5 min of storytelling and included mixture of skill stations and group activity. Sessions took place for 35 min once weekly for 12 weeks and were delivered by the principal investigator alongside the classroom teaching assistant. Skill-specific corrective feedback was given.	Following the intervention, all children improved their motor skills, with a bigger improvement observed for South Asian children.

(continued)

Table 1 *(continued)*

Population (study), design	Country, sample	FMS measure	Intervention	Findings
Children (Wainwright et al., 2020) Quasi-experimental	Wales $N = 164$ 4–5 years; Gender split not reported	13 skills TGMD-3	Eight-week intervention with 10 classes ($n = 133$) and compared to two classes ($n = 21$) using SKIP-Cymru. Intervention comprised a training day for foundation phase staff, mentoring from trained sports development staff and parental engagement via active family sessions in school and parent bags (containing activity booklets and some equipment) being sent home with children. SKIP-Cymru comprised twice weekly sessions, each lasting 45 min, using the SKIP model originally employed in the United States (Brian et al., 2017).	Pupils who undertook SKIP-Cymru saw a 35% increase in total TGMD-3 scores compared to a 3% increase in the control group. When split by locomotor and object control subsets, the SKIP-Cymru group improved 31% and 49%, respectively, compared to 0% and 4% for the control group.
Children (Johnstone et al., 2017) Quasi-experimental	Scotland $N = 196$ 7.0 years, $SD = 1.1$; 54% female Low SES	12 skills TGMD-2	Go2Play was a 5-month Active Play intervention delivered outdoors in primary school settings. The intervention components included a combination of free play with equipment and active play with games to increase movement skills and PA levels. Each session focused on one movement skill and was facilitated by play workers. Sessions were delivered for 60 min, with one session per week.	Participation in the intervention group was associated with significant effects on gross motor quotient score and percentile, and locomotor skills, relative to CON. No intervention effects were found for object control skills.
Children (Farmer et al., 2020) Three-armed quasi-experimental	Ireland $N = 120$ 8–12 years; All female	7 Skills TGMD TGMD-2 Get skilled: Get active	Ten-week community sports-based intervention consisting of a weekly delivered multicomponent approach to increase PA levels, develop FMS, and enhance psychological well-being. The Gaelic4Girls intervention was underpinned by the self-determination theory and elements of the social ecological model and included three major components: (a) player participant component, (b) coach education component, and (c) parental/guardian component. Sessions were delivered for 60 min, with one session per week (6×10-min rotatory skills stations). The coach component consisted of 8×1-hr CPD workshops with a pedagogical emphasis on the use of skill-specific corrective feedback, opportunities to maximize PA, and psychological well-being, as well as coach reflective practices. Key features of this intervention included the integration of technology (YouTube and QR codes) and the inclusion of an innovative FMS dance, in support of hard copy resources (skill cards and posters) as well as the concurrent involvement of club coaches and parents/guardians).	Participation in the intervention group was associated with greater development in overall gross FMS ($p = .005$) and locomotor ($p = .000$) domains, when compared with participation in the traditionally delivered program and a control group. Positive interaction effects were observed for MVPA among intervention participants only.

(continued)

Table 1 *(continued)*

Population (study), design	Country, sample	FMS measure	Intervention	Findings
Children (Johnstone et al., 2019) Feasibility cluster RCT	Scotland $N = 137$ 6–8 years; 58% female Low SES	12 skills TGMD-2	The Active Play intervention involved a combination of active play activities, facilitated by play workers, and free play opportunities, each supported with a range of equipment. The intervention was outdoor at the primary school and consisted of one lesson per week for 10 weeks, lasting for 60 min.	There was preliminary evidence of a small intervention effect on gross motor quotient score and percentile, and locomotor skills. No intervention effects were found for object control skills. Positive intervention effects were observed for MVPA.
Adolescents Project FLAME (Lester et al., 2017, 2020) Cluster RCT	Ireland $N = 363$ 12–16 years; 44% female	10 skills TGMD TGMD-2 Get skilled: Get active 7 functional movements FMS™	Thirteen-week whole-school intervention consisting of a weekly delivered multicomponent approach to develop FMS and functional movement underpinned by the developmental model of motor competence. Project FLAME included four major components with an emphasis on promoting the quality, rather than the quantity of movement, specifically through the (a) specialist PE teacher component, (b) kinesthetic classroom component, (c) student component, and (d) digital literacy component. The specialist PE teacher component consisted of 15–20 min within the students' allocated weekly PE lesson(s) focusing on a prescribed movement with a pedagogical emphasis on the use of external movement-based cues. Two CPD workshops were provided to the PE teachers involved. Movement breaks were delivered by nonspecialist PE teachers (i.e., classroom teachers) whereby a series of seven movement breaks, each of 3-min duration, ran concurrent to the PE component of the intervention. Key features of this intervention included the integration of technology (YouTube and QR codes) in support of hard copy resources (skill cards and posters) as well as the concurrent involvement of specialist PE and nonspecialist PE teachers.	Significant treatment–time interaction effects were found, specifically with the intervention group showing greater development in overall gross FMS ($p = .002$) and locomotor ($p = .003$) domains, when compared with a control group.

(continued)

Table 1 *(continued)*

Population (study), design	Country, sample	FMS measure	Intervention	Findings
Adolescents Y-PATH (Belton et al., 2014; McGrane et al., 2018; O'Brien et al., 2013) Cluster RCT	Ireland $N = 482$ 12–13 years; 49% female	15 skills TGMD-2 Victorian FMS Manual	Multicomponent school-based PA intervention delivered for 8 months across an academic school year including family component (parent information leaflets and information sessions) and underpinned by Youth Physical Activity Promotion Model. The Y-PATH intervention focused on increasing health-related activity and FMS in PE lessons, and providing students with pathways to access community sports clubs and activities. The intervention was implemented by school PE teachers following a 1-day training workshop. In addition, all teaching staff in the school received information leaflets and an information session aimed at improving staff and student PA during school time, with a pedometer challenge involving all the school. A website provided resources and information to support intervention delivery.	Total FMS, object control, and locomotor scores significantly increased following Y-PATH intervention at 8-month postintervention and 3-month retention ($p < .0001$), irrespective of gender, weight status, or baseline PA level.

Note. CON = control, CPD = continuing professional development, SES = socioeconomic status, QR = quick response, CAMSP = Children's Activity and Movement in Preschool Study; FMS = fundamental movement skills; TGMD = Test of Gross Motor Development; PA = physical activity; PE = physical education; BWF = Badminton World Federation; RCT = randomized controlled trial; Y-PATH = Youth-Physical Activity Towards Health; MVPA = moderate to vigorous physical activity.

Ireland over the last decade. These interventions employ different approaches including modified PE, free play, and sports-based interventions. Two studies have examined the effectiveness of interventions to improve MC in preschool children (Duncan, Roscoe, Faghy, et al., 2019; Foulkes et al., 2017). In a cluster randomized controlled trial, Foulkes et al. (2017) found that a 6-week Active Play intervention ($n = 162$), delivered by the local government in nursery settings, had no effect on FMS outcomes in 3- to 5-year-old children ($n = 162$) from low socioeconomic status areas. However, of note, the duration of Foulkes et al. (2017) intervention is relatively short, and the process could be methodologically critiqued in relation to the nature of training received by those delivering the intervention—thus, the importance of providing comprehensive guidance to those delivering MC interventions, particularly where they have no specific qualifications or prior training in MC. In a similar age group ($n = 74$), Duncan, Roscoe, Faghy, et al. (2019) reported that children who received a novel combined movement and storytelling intervention improved their MC, compared to a control group who did not. This led Duncan, Roscoe, Faghy, et al. (2019) to suggest that integrating MC intervention with storytelling augmented gains in MC potentially due to children being more invested in the intervention due to the storytelling element. However, although children improved their MC, these gains were not sustained at 8 weeks post-intervention follow-up. An intervention period of 6 weeks is however very short to realize consolidated change in MC over the longer term. Longer duration interventions are therefore needed to retain the gains in MC reported during these interventions, in the longer term and once the intervention has been withdrawn.

Over the past decade, most MC interventions conducted in the United Kingdom and Ireland have targeted primary school aged children (Bryant et al., 2016; Duncan et al., 2018, 2020; Eyre et al., 2020; Farmer et al., 2020; Johnstone et al., 2017, 2019, Wainwright et al., 2020). These interventions have been evaluated through strong methodology with cluster randomized (Duncan et al., 2018, 2020; Johnstone et al., 2019) or nonrandomized controlled trials (Bryant et al., 2016; Eyre et al., 2020; Farmer et al., 2020; Johnstone et al., 2017; Wainwright et al., 2020). All these interventions reported improvements in MC as assessed using the TGMD. Farmer et al. (2020) was the only community-based intervention and was conducted in organized youth sport settings in Ireland. Most other studies were conducted in primary school settings and delivered by researchers ($n = 4$ studies) or facilitated by play workers ($n = 2$ studies), with some assistance from primary school teachers and teaching assistants. Interventions were typically delivered once per week, within PE classes/organized sport clubs, ranging from 6 weeks to 5 months in length, and 30–60 min in session duration. Interventions were varied, consisting of neuromuscular and resistance training activities, prescribed FMS activities within skill stations, circuits, sport (Badminton, Gaelic Football) and dance activities, as well as imaginative- and creative-based methods, such as active and free play outdoors and combined storytelling and movement approaches. Pedagogical approaches were inconsistently reported, which is reflective of the wider international literature (Lander et al., 2017), although direct and explicit teaching strategies, alongside provision of corrective skill feedback was apparent in some studies (Duncan et al., 2018, 2020; Eyre et al., 2020). Studies involving active and free play outdoor activities reported no effects on object control skills (Johnstone et al., 2017, 2019). Of note, the SKIP-Cymru approach used by Wainwright et al. (2020) (see Table 1), also fed into policy recommendations for

the Welsh government that they should ensure every child in Wales is enabled to develop the essential FMS required at an early age in school, and that investment for programs such as SKIP-Cymru was needed to ensure schools are adequately support children to learn these skills (National Assembly for Wales, 2019).

Adolescents are an under-researched population when examining the efficacy of MC interventions (Lopes et al., 2020). Ireland has paved the way here with two controlled school-based trials (randomized and nonrandomized) in which the interventions have resulted in improved MC in adolescents (Lester et al., 2020; McGrane et al., 2018). The Youth-Physical Activity Towards Health intervention (Belton et al., 2014; McGrane et al., 2018), a multicomponent school-based PA intervention with a parent educational component, was delivered for 8 months, with FMS activities delivered by school PE teachers following a 1-day training workshop to enable the school PE specialists to deliver the intervention. MC outcomes significantly increased following the 8-month intervention and gains were maintained at 3 months post-intervention. More recently, Lester et al. demonstrated that a 13-week whole school multicomponent intervention (Project FLAME) improved FMS outcomes, relative to controls (Lester et al., under review). The intervention was delivered by a PE specialist training in the intervention. The volume of the intervention included 15–20 min of prescribed movement activities (using external cues), delivered by a PE specialist within the weekly PE lesson with supporting physical and digital resources, alongside classroom movement integration activities. These studies demonstrate that it is never too late for adolescents to benefit from MC interventions, and this population is an important focus for future research.

In summary, there are examples of promising and successful MC interventions within the United Kingdom and Ireland. These studies demonstrate that interventions targeting motor skills are effective in enhancing MC and other health-related (e.g., PA) or academic (e.g., language) related constructs. Most have been conducted within educational settings. Given increasing curricular pressures on PE in schools in the United Kingdom and Ireland, exploring interventions in home and community settings is also warranted.

The quality of the intervention studies published to date is mixed. Some studies report intervention content in depth, process evaluation, and intervention fidelity type outcomes, while others present only minimal information relating to intervention content or do not report any form of process evaluation. Few intervention studies conducted fidelity measures of either the training of intervention personnel or the actual intervention itself. This subsequently hampers researchers and practitioners in understanding what works and why it might do so. Researchers should be clear on what constructs of fidelity are being measured and use robust measures to do so. There is a need for better quality research evidence, blinding assessors to intervention conditions, inclusion of follow-up measures at least 3 months (preferably 6–12 months) postintervention, clearer description of randomization, and using an intention-to-treat protocol for analysis (Tsiatis, 2006). In addition, analyses need to account for the nested effect of children within the classroom as the "treatment" is delivered at the level of the classroom in most cases. Most interventions to date have been delivered by external staff (researchers) and there is a need for theoretically designed and driven interventions using key constructs of behavior change which are socially valid and delivered by practitioners rather than researchers alone.

To advance the field, study protocols should clearly describe who benefits from intervention, the pedagogical/theoretical approach used to underpin professional development training and intervention, including how such approaches were applied (e.g., Rudd, Pesce, et al., 2020). Process evaluation is under used in the interventions that have taken place in the United Kingdom and Ireland. Process evaluation should also be employed to explore contextual factors, implementation processes and whether interventions were delivered as intended (see Ma, Hogan, et al., 2021 and Ma, Lander, et al., 2021 for recommendations). A key challenge for the field to address in the United Kingdom, Ireland, and internationally is the sustainability and adoption of MC interventions into practice.

Recommendations

- Given the available evidence, decision makers in local and national government and research funding bodies in the United Kingdom and Ireland need to better acknowledge the importance of MC and should position the development of MC as a fundamental priority to benefit children and adolescents.
- The development of positive trajectories of MC for health benefit in children and adolescents should not solely be left to school PE. Cross-sector collaboration including public health, local and national government, and community groups need to play a part, and to acknowledge the important role that developing MC plays in enabling PA for lifelong health and well-being.
- Developmentally appropriate and evidence-based interventions, targeted to different age groups alongside sustained opportunities to practice a variety of skills, are needed to enhance the MC of children in the United Kingdom and Ireland.
- Researchers need to ensure fidelity measures; process evaluation and implementation information are also collected when trialing or evaluating interventions to enhance MC. Intervention mapping needs to occur where the intervention is theoretically designed with fidelity measures mapped to the key goals and pedagogies of any intervention.
- Practitioners need to be better trained to understand and develop MC in children and adolescents across school (both within PE and the wider curriculum), community sport, and public health.
- National observatories focusing on MC for health, alongside regional and national surveillance research programs are needed. Such surveillance data would be impactful in ensuring evidence informed practice to improve the health and general development of children and adolescents through MC.

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