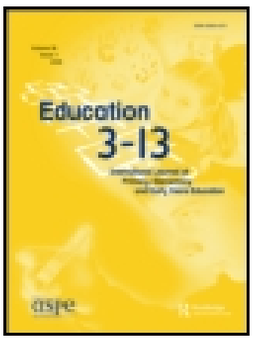

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Physical development in the early years: exploring its importance and the adequacy of current provision in the United Kingdom

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ABSTRACT

Poor physical development in young children has been shown to impact readiness for school, behaviour, social development and academic achievement. This research sought to explore levels of physical development in young children in the term that they started school. The Movement Assessment Battery for Children (MABC-2) was used to assess 115 children (aged 4–5) from four schools and 25 teachers completed an online survey. Findings from both instruments revealed a decline in physical development. It is concluded that a thorough examination of what is known and understood about young children's physical development is urgently needed (for those working in both health and education), and further research to explore training provision in this area is suggested.

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Physical development; early years education; school readiness

Introduction

Physical activity guidelines were introduced into the United Kingdom (UK) in 2011 (Department of Health 2011) and revised in 2019 (CMO 2019). In 2015, however, Townsend et al. (2015) identified that just nine percent of boys and ten percent of girls (aged 2–4) were meeting the recommended levels of daily physical activity (180 min). Likewise, childhood obesity and a decline in play, especially outdoor play (Goddard Blythe 2005; Gray 2011; Stone and Faulkner 2014; Coates 2019) are also put forward as contemporary concerns for the health and wider development of young children. Findings from the National Childhood Measurement Programme (NHS Digital 2019) reveal, for example, that 12.9% of children aged 4–5 were overweight in 2018/19 with 9.7% being obese. Worryingly, the figures for obesity doubles by the time children are 10–11. Linked to these concerns, we were aware from our own observations as well as personal discussions with teachers and colleagues that low levels of physical development in young children are becoming increasingly problematic. Issues, which upon further investigation were frequently confirmed (Goddard Blythe 2005, 2009, 2011; Archer and Siraj 2015, 2017; O'Connor and Daly 2016; Manners 2019).

The focus of this paper is on physical development but a number of related terms (physical activity, physical education and sport) overlap with this and, as such, it is helpful to explore these in relation to physical development. Within the UK, the Early Years Foundation Stage Framework (EYFS) (DfE 2017a) provides guidance to early years practitioners in relation to children aged 3–5. This age range encompasses children who are still in a nursery or pre-school setting and those who have started the first year of formal schooling which is referred to in the UK as the reception year; this starts in the September after a child's fourth birthday. Physical development is a 'prime area' of the EYFS and comprises both gross and fine motor skills. Within the EYFS, the difference

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between gross and fine motor skills is stated as follows: 'Children [should] show control and co-ordination in large and small movements. They [should] move confidently in a range of ways, safely negotiating space. They [should] handle equipment and tools effectively, including pencils for writing' (DfE 2017a, 8). In addition to this, physical development refers to the stages or 'milestones' that typically developing babies and young children should pass through or 'achieve' (e.g. rolling, sitting, creeping, crawling, standing, walking, grasping and fine tuning an infant's 'grasp' into a pincer grip as required for writing and other fine motor skills).

The UK Chief Medical Officer (CMO) physical activity guidelines identify a number of activities to be encompassed by the term, 'physical activity', including: cardiovascular; muscle and bone strengthening; and balance training. In addition, according to the guidelines, physical activity can be measured in terms of its intensity: sedentary (e.g. sitting); light (e.g. house work); moderate (e.g. walking); vigorous (e.g. swimming); and very vigorous (e.g. sprinting uphill). Bearing in mind, some of the physical development milestones identified above, these physical activities reflect more advanced skills. This is also true of physical education (PE), which, in the UK, is a national curriculum subject from Year 1 (ages 5–6). The research presented in this paper concerns younger children (ages 4–5) and, thus, PE is not relevant; indeed, Duncombe (2019) has argued that PE should not be introduced before underpinning physical skills have been developed. Likewise, 'sport' could be argued to be too advanced for this age group, although Mason (2019) does identify a number of adapted sports clubs which may be more developmentally appropriate that could be provided for pre-school children.

With Physical Development being a core component of the EYFS since its revision in 2012, it would be easy to assume that this important area is now adequately provided for in early years settings. Indeed, in a recent report, it was stated that 90% of young children were achieving expected levels of physical development by the end of their journey through the EYFS (DfE 2017b). At the same time, however, news reports are alerting us to the fact that more and more children are not 'school ready' (e.g. The Telegraph 2014; TES 2017; Schools Week 2018). Likewise, research cited in Haynes and Haynes (2016) highlights a concerning number of children aged 4–5 unable to stand on one leg and with balance problems and poor spatial awareness. Of these, only 17% had expected levels of gross motor skills previously expected at school entry, 30% had visual tracking problems (needed for reading and writing) and 40% had not achieved a pincer grip, which would be essential for fine motor skills such as writing and doing buttons. In another project, cited in Duncombe (2019), children were 'tested' prior to their participation in a movement programme across 12 measures of physical development (e.g. balancing on one leg, crawling and marching). Findings revealed that, out of the 2,363 children from 78 Leicestershire primary schools, a worrying 77% did not pass five or more of these tests. A score of below five would indicate a significant delay in physical development.

The situation, it would seem, is neither transparent nor as positive as the DfE data suggest. Thus, as part of a wider research project that sought to assess the impact of a daily movement programme on young children's physical development, this paper will: focus on whether and why physical development has, indeed, declined upon entry to school in recent years; explore why this might be problematic; and discuss what changes to early years provision, if any, may be needed in the future.

Literature review

Why is a good level of physical development important?

Jess and Dewar (2004) draw on the work of Seefeldt, Haubenstricker & Rechlien (1979) to propose that 'children who possess inadequate motor skills are often relegated to a life of exclusion from organised and free play experiences of their peers and subsequently to a lifetime of inactivity because of their frustrations in early movement behaviour' (Jess and Dewar 2004, 25). Likewise, Pyfer (1988) highlights the link between poor physical development and later difficulties in PE, and Cantell, Smyth, and Ahonen (1994) suggest that children with motor delays in early childhood

are likely to have some degree of motor difficulties throughout their lives. With this in mind, the overview of literature conducted by Bailey et al. (2009) is especially pertinent. Within this paper, four domains in which physical education and school sport may make positive contributions towards are identified: physical, social, affective and cognitive. Thus, illustrating that an ability and willingness to engage in PE and school sport may impact a child's wider development. Clearly, if this ability and enthusiasm is not nurtured in the early years, some children may not benefit from later engagement in PE and are unlikely to reap the broad benefits associated with participation.

As the overview by Bailey et al. (2009) implies, the impact of poor physical development is more wide-ranging than merely affecting physical skills and the ability to participate in physical activity, PE and sports. Expanding on this, for example, a child who has not yet achieved a good level of fine motor skill will struggle to write well enough to express their ideas on paper. Just as finely tuned motor control in the hands and fingers is required to write, it is also required for the eyes to be able to make the necessary vertical movements when copying from the board or doing column methods in mathematics, and the horizontal movements (horizontal tracking) required for reading (e.g. Goddard Blythe 2001).

Furthermore, Cheatum and Hammond (2000) identify that, in addition to having difficulty with the fine motor control required for writing, children may also struggle because of poor gross motor development as these precede and underpin hand writing. This includes the larger muscles in the torso, shoulders and neck. Thus, gross motor control must also be developed enough to enable children to sit up, sit still, sit cross-legged on the floor, to hold the head up for periods of time (rather than slumping at the desk) and to support extended periods of written work. As Goddard Blythe (2005, 137) writes: 'the most advanced level of movement is the ability to stay totally still'.

When the physical components of academic tasks are broken down like this, the link between physical competence and academic success becomes more transparent. Indeed, a number of studies have been conducted to investigate the association between immature physical development and children with special educational needs such as dyslexia, attention deficit hyperactivity disorder (ADHD), developmental coordination disorder (DCD) and children with delayed language development (e.g. Cheatum and Hammond 2000; Goddard Blythe 2001; Taylor, Houghton, and Chapman 2004; Jordan-Black 2005; McPhillips and Jordan-Black 2007; Konicarova and Bob 2012; Leonard and Hill (2015); Dewey et al. 2002). Furthermore, Haynes and Haynes (2016) highlight an association between neuro motor readiness for school and immature vestibular functioning in children with dyslexia and dyspraxia, and Mcphillips and Sheehy (2004) make the connection between children with reading difficulties and an underlying developmental delay. In a review of related research, Brown (2010) identifies the following potential negative outcomes from poor physical development/attainment of motor milestones in infancy: later motor, educational and social difficulties (Cantell, Smyth, and Ahonen 1994); later levels of adult physical development and cognitive performance (Kuh et al. 2006; Murray et al. 2006); and reading and writing delays (O'Hare and Khalid 2002).

What might impact physical development?

In reviewing the factors that might prevent or 'slow' the normal course of physical development, it is helpful to start at the beginning (conception) and then trace 'key moments' that might affect typical development. Difficulties may start in the womb and during the birth process, for example, Goddard Blythe (2008) and Cheatum and Hammond (2000) identify that drug or alcohol abuse by a pregnant mother may lead to later developmental problems in the child. Goddard Blythe (2009) also highlights numerous pre-natal factors (e.g. high blood pressure, viral infection, severe emotional stress) and the birth itself (e.g. early/late or assisted) that may be indicative of or contribute to later neuro-developmental delays. Furthermore, Andersson et al. (2015) identify that early umbilical cord clamping negatively affects later fine motor skills (especially in boys) compared to those with delayed cord clamping, and Sugden and Wright (1998) found an association between low birth weight children

(those weighing below 1000 g) and children who later scored below the 10th percentile on the Movement Assessment Battery for Children (Henderson and Sugden 1992). Thus, future motor development may be affected before the child takes his or her first breath. These issues can then be exacerbated or potentially initiated during the first year of life if conditions are not conducive to successful physical development.

Early movements are predominantly reflexive; that is there is little conscious control over these and movement is largely involuntary and for survival purposes (Gallahue, Ozmun, and Goodway 2012). As conscious control over movement develops, a typically developing baby should pass through a number of developmental stages; sometimes referred to as 'milestones'. Marlen (2019), drawing on the Pikler approach, identifies these as: gaining control of the head, hands and feet whilst on the back; rolling onto the side and back onto the back; rolling onto the tummy; gaining control of the head from a prone position; supporting the head in a half arm extension position; rolling from the back onto the tummy and back again; balancing on the side; belly or commando crawling; half sitting; crawling; full sitting; standing whilst supported; standing independently; and walking. Marlen (2019) highlights a baby's innate ability to successfully pass through each of these stages if they are given the correct opportunities to do so. She proposes that certain modern devices (e.g. baby gyms, mobiles, car seats, buggies and 'bumbo seats') may hinder development because they prevent this natural progression. A concern that is shared by O'Connor and Daly (2016) who state that most baby 'containers' force the infant into a 'C-shape' which is not a favourable position for natural development. Moreover, Garrett, McEroy & Staines' (2001) research reveals that crawling, standing alone and walking can be delayed by 3.3. to 3.7 days for every 24 h of time spent in a walking ring.

In support of this, Goddard Blythe (2005) asserts that: 'None of these [developmental] stages can be worked through thoroughly from the confines of a baby seat' (185). Likewise, O'Connor and Daly (2016) note that propping infants into a seated position may interfere with natural development and hinder the development of head righting reflexes – essential for balance throughout life. These concerns are confirmed by Engelbert et al. (1999) who researched the impact of baby walkers on motor development and identified a causal link between these and delayed motor development, concluding that their use should be discouraged.

Thus far, we have discussed early infant movements predominantly executed in the prone or supine position; the discussion will now turn to a later developmental stage – crawling. Crawling is often preceded by 'belly crawling' similar to an army-style commando crawl; crawling in this discussion, however, refers to the quadruped (on-all-fours) position. In order to identify why missing (or cutting short) this important developmental stage is problematic, the benefits of crawling will firstly be outlined.

Crawling is a weight bearing activity in a new position relative to gravity; it, therefore, helps to develop balance and also starts to build up the muscles in the fingers, hands, arms, legs and shoulders required for later reading, writing and sitting still (O'Connor and Daly 2016). Likewise, it is believed that vision is extended and refined as the child starts to move about in this new position with the hands being at a similar distance to the eyes as they later will be for reading and writing (Goddard Blythe 2008). In the early stages of crawling, the limbs on the same side tend to move together (homologous crawling) with a more advanced stage being referred to as cross-lateral crawling; this is where opposite limbs move in time together (e.g. left arm with right leg). Haynes and Haynes (2016) identify this as important because it encourages the crossing of the midline and, in turn, strengthens communication between the left and right brain across the corpus callosum. Children who have not achieved this cross-pattern crawling may be 'locked' into this stage and have problems crossing the midline or getting the limbs on either side of their body to work independently and/or together. Cheatum and Hammond (2000) suggest that this is often seen later in catching activities when a child tends to use both hands when catching and struggles to catch on one side or the other, preferring to catch near the middle of their body. Writing, similarly, requires the hands and eyes to cross the midline

and so problems may also appear with these activities. A helpful consideration in conclusion to this section comes from Goddard Blythe (2008) who states:

> There are many children who did not crawl or creep in the first year of life who do not go on to have later problems. However, amongst children who do have specific learning difficulties, the incidence of children who did not crawl is higher (90).

Furthermore, and in support of this, Visser and Franzen (2010) identify that: 'Children seen in occupational therapy for pencil grasp and control problems are often identified, based on parents' information, as having omitted crawling milestones' (19). A further consideration is the length of time spent in this 'stage' with Chapelais and Macfarlane (1984) warning us that that less than two months of crawling may not be sufficient to fully develop the strength needed in the upper limbs for later, more mature skill development.

In exploring additional reasons why infants and young children may be missing key stages of development or passing too quickly through them, many of the usual 'culprits' are exposed: increased screen time (Sigman 2012; Vandewater et al. 2005); declining opportunities for play and especially play in outdoor environments (Goddard Blythe 2005; Coates 2019); an increased focus on getting children academically ready to start school (Wesley and Buysse 2003); health and safety concerns [that have led to a decrease in risky play] (O'Connor and Daly 2016; Valentine and McKendrick 1997; Veitch, Salmon, and Ball 2006); and phasing out of routine physical development tests (O'Connor and Daly 2016, 15). In addition, O'Connor and Daly (2016) state that 'physical development is ignored and underrated' and highlight that this may be due to one or a combination of the following:

- Physical development tends to be taken for granted;
- Not moving (sitting still) is over-praised;
- The focus is too often on the brain rather than the body because of academic priorities (e.g. teaching phonics at pre-school);
- Physical activity is seen as a chore.

Whilst there is not space here to explore these issues in more depth, identifying and acknowledging them alerts us to potential solutions as well as being helpful for the later discussion.

A further issue of concern is knowledge and understanding of physical development. That is, what is known by the 'key' people in health and education with responsibility for young children's physical development (early years practitioners, paediatricians, health visitors, GPs, policy makers etc.)? It is not the purpose of this paper to identify whether or why there may be a lack of knowledge and understanding in this area but one additional reason for why levels of physical development may be lower than desirable could lie, albeit unintentionally, in a system (health and education) that has neglected to fully understand the physical development needs of young children and how these might be provided. For example, the benefits of tummy time are well publicised and promoted widely in the UK, yet Marlen (2019) notes the importance of babies also spending time on their backs before being put into the prone (on the tummy) position, however, this key information is not readily available. Likewise, in reviewing official EYFS guidance (Early Education 2012, 22), we were concerned to see that 'bottom shuffling' was being promoted as an acceptable activity. Bottom shuffling (where infants move around shuffling on their bottoms) tends to occur when crawling has been missed. There is little evidence to suggest that bottom shuffling, in itself, may contribute to developmental delays but we do know from the information provided above that crawling is essential for later success (and bottom shufflers rarely crawl); a point recognised by O'Connor and Daly (2016). The inclusion of this in official guidance is, at best worrying, and warrants investigation.

Further research questioning the knowledge and understanding of those charged with the care of our youngest children comes from Teitelbaum et al. (1998). Their research explored developmental abnormalities during infancy in a sample of 17 autistic children; they highlight:

> Time and time again, in our correspondence with the mothers of autistic children, we have heard that the mother suspected that something was wrong with her baby but that the pediatrician told her everything was alright and that she need not worry. The pediatrician should be the earliest, not the last, to know that the child might be autistic (13987).

Thus, there seems to be some uncertainty amongst medical practitioners and policy makers as to what is 'normal' physical development. These gaps in knowledge may help to explain why levels of physical development might be declining as children start school. Whilst acknowledging that this link is not proved, the research outlined above does provide support for further investigation in this area. This literature review has highlighted why low levels of physical development might be problematic; the research reported below was designed to answer the following research questions: 1. Have levels of physical development declined upon entry to reception in recent years? 2. How have changes to young children's physical development been observed by teachers?

Methodology

Overview

A mixed methods approach was used in this study. Firstly, 115 children were tested using the Movement Assessment Battery for Children 2nd edition (MABC-2; Barnett, Henderson, and Sugden 2007) and, secondly, an online survey was sent to reception teachers within Leicestershire (and completed by 25 teachers). Thus, a mixture of qualitative and quantitative methods was used in order to explore whether and how physical development, as children start school, has declined in recent years. This was so that teachers' views could be combined with physical development data to produce a more cohesive picture.

The movement ABC-2

The Movement ABC-2 (Barnett, Henderson, and Sugden 2007) is well established as a research tool. It is used to: select subjects for experimental study; as an assessment instrument in longitudinal studies of children known to be at risk of motor difficulties; as a means of studying the factors contributing to poor motor competence; and as a measure of change in intervention studies. The Movement ABC and Movement ABC-2, are two of the most frequently used tests of motor impairment in the world; featuring in over 500 research studies internationally and it has been translated and standardised in several countries. The MABC-2 was published in 2007 (based on the assessment of 1200 children between the ages of 3 and 16).

The MABC is an individually administered test that takes between 20 and 40 min to complete and can be used with children aged from 3 years to 16 years. The 3–6 years age band was used in this research and, within this, eight tasks are divided into three domains: (a) manual dexterity, (b) balls skills, and (c) balance. An overall physical development score can also be calculated. Standard scores for each domain can be compared to normative data and interpreted in terms of percentile equivalents. Those scoring below the 16th percentile are considered to have or be at risk of developing movement difficulty.

Participants

Two schools were recruited prior to the start of the 2015/16 academic year; one of these (school A) was chosen because of its location and a willingness from the head teacher to be involved. School B was recruited because of their initial involvement in the wider research project. Two further schools were then selected prior to the start of the 2016/17 academic year following the lead teacher's completion of the online survey presented in this paper where they were asked whether they would like to be involved. Selection was then based on whether the school had more than one class so that a

comparison class could be chosen (this was important for the wider research). As in the first year of research, an independent and a state school were selected. Further details can be found below:

- School A (large state school in an area of high socio-economic status)
  - 3 form intake – class teachers decided which 2 classes participated
  - Full data sets obtained for 45 pupils (24 males; 21 females)
- School B (independent school)
  - 1 form intake – all children invited to participate but only 10 children in the year group
  - Full data sets obtained for 7 pupils (2 males; 5 females)
- School C (medium sized state school in an area of medium socio-economic status)
  - 3 form intake – class teachers and head teacher decided which 2 classes participated
  - Full data sets obtained for 39 pupils (20 males; 19 females)
- School D (independent school)
  - 2 form intake – all children invited to participate
  - Full data sets obtained for 24 pupils (14 males; 10 females)

Methods

Physical development tests

The Movement ABC-2 is divided into three sections (balance, aiming/catching and manual dexterity). There are eight tests in total for this age group as detailed below:

Balance.

- Standing on one leg (both legs tested) (number of seconds up to 30 recorded)
- Consecutive jumps along 5 mats (number of clean jumps without double bounces or landing on two mats recorded)
- Walking with heels raised along tape on the floor (number of accurate steps up to 15 recorded)

Aiming/Catching.

- Catching 10 beanbags (successful catches out of ten recorded)
- Throwing 10 beanbags onto a target (a mat on the floor) (accurate throws out of 10 recorded)

Manual dexterity.

- Completing a drawing trail (number of errors recorded)
- Posting coins (time taken recorded)
- Threading beads (time taken recorded)

For each assessment, a demonstration was given, the children were allowed a practise and then they had two formal trials with their best score being recorded (aiming and catching was scored out of 10 and not repeated). The equipment is all included in the pack along with precise instructions so that each trial is standardised (as much as is possible).

Teacher survey

In collaboration with The 0–5 Early Learning and Childcare Service and the Teaching School Alliances in Leicestershire, an online survey link was sent out to approximately 50 reception teachers in

Leicester and Leicestershire (in July, 2016). This was completed by 25 teachers, three of whom were also involved in the physical development testing, representing a 50% response rate (approximately – due to a change of staff, the final number of targeted teachers was not established). The survey asked teachers whether they thought that children were starting school less physically developed than in previous years, when they started to notice a decline and what changes they had noticed.

Ethical considerations

Full ethical approval was granted from the University's ethics committee prior to the start of data collection. The age of the children involved in this study led to a number of ethical issues having to be considered and resolved. The children had just started formal schooling for the first time so we waited approximately three weeks before starting the data collection to allow them more time to settle in. We also asked one of the learning support assistants from each class to accompany the children so that somebody familiar was in the room with them. To help them feel more comfortable with the situation, five children were present at any one time and they rotated round four 'stations' to complete the tests. A box of toys was provided so that the fifth child could play with these whilst waiting for their turn. The children were reassured that it did not matter what they scored but that they should try their best and, on the whole, they could not see how other children had performed. Additionally, children were informed that they did not have to participate and five children across the four schools chose not to.

Data analysis

The raw scores from the Movement ABC-2 were entered into Excel and then conversion charts (as provided in the assessment pack) used to calculate standard scores for each assessment activity. It was then possible to calculate an overall standard score and percentile score for each component (Balance, Aiming/Catching and Manual Dexterity) and then for an overall physical development standard and percentile score to be calculated.

The data from the teachers' survey was download directly into Excel where the first two questions could be quantified. The final four questions were open-ended and were analysed thematically.

Findings

Physical development tests (Movement ABC-2)

Full Movement ABC-2 data sets were obtained for 115 children across the four schools. The assessment highlights that children scoring at or below the 5th percentile would be classified as 'having a movement difficulty' and that children scoring between the 6th and the 15th percentile would be classified as being 'at risk of having a movement difficulty'. Based on these previously established norms, we would expect that approximately 5% of children tested would fall into the former category and 15% into the two categories combined. In addition, approximately 50% of the children should score above/below the 50th percentile. The table below, thus, presents a worrying picture Table 1.

The data indicate a rise in both the percentage of children with or at risk of a movement difficulty compared to norms established in 2007. In fact, this figure has approximately doubled in ten years (32.17% compared to 15%). Likewise, the percentage of children scoring below the 50th percentile has also increased with 80.87% of children now scoring in the bottom half (30.87% more than in 2007). Whilst it is not in the researchers' remit to diagnose conditions such as developmental coordination disorder, following an assessment by a qualified professional and with some additional contextual information, it would not be surprising if the majority of the 17.39% scoring at or below the 5th percentile were diagnosed with this condition.

A second way of analysing the data is to look at the mean percentile scores from across the sample of 115 young children as presented in the table below Table 2.

Table 1. Percentage of Children Scoring within specified percentiles as compared to expected levels (based on 2007 norms).

Score	Interpretation	% of children scoring in this percentile range	Expected % based on 2007 norms	Difference between expected and obtained
5th percentile or below	Children identified with a movement difficulty	17.39%	5%	12.39% more than expected
6–15th percentile	Children identified as being at risk of a movement difficulty	14.78%	10%	4.78% more than expected
15th percentile or below	Children identified with or at risk of having a movement difficulty	32.17%	15%	17.1% more than expected
At or below the 50th percentile	Children scoring in the bottom 50%	80.87%	50%	30.87% more than expected
At or above the 75th percentile	Children scoring in the top 25%	13.91%	25%	11.09% less than expected

As with the previous table, if we compare the data with the 2007 norms, we can see that there has been a decline in all areas in the last ten years with balance seeming to be least affected. A decline of 18 percentile points for overall physical development in just ten years is certainly noteworthy and will be further discussed and explored in the next section. Firstly, however, the qualitative data from the teachers' survey will be presented.

The teachers' survey

An overwhelming 96% of teachers responded that they thought children are now starting school less physically ready than in previous years. When asked to identify when they had first noticed this decline, the majority (87.5%) felt that this had been in the last six years (NB. The survey was conducted in 2016). A breakdown of their views is provided below:

- In the last 1–2 years: 2 (8.3%)
- In the last 3–4 years: 16 (66.7%)
- In the last 5–6 years: 3 (12.5%)
- In the last 7–8 years: 2 (8.3%)
- In the last 9–10 years: 1 (4.2%)
- More than 10 years ago: 0 (0%)

The teachers were then asked to provide examples of any changes they have noticed in relation to children's physical development and these are as follows:

1. Changes to fine motor skills:
    - Handwriting/pencil grip (10 comments)
    - Scissor skills (3 comments)
    - Dressing/buttons (3 comments)
    - Threading beads (1 comment)
    - Cutlery (1 comment)
2. Changes to gross motor skills:
    - Posture/the ability to sit up and sit still (8 comments)

Table 2. Mean percentile scores for balance, aiming/catching, manual dexterity and overall physical development compared to norms established in 2007.

	Balance	Aiming/ Catching	Manual Dexterity	Overall Physical Development score
Mean percentile score	44	30.92	34.43	31.87
Changes from 2007 norms	−6 percentile points	−19.08 percentile points	−15.67 percentile points	−18.13 percentile points

- Coordination (5 comments)
- Core strength (5 comments)
- Stamina/fitness/getting tired quickly (5 comments)
- Balance (3 comments)
- Upper body strength (3 comments)
- Hand-eye coordination/spatial awareness (3 comments)
- General strength (2 comments)
- Gross motor skills in general (2 comments)
- Confidence/ability in PE (2 comments)
- Ability to walk up and down stairs (1 comment)
- Proprioception (1 comment)
- Hand dominance (1 comment)

These points are illustrated in a number of selected comments below:

> I have intelligent children in my class who are struggling to concentrate, because they don't have the core stability to sit upright on a chair or on the carpet. I have children who have the phonetic skill to be able to write, but who have such poor fine motor skills due to a lack of strength in their hands that they really struggle.

> Scissor skills and pencil control are not good. Also this year some children are not walking up and downstairs confidently.

> Their ability to hold a pencil (let alone properly) has significantly declined. Their muscles in their hands are just not developed enough to hold and grip the pencil (linked to this is their ability to draw a recognisable person and the spatial awareness of their drawing on the page).

> Cutting skills have also decreased. More children need to be taught how to hold a pair of scissors, before being taught how to snip, before being taught how to cut along a line. Ability to manage fastenings such as buttons and being able to dress/undress has also declined. Some children are physically unable to use their upper body strength to take off a t-shirt/jumper.

> Many children needing to 'loll' back on furniture (or other children) when sitting down the carpet, and lying down to play e.g. with small world/ construction when on the carpet.

Discussion

Data from the Movement ABC-2 assessment as well as the teacher survey confirm our concerns expressed at the start of the paper (i.e. that physical development in young children as they start school at aged 4 has declined in recent years). Of particular concern is the percentage of children starting school with or at risk of having a movement difficulty (32.17%); a figure that has approximately doubled in 10 years (2007–2017). In addition, physical development scores have declined by 18 percentile points in the same time scale. These numbers are unacceptable. Teachers who completed the online survey confirm a decline with 96% of teachers responding that they believe children are starting school less physically prepared than in previous years. Their comments help to clarify ways in which this decline is apparent in the classroom with teachers highlighting a range of gross and fine motor skills that their pupils now struggle with (over and above what was observed in previous years). The original Movement ABC was published in 1982; we would be interested to see how the norms established at this time compare to the norms established for the second edition in 2007 and also to our own data from 2015–2017. A concern worth stating at this point in the discussion is that, should the Movement Assessment Battery used here be re-normalised at some point in the future, will the declining levels of physical development that our research has uncovered become statistically 'normalised' and therefore be seen as acceptable?

A number of potential reasons that may have contributed to this decline were put forward earlier and are worth reiterating at this stage if recommendations for future policy and practice are to be

considered (increased screen time; declining opportunities for play and especially play in outdoor environments; an increased focus on getting children academically ready to start school; health and safety concerns; and phasing out of routine physical development testing). At the heart of this has to be a consideration of ways that we can get our youngest children to, not only move more, but to move in more developmentally appropriate ways. We know that a high percentage of young children are not meeting UK physical activity guidelines (Townsend et al. 2015) and this is not an issue to be dismissed, however, physical development is more than just physical activity (a child who walks for an hour a day would meet the UK physical activity guidelines but would not necessarily have engaged in any movements that were beneficial to their physical development). This difference is important and illustrates why increasing understanding in this area is essential. We stated earlier that we had concerns over parents' and practitioners' understanding of this area and would welcome future research that can help to pinpoint current understanding as well as highlight gaps in knowledge. This would have implications for future policy, practitioner training and health advice for parents. Exploring ways in which this might be done was beyond the scope of this study but The Play Partners research (Preedy and Sanderson 2019) demonstrates an effective way in which parents could be trained to engage in more productive physical play with their children. Likewise, Archer and Siraj (2017) have developed an environmental rating scale for practitioners to assess the movement opportunities provided in their setting. Recent publications (O'Connor and Daly 2016; Manners 2019; Duncombe 2019) also guide the reader in a helpful direction. Physical development provision in Finland (Sääkslahti and Duncombe 2019) may also be a helpful starting point for practitioners wishing to overhaul their practice.

At this point in the discussion, it is helpful to draw on the wider literature and ask for a consideration of whether schools are ready for children (UNICEF 2012) rather than the focus being on whether children are ready for school – an important difference. For example, Wesley and Buysse (2003) identify tensions between what children need in terms of their physical development and what teachers are asked to provide. There also seems to be a tendency for children to be formally educated at earlier ages with O'Connor and Daly (2016, 132) identifying a 'Government drive to introduce children as young as two years old into school environments' and Wesley and Buysse (2003, 353) arguing that schooling for this age group has become so academically focused that it now resembles the first grade.

Another consideration, albeit controversial and costly in terms of both time and money, is whether developmental screening should be reintroduced to schools and what format this might take. At the very least, we could consider more selective screening that seeks out possible motor difficulties as being associated with wider academic delays such as reading (Brown 2010). Support for this comes from research by Satz et al. in 1978 who discovered that one simple test – the finger and thumb opposition test (that looks at pincer grip) was among one of the strongest predictors of later learning difficulties. As Haynes & Haynes assert, the focus would be better on getting it right in the first place rather than trying to put it right with interventions and reactive programmes at a later date. Research by Teitelbaum et al. (1998) suggests that movement analysis in infancy may be a useful diagnostic tool for autism having found disturbances in some or all developmental milestones (of lying, righting, sitting, crawling and walking). Although, in a similar study, Ozonoff et al. (2008) found similar disturbances in physical development amongst children with general developmental delay, perhaps suggesting an overlap of symptoms rather than these delays and disturbances being specific to autism. At the very least, we suggest that the re-introduction of developmental screening be considered and future research efforts turned towards this. These could be administered as part of assessments conducted at the start and end of the reception year.

In terms of limitations, we acknowledge that our data may have been strengthened by a larger sample size. That said, the Movement ABC-2 findings were consistent across the four different schools, confirmed by teachers who participated in the survey and are in line with similar findings reported elsewhere (e.g. Haynes and Haynes 2016; Duncombe 2019). Inadequate research funding also limited the extent to which we were able to validate our findings using other methods and

assessments. Ideally, more contextualised observations of children's physical development in their natural setting would have provided another angle to this research (e.g. The Early Years Motor Skills Checklist, Chambers and Sugden 2006), as would questionnaires or interviews with teachers and parents.

Conclusion

As is often the case with small-scale exploratory research, we have created more questions and areas for future research than we have perhaps answered. These are, however, important questions. The data in this research highlights that children's physical development, as they start school, is declining and there is, thus, clearly a need (arguably an obligation) for further investigation. In reviewing the literature, a number of potential reasons for this decline were put forward to highlight reasons why babies and young children may not complete typical developmental milestones such as crawling. In exploring some of these, we would question the extent to which physical development is fully understood amongst those given the greatest responsibility for our youngest children. We have highlighted worrying gaps in knowledge and understanding with regard to children's physical development and would call for future research to explore, as a priority, what is currently known by parents, early years practitioners, paediatricians and policy makers. From this, it would then be possible to identify gaps and misinformation and for these to be addressed. Linked to this, the next step would be to monitor and evaluate current training in physical development for early years practitioners and other health professionals who advise parents on their child's development. To reiterate the point made by Teitelbaum et al. (1998), 'the paediatrician should be the earliest, not the last to know … '.

Moving forward, there needs to be an acknowledgement and understanding that 'the physical' underpins more advanced cognitive functions and time and space needs to be made available in early years settings to reflect this. Babies need time and space to develop at their own pace and to pass through the developmental stages that they are innately programmed to do. Likewise, young children need time and space to play and to move and to strengthen the gross and fine motor skills that they will later need to succeed in the classroom, thereby, developing the physical foundations essential for academic achievement. In conclusion, we draw on the work of Weiler et al. (2014) who ask 'is the lack of physical activity strategy for children complicit mass child neglect?'. They cite the UK government's definition, which states child neglect to be 'the persistent failure to meet a child's basic physical and/or psychological needs, likely to result in serious impairment of health or development' (HM Government 2013). Our research has, indeed, demonstrated a failure to meet the physical needs of a large proportion of children in the UK and highlighted a serious impairment in their physical development. With the government's definition in mind, would these findings be reflective of 'mass child neglect'? If this is the case, our findings and recommendations provide a helpful starting point for highlighting the issues and ultimately for improving early years physical development provision in the future.

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