6 Independent mobility and children’s physical development

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There is now abundant evidence in adult life of the protective effect of regular physical activity against coronary heart disease.\(^1,2,3\) It has advantages too in reducing blood pressure, countering obesity, lowering lipids, retarding osteoporosis, improving psychological wellbeing, and even reducing the risk of cancer.\(^4,5\) It may also confer these benefits in childhood but, more importantly, it is a positive, potentially enjoyable intervention almost entirely without risk,\(^6\) and is widely accepted socially as an important normal part of a young person’s development. The Allied Dunbar National Fitness Survey\(^7\) reported that lifelong physical activity is most likely to be started in childhood. Yet, despite a wide acknowledgment of the desirability of physical activity in youngsters, we know relatively little about their physical activity patterns.

What is the volume (intensity, duration and frequency) and type of physical activity which is associated with the improvement or maintenance of children’s health? A recent review\(^8\) concluded that appropriate (i.e. health-related) physical activity for children involves large muscle groups in dynamic movement for 20 minutes or longer. The types of activity referred to included cycling, swimming, jogging, skating and dancing. It was emphasized that this type of physical activity should take place at least three times a week and that it should be of an intensity which elicits heart rates equal to or in excess of 140 bpm.\(^9\) As children have, on average, maximum heart rates of about 200 bpm,\(^9\) this threshold is in close relative agreement with the level of physical activity suggested by Morris et al.\(^10\) to be associated with a low incidence of coronary heart disease in adults. To put this heart rate threshold into perspective, it is worth noting that with children we have found that brisk walking at 6 km/h on the treadmill elicits steady state heart rates in excess of 140 bpm.\(^11\) So the current concept is
that health-related physical activity involves sustained, regular periods of moderate-intensity physical activity.

The measurement of adults’ habitual physical activity is one of the most difficult tasks in epidemiological research and the assessment of the daily physical activity of ‘free-ranging’ children is even more problematic. Methods for estimating the level of adults’ physical activity have been developed. Several of these have been used in the assessment of children’s habitual physical activity but without due consideration being taken of the differences between children and adults. With children the technique used must be socially acceptable; it should not burden them with cumbersome equipment and it should minimally influence their normal physical activity pattern. Ideally the relative intensity and duration of physical activity should be monitored and, if a true picture of habitual activity is required, some account should be taken of any day to day variation. Bar-Or\textsuperscript{12} has suggested that a minimum follow-up of three days is needed with children, including one weekend day. Few studies of British children have satisfied all of the above criteria.

With the development of self-contained, computerised telemetry systems the use of continuously monitored heart-rate became a feasible method of assessing the relative intensity and duration of physical activity. Leger and Thivierge\textsuperscript{13} carried out a detailed analysis of the most popular commercially available heart monitors and concluded that the ‘Sport Tester’ was first choice as, ‘in addition to having excellent validity and stability it permits almost total freedom of motion’. The Sport Tester consists of a lightweight transmitter and a receiver/microcomputer. The transmitter is fixed to the chest with electrodes and the receiver/microcomputer is worn as a watch on the wrist. The Sport Tester is capable of strong minute-by-minute heart rates for up to sixteen hours. In a series of investigations,\textsuperscript{14-17} we utilized this facility to investigate whether British children regularly experience health-related physical activity.

The volume of physical activity of 163 girls and 103 boys, aged 11 to 16 years, was estimated from continuous heart rate monitoring over three weekdays. Each child was monitored from about 0900 to 2100 during a normal school day. The receivers were retrieved, replaced, and refitted the next morning and the process repeated over three days. In addition, 212 of the children were monitored from 0900 to 2100 on a Saturday.\textsuperscript{14} Only four boys and one girl experienced a daily period of physical activity of the length and intensity defined by Simons-Morton et al.\textsuperscript{8} as health-related physical activity. Of the boys, 77 per cent failed to experience a single twenty-minute period at the intensity equivalent to health-related physical activity over three days of monitoring; the failure figure for girls was 88.
per cent. Over a third of the boys and over half of the girls failed to experience a single ten-minute period with their heart rate maintained at or above 140 bpm during the weekday monitoring, with 71 per cent of the boys and 94 per cent of the girls failing to experience a single ten-minute period with their heart rate at or above 140 bpm during Saturday monitoring. This report provided the first objective evidence of British children’s low levels of habitual physical activity. A comparison of the level of physical activity of girls and boys revealed that girls were significantly less active than boys and that, unlike boys, girls’ volume of physical activity gradually decreased from the age of 11 years through to 15 years.

These findings stimulated us to study a group of primary schoolchildren, aged 10 years, from the same catchment area as some of the secondary schoolchildren, mean age 13 years, whom we had already surveyed. A comparison of physical activity patterns revealed that, although there was no significant difference between the volume of physical activity of primary schoolboys and secondary schoolboys, the primary schoolgirls were significantly more active than the secondary schoolgirls. Furthermore, no significant difference between the volume of health-related physical activity of the primary schoolboys and the primary schoolgirls was detected. This prompted us to make a more in-depth analysis of primary schoolchildren’s physical activity patterns. A study of the three-day activity patterns of 67 boys and 65 girls, aged 10 years, confirmed that there was no significant difference between the health-related physical activity patterns of girls and boys. Very few primary schoolchildren, however, experienced daily periods of twenty minutes or longer with their heart rates above the recommended threshold. It appears that sustained periods of physical activity for this length of time are not features of the habitual physical activity of this generation’s young children. A similar analysis of ten-minute periods also revealed that only a minority of children experienced a daily session with their heart rate above the recommended level.

All of the above studies were carried out throughout the school year, but in order to investigate whether there was any difference between physical activity levels during the autumn and summer terms, 24 children were monitored for three days in the autumn term 1989 and three days in the summer term 1990. No significant differences were detected.

This series of studies clearly demonstrated that British children, at least in the South of England, have surprisingly low levels of habitual physical activity and that many children seldom experience the intensity and duration of physical activity associated with health-related outcomes. Boys
are more active than girls from the age of about 11 years and girls’ activity levels deteriorate as they move through secondary school.

Public awareness of the importance of increasing children’s physical activity needs to be raised. Attractive and accessible sports facilities need to be made available at reasonable cost and at times when children can use them, such as early evening, during weekends and school holidays. Yet, at a time when local authorities and local education authorities should be extending the use of their facilities, evidence is accumulating to support the view that lack of maintenance of facilities and resources for physical education is becoming serious. Lack of opportunity to participate has not, however, been identified as a major problem by the children in our studies, though many of the children have emphasised the value of a family approach to encouraging activity. They have particularly highlighted the importance of parental and sibling example. Attitudes towards physical activity are established at an early age; parents therefore have a prime responsibility to encourage their children to engage in active play, but the community must provide adequate safe, clean play areas for this to take place.

The value of parents as significant socialising agents influencing sport and activity involvement is well established. Family encouragement and the involvement of parents in vigorous activity have been found to be instrumental in the involvement of children, and parental attitudes towards activity have been shown to demonstrate a significant effect upon children’s intentions to exercise. Perhaps the origins of the remarkably low physical activity patterns of teenage girls lie in parental attitudes because parental behaviour appears to be more influential for increase in exercise frequency among girls than boys. Because exercise and sport have been sex-stereotyped as masculine in our culture, boys have more potential reinforcement for exercise than girls. Boys’ games are generally of longer duration, and the ceiling of skill is often higher. The type of game normally adopted by boys can be played in more simple versions at younger ages, becoming more challenging with age as higher levels of skill and strategy are incorporated. In contrast, the types of games often adopted by girls seem to be less challenging with increasing age because the ceiling of skill was achieved at an earlier age. Parents should be encouraged to provide positive role models for their children’s activity behaviour and parental modelling may be especially important for girls.

All children attend school from an early age and the routine of travelling to and from school provides an excellent opportunity for both individual and family exercise. With young children an escorted twice daily brisk walk
or cycle ride may benefit both child and parent(s) as well as provide a positive parental role model for the child.

The primary school provides an ideal environment in which to promote active lifestyles in partnership with the home. Children’s natural curiosity can be used to help them understand how their bodies function, and the importance of physical activity can be emphasised and related to other aspects of education. The National Curriculum for physical education came on-stream in September 1992 requiring that young children are guided through a physical education curriculum that includes gymnastics, games skills, dance, swimming, athletics and outdoor education, with adequate opportunities to explore the full range of available activities. With a balanced, enjoyable programme, children can develop a repertoire of motor skills, achieve success at their own levels, and feel confident enough in their own abilities to want to pursue more active lifestyles. However, a survey by the National Association of Headteachers (NAHT) and the Central Council for Physical Recreation (CCPR) reported that 56 per cent of primary schools, as currently staffed and resourced, could not deliver this part of the National Curriculum. Furthermore, the same survey reported that only eight per cent of primary school teachers of physical education have formal qualifications in the subject. It is clear that many more resources and in-service training opportunities in physical education must be made available to all primary school teachers involved with the subject.

The recent School Sport Forum advocated ‘a daily session of vigorous activity in each primary school as part of the physical education programme or as a supplement to it’. However, this recommendation needs to be viewed with caution because of children’s resistance to participation in compulsory, structured programmes of vigorous physical activity. It is much more important to make children’s early activity experiences enjoyable in order to foster future participation.

In the secondary school it would be wrong to divorce physical activity from other aspects of a healthy lifestyle, so special provision needs to be made for a cross-curricular approach to activity education. Teachers of science, home economics, physical education and health education and school meals and school nursing staff should all be part of a multi-disciplinary, integrated approach. Relevant parts of programmes of study in all subjects should be interpreted with the emphasis on the promotion of healthy, active lifestyles that will persist into adult life.

Physical education by its very nature is the ideal medium for promoting physical activity. Both the Parliamentary Education, Science and Arts Committee and the Secondary Heads Association recommended that
all pupils should have a minimum of two hours of curriculum time each week devoted to physical education. However, a survey by the Secondary Heads Association\textsuperscript{26} reported that whereas in 1987 it was found that 38 per cent of state school pupils of age 14 had less than two hours physical education, by 1990, as schools planned for the introduction of the National Curriculum, this figure had increased to 71 per cent.\textsuperscript{26} Physical education is now established as a compulsory component of the curriculum but, as with primary schoolteachers, it is important for headteachers to ensure that the subject has sufficient resources, including time, for it to be effective.

Heads of physical education departments have been reported to regard health-related fitness as the second most important objective of physical education, but their curricula often do not explicitly reflect this emphasis.\textsuperscript{18} Although the provision of a high activity content should be an important component of most physical education lessons, the prime objective underpinning the inclusion of health-related physical activity in the physical education curriculum should be for children to achieve ‘activity independence’. Teachers must help and encourage children to internalise the motivation to be active so that when the extrinsic motivation of the teacher is removed, the child will continue with an active lifestyle. To achieve ‘activity independence’, children should understand the principles underlying healthy activity and be taught how to become informed decision makers who can plan and implement individual activity programmes that can be periodically re-appraised and modified as they get older.

If teachers are to develop successful courses, they need to understand current concepts in exercise and health science and be cognisant of the growing body of knowledge associated with exercise adherence. This has far-reaching implications for both initial and continuing teacher education programmes. Universities and other institutes of higher education must provide initial teacher-training students with a thorough grounding in both the practical and the theoretical aspects of exercise and health science. The potential cross-curricular contribution of physical education to the whole curriculum for 5-18 year olds must be emphasised, and suitable programmes of study must be integrated into current initial training courses. These courses should be underpinned and enriched with dynamic research programmes. Optimum methods of delivery of courses, founded on research results, urgently need to be investigated. Universities, colleges, local education authorities and schools need to work together to design appropriate postgraduate courses and to encourage school-based action research in exercise and health science as part of the continuing professional development of experienced teachers.
In comparison to what we know about adults, we know very little about paediatric exercise and health science. Groups of scholars need to collaborate to address the exciting research problems on an interdisciplinary basis. My own research team, funded by the British Heart Foundation, is currently studying 250 children on a longitudinal basis and we expect to follow the children from age 10 to 16 years. The children visit the laboratory twice a year where they undergo a range of biochemical, physiological, psychological, anthropometrical, biomechanical and sociological measures and their physical activity is monitored for two weeks each year. We are particularly interested in fat distribution, indices of cardiopulmonary fitness, the effects of exercise programmes, the determinants/correlates of habitual physical activity and drop-out from sports programmes in relation to age, sex and maturity.

The implications of the findings of our recent research indicate that the current level and pattern of children’s physical activity is a cause for grave concern. Adult activity patterns appear to be established during childhood. We must therefore promote and foster more active lifestyles during childhood and youth. The future health of our children depends upon it.

References


