JRM-CC
JOURNAL OF REHABILITATION MEDICINE CLINICAL COMMUNICATIONS
VOL. 4, 2021 ARTICLE 1000058

SHORT COMMUNICATION

PRACTICAL AND CLINICAL APPROACHES USING PACING TO IMPROVE SELF-REGULATION IN SPECIAL POPULATIONS SUCH AS CHILDREN AND PEOPLE WITH MENTAL HEALTH OR LEARNING DISABILITIES

Andrew M. EDWARDS, PhD[1], Ulric S. ABONIE, PhD[2], Florentina J. HETTINGA, PhD[3], David B. PYNE, PhD[4], Tomasina M. OH, PhD[5] and Remco C. J. POLMAN, PhD[6]

[1]*School of Psychology & Life Sciences, Canterbury Christ Church University, Canterbury, UK,*
[2]*Department of Physiotherapy and Rehabilitation Sciences, University of Health and Allied Sciences, Volta Region, Ghana,*
[3]*Department of Sport, Exercise & Rehabilitation, Northumbria University, Newcastle upon Tyne, UK,*
[4]*Research Institute for Sport and Exercise (UCRISE), University of Canberra, Canberra, Australia,*
[5]*Faculty of Health: Medicine, Dentistry & Human Sciences, University of Plymouth, Plymouth, UK*
[6]*School of Exercise and Nutrition Sciences, Queensland University of Technology, Brisbane, Queensland, Australia*

For special populations such as people with a mental health issue or learning disability, a disconnect between the ability to accurately monitor and regulate exercise behaviour can lead to reduced levels of physical activity, which, in turn, is associated with additional physical or mental health problems. Activity pacing is a strategy used in clinical settings to address issues of pain amelioration, while self-pacing research is now well addressed in sport and exercise science literature. It has been proposed recently that these overlapping areas of investigation collectively support the development of self-regulatory, lifestyle exercise skills across broad population groups. Activity pacing appears to have substantial application in numerous development and rehabilitation settings and, therefore, the purpose of this short communication is to articulate how an activity pacing approach could be utilized among population groups in whom self-regulatory skills may require development. This paper provides specific examples of exercise practice across 2 discrete populations: children, and people with mental health and learning difficulties. In these cases, homeostatic regulatory processes may either be altered, or the individual may require extrinsic support to appropriately self-regulate exercise performance. A support-based exercise environment or approach such as programmatic activity (lifestyle) pacing would be beneficial to facilitate supervised and education-based self-regulation until such time as fully self-regulated exercise is feasible.

Key words: pacing; lifestyle intervention; behaviour; physical activity.

LAY ABSTRACT

Activity pacing is a practical means of supporting self-regulation in physical activity. This could be achieved through lifestyle support or in specific practical sport or physical activity situations, depending on the population. Improving the development of self-regulatory, lifestyle exercise skills across broad population groups could be helpful in addressing deficiencies in physical activity levels, which, in turn, can be associated with additional physical or mental health problems. This paper provides specific examples of pacing-based exercise practice across 2 example populations: children, and people with mental health and learning difficulties. In these cases, self-regulation processes may need to be developed, or require external support. Pacing is therefore relevant to different populations in different ways.

Accepted Mar 30, 2021; Published May 4, 2021

Jrm-CC 2021; 4: jrmcc00057

Correspondence address: Prof. Andrew M. Edwards, School of Psychology & Life Sciences, Canterbury Christ Church University, Canterbury, UK. E-mail: andrew.edwards@canterbury.ac.uk

Physical activity is often reduced when there is an uncoupling of the ability to accurately monitor and regulate exercise behaviour (1). This can occur in rehabilitation settings in individuals with either acquired conditions or with congenital cognitive or learning difficulties, while also being the case with children who have not yet acquired the developmental experience to self-regulate (2, 3). Therefore, a strategy to support the

doi: 10.2340/20030711-1000058

development of self-regulatory skills across a broad range of populations, such as activity pacing, is important for achieving sustainable participation in healthy lifestyle exercise practices. This short communication highlights the opportunities in activity pacing in relation to 2 example population groups.

In medical rehabilitation settings, a lifestyle pacing approach, termed "activity pacing", is relatively well established to treat pain sensations and chronic fatigue (1, 4–5). This therapeutic rehabilitation intervention describes pacing as an approach to managing efforts beyond that of a single exercise bout, which has considerable scope for wider application. Activity pacing is a strategy to educate and better develop individuals' self-regulatory skills to divide daily activities into smaller, more manageable, portions during a period of recovery or where development is required. The goals of this strategy are to disentangle condition-symptoms from activity-sensations, so that individuals avoid overexertion, but to enable self-pacing to achieve adaptive goals, functioning in many cases as an active learning strategy for self-regulation or as a rehabilitation therapy (6). Thus, special populations beyond those identified in this article should be able to exercise, to promote gradual, progressive, and appropriate increases in independence and sustainable lifestyle activity. Activity pacing is therefore a process that has considerable potential to assist individuals to become self-sufficient, aid performance, leading to healthy, active and sustainable lifestyles (1, 4, 7), particularly for those who are at risk for over- or under-activity.

Activity pacing describes subdivisions of "naturalistic pacing" and "'programmatic pacing". Naturalistic pacing refers to the natural (or innate) use of pacing in everyday life without specific practitioner-prescribed support in place for individuals or groups (6). In contrast, programmatic pacing involves adaptive pacing activities with some level of support and instruction to enable individuals to modify how and when activities are completed, and be active without exacerbating symptoms. Programmatic pacing therefore facilitates gradual and graded increases in activity towards a state of greater independence and maximization of self-regulation (8). Consequently, all individuals can undertake naturalistic (natural) pacing to some extent, but it is programmatic pacing in which acute instruction, support and goal-setting are provided. In this process more explicit reinforcement is used to promote development of greater independent self-regulatory skills and attainment of sustainable goals. The importance of habitual physical activity for improving health and minimizing risk factors associated with development of a broad spectrum of health conditions has been documented extensively (e.g. 4). Notably, regular participation in physical activity is well known to improve quality of life, physical and mental well-being, and promote independence across the lifespan (5).

Self-regulation in response to exercise is much more complex when brain-muscle feedback and feed-forward mechanisms (9) are not fully developed or functioning optimally. Therefore, fully independent self-regulatory pacing of daily lifestyle activities may not be immediately possible for population groups who are unfamiliar with their bodies' capabilities and limitations (1). Consequently, support to educate and develop self-regulation skills, and working to create less dependency and promote independence, are important elements to develop.

In order to place these issues within a wider theoretical framework, this paper considers how an activity pacing-based approach relates to 2 example populations, children and people with mental health and learning disabilities, by engaging each in sustainable, self-regulated exercise.

Children: activity pacing approach and implications

The first signs of developing pacing skills seem to appear during late childhood (~10–11 years old), whereby the behaviour of elite youth athletes in both time-trial and head-to-head events develops further to ultimately resemble that of adults (10, 11). The purported theoretical basis behind this pattern of development is that adolescence is characterized by both cognitive and physical changes associated with growth and maturation (12). One key development is that of the pre-frontal cortex, which has been associated with self-regulatory learning and executive functioning (13), both of which are critical to developing cognitive skills essential for adequate pacing (10). Therefore, pacing is a learning process for children where they develop skills towards adulthood, gaining experience and greater self-awareness to become independent self-regulatory exercisers.

The definition of activities that constitute exercise often differs between children and adults. While adults may consider exercise to be a formal activity requiring the performance of a specific routine in a fixed exercise or sporting environment, for children it is much less complicated (14). Typically, exercise involves unstructured play or engaging in almost any form of physical activity (15). Unstructured free-form play is one of the cornerstones of children's physical development and an important feature of learning self-regulatory exercise skills (12). All developmental movement skills strengthen neurological and musculoskeletal systems and are experienced with great frequency during free-form play (15).

As a child matures, free play is gradually replaced with more adult-like formal play or game opportunities, such as competitive sports (10, 11). These activities are also crucial stages in childhood physical development. However, this development also progressively requires children to follow rules, coaches' instructions, limit individual flair or inventiveness for the sake of the group or team, and diminish individual self-expression. These developments are important features of physical and social maturation; however, they could also be counterintuitive for development of self-regulatory and fundamental motor

skills. Nevertheless, self-regulation of exercise requires experience, prior knowledge and accurate assessment of individual capabilities in a specific situation. Children cannot be expected to derive these qualities entirely from free-form physical activity. Direction, encouragement, guidance and technical instructions are all important features of facilitating development of fundamental movement skills and self-awareness (14). The difficulty is, of course, finding a balance between (fun) free-form activity and structured physical training sessions. Free-form activity in this context is comparable to naturalistic pacing, while structured physical training session can be likened to programmatic pacing.

Nearly half of modern adolescent youth (aged 12–21 years) are not vigorously active on a regular basis, and despite some sex differences (16) by age 15 years daily physical activity commonly declines to less than 50 min per day (16). There are many reasons for this pattern of change; these include physical maturation, school physical education classes often become optional, sports teams become more selective, and social activities, such as social media and video gaming, become more interesting. Although physical activity plays important roles in determining cardiorespiratory, skeletal and psychological health, young children and adolescents tend not to see health as a motivational factor (13, 14). Motivation is usually derived from enjoyment, feelings of competence, socialization and engagement (13). Developing sustained motivation is best achieved when a child enjoys the activity, achieves some success, and perceives that the environment is supportive and fun. If the child does not enjoy the experience it is highly unlikely that a sustainable exercise practice will be established.

The teaching of sport often embraces the skill/drill focus associated with the technical or traditional model of coaching/teaching (16, 17). The underlying principle of this model emphasizes the transfer of knowledge from a coach to the athlete. Several alternative pedagogical approaches to teaching games have emerged over the last decade. These include teaching games for understanding (TGfU), Game Sense and Play for Life (17). These approaches are child/athlete centred and focus on a more holistic approach to skill learning. For example, TGfU shifts the teaching emphasis from technique to total performance in game situations. Consistent with constructivist learning theory, these approaches try to engage children in meaningful and enjoyable physical activity or sport, social interaction, problem-solving and decision-making. Such methods allow children to self-pace their activities and gain the necessary awareness and self-regulatory skills to successfully execute sporting activities in the future.

In terms of perceptual responses to exercise, children tend to differentially self-rate equivalent percentages of aerobic power to be more challenging than adults (3, 4). This disparity may be a result of greater sensitivity to pulmonary discomfort owing to the higher respiratory rate and ventilatory equivalent of children (7, 9). These considerations are also meaningful in the design, implementation and monitoring of exercise, physical activity and training conducted by children. Therefore, children could benefit from instruction on the importance of using both internal and external cues in pacing as they develop and refine a range of different exercise intensities in their chosen activity.

Because of the physiological and physical differences between children and adults most sports have developed adapted versions, or introduced modified equipment, as a means of graduated technical and physical demands. Such approaches are like programmatic pacing, and practical means of facilitating coordinative development, facilitating functional movement development, task success and enjoyment in the activity (16). Practical examples include children running or swimming shorter distance races, using lower basketball rings or volleyball nets, and playing on smaller pitches with small soccer goals and soccer balls. These modifications result in the game being more like that being played by adults. If the modifications are done well, this should result in the sport being akin to that played by adults. As such, the pacing strategies in these modified games should transfer well to the full version of the sport. As children develop, they would benefit from programmatic pacing in the form of coaching guidance to help develop and master performance pattern in adulthood, also obtaining experience to form their performance skills (1, 4, 10, 16).

People with mental health and learning disabilities: activity pacing approach and implications

Some individuals struggle with self-regulation and pacing during exercise and physical activity. For example, cognitive ability has been linked to regulation of exercise intensity (3), and elite Paralympic runners with an IQ below 75 demonstrated a more variable and slower paced profile than elite runners without intellectual disability of comparable training level. In addition, runners with an intellectual disability seem to experience difficulties in self-regulating their pace when asked to maintain a constant submaximal velocity (18), with a tendency to accelerate. Based on the results, it appears that elite runners with an intellectual disability experience difficulty in efficiently self-regulating their exercise intensity, and their cognitive resources may constrain the successful integration of appropriate pacing strategies during competitive races (1, 20). Participants with intellectual impairment have reduced higher order cognitive skills (3), and known to have deficits in a range of other complex higher-order skills relevant to pacing (e.g. problem-solving, logical reasoning, and language-dependent strategies, such as self-talk (2)). Self-regulation (9), cognitive control and adequate focus of attention are important metacognitive skills required for successful pacing (19).

Tactical, technical and physical skills in elite sport performance are affected in athletes with intellectual disabilities (2, 20), including reaction time and visuospatial skills. This is the case in open, cognitively demanding sports, such as table-tennis, but also in low "cognitive load" sports performed in a relatively stable environment, such as the closed sports of running or swimming, where pacing is one of the main performance determinants. These outcomes indicate that in elite sports, athletes with intellectual disabilities struggle with the process of self-regulation and pacing. It could be expected that their capacity to confidently engage in decision-making and planning over how and where to distribute available energy across daily activities might also be limited, which impacts on physical activity behaviour and an active lifestyle. Future research might meaningfully explore these issues, as well as the potential for activity pacing to be a facilitator towards an active lifestyle in persons with intellectual disability.

Individuals with poor mental health are another group that are likely to experience difficulties with self-regulation and pacing during exercise and physical activity. Individuals with severe mental illness, for example, those with schizophrenia, major depressive or bipolar disorder, are under-researched when it comes to activity pacing. In fact, our literature search revealed that no study has been reported so far on activity pacing and severe mental illness. We know, however, that this is a population that experiences loss in skills relevant to pacing. First, lack of motivation is a major symptom of schizophrenia, either as part of the complex of so-called negative symptoms (21) or induced by antipsychotic medication (22), along with tiredness and sedation. Secondly, planning impairments are to be expected as part of the well-documented pattern of impaired executive function seen in schizophrenia and major affective disorder (23). In schizophrenia it is well-recognized that independent living skills are compromised, particularly in severe cases, and, even when symptoms are mild, this is likely to impact on self-regulation. Depression can also impact on self-regulation (27). Many patients with schizophrenia, and a smaller proportion of those with major affective illness also show general cognitive impairment, although this does not commonly reach the levels seen in patients with intellectual disability (28).

There is evidence pointing to physical activity being beneficial in several ways for populations with mental disorders, who, on average, die 15–20 years prematurely (24). Much of this excess mortality can be attributed to chronic health conditions associated with an unhealthy lifestyle (29). Several studies suggest that lifestyle changes that include exercise could mitigate some of these physical health issues (25). Meta-analyses and systematic reviews (26) indicate that physical activity or exercise interventions also alleviate depressive symptoms in those with mental illness, as well as psychiatric symptoms in people with schizophrenia. Other positive effects associated with physical activity or exercise include significantly improved global functioning and quality of life (25). However, for patients to experience benefits it appears that enough exercise must be performed, although what constitutes enough is an open question (23), and benefits may be dependent on the amount of exercise (in terms of frequency, duration and intensity). For example, at least 1 randomized controlled trial (26) showed improvements in mental health and cardiovascular fitness when patients were engaged in aerobic exercise for 60–120 min per week. Firth et al.'s (26) meta-analysis concluded that psychiatric symptoms were significantly reduced by interventions using around 90 min of moderate-to-vigorous exercise per week in patients with schizophrenia.

In summary, it seems that sufficient amounts of supervised exercise are beneficial to individuals with mental illness. However, the illness-related challenges and barriers faced by this group need to be considered if interventions are to be effective. At this point there remains a question as to the effectiveness of exercise in this population. Activity pacing has real potential to address/mitigate barriers; for example, in the way it enhances participation of women with chronic fatigue syndrome in activities of daily living (4), or helps regulate physical activity in people with osteoarthritis (30). Further research is needed into the effects of incorporating activity pacing into physical activity interventions for people with severe mental illness.

CONCLUSION

This short communication highlights the developing area of activity pacing and the importance of an individual's ability to self-regulate across rehabilitation and development contexts. In conditions where there is a disconnect between the individual's ability to accurately monitor and regulate (pace) their exercise behaviour, physical activity levels are often reduced, which in turn are associated with additional physical or mental health problems. The development of self-regulatory pacing strategies is essential to initiate and maintain an active lifestyle. In populations in which this approach needs to be developed, or where self-regulation is perturbed because of maturational, neurological, physical or psychological reasons, alternative strategies need to be established and implemented to develop self-regulated pacing behaviour. This outcome could be achieved through programmatic pacing strategies in the form of new pedagogical teaching, coaching or rehabilitation strategies (e.g. ecological dynamics), supportive environments, use of physiological (e.g. heart rate monitor), or activity monitoring devices (step counter, accelerometer, phone app) until the time that fully self-regulated physical activity is feasible. This approach ensures that all individuals can exercise in a functional (e.g. improvement in aerobic capacity or

strength), safe and enjoyable way ensuring long-term adherence to an active lifestyle. The goal is to reduce risk factors to chronic disease and enhance quality-of-life, and physical and psychological well-being.

The authors have no conflicts of interest to declare.

REFERENCES

1. Abonie US, Edwards AM, Hettinga FJ. Optimising activity pacing to promote a physically active lifestyle in persons with a disability or chronic disease: a narrative review. J Sport Sci 2020; 38: 590–596.
2. Burns J. The impact of intellectual disabilities on elite sports performance. Int Rev Sport Exerc Psychol 2015; 8: 251–267.
3. Van Biesen D, Hettinga FJ, McCulloch K, Vanlandewijck Y. Pacing profiles in competitive track races: regulation of exercise intensity is related to cognitive ability. Front Physiol 2016; 7: 624.
4. Abonie US, Sandercock GR, Heesterbeek M, Hettinga FJ. Effects of activity pacing in patients with chronic conditions associated with fatigue complaints: a meta-analysis. Disabil Rehabil 2018; 42: 613–622.
5. White PD, Goldsmith KA, Johnson AL, Potts L,Walwyn R, DeCesare JC. Comparison of adaptive pacing therapy, cognitive behaviour therapy, graded exercise therapy, and specialist medical care for chronic fatigue syndrome (PACE): a randomised trial. Lancet 2011; 5; 377(9768): 823–836.
6. Nielson WR, Jensen MP, Karsdorp PA, Vlaeyen JW. Activity pacing in chronic pain: concepts, evidence, and future directions. Clin J Pain 2013; 29: 461–468
7. Antcliff D, Keenan A, Keeley P, Woby S, McGowan L. Engaging stakeholders to refine an activity pacing framework for chronic pain/fatigue: a nominal group technique. Musculoskel Care 2019; 1–9.
8. Andrews NE, Stron, J, Meredith PJ. Activity pacing, avoidance, endurance, and associations with patient functioning in chronic pain: a systematic review and meta-analysis. Arch Phys Med Rehabil 2012; 93: 2109–2121.
9. Edwards AM, Polman RC. Pacing and awareness: brain regulation of physical activity. Sports Med 2013; 43: 1057–1064.
10. Micklewright D, Angus C, Suddaby J, St ACG, Sandercock G, Chinnasamy C. Pacing strategy in schoolchildren differs with age and cognitive development. Med Sci Sport Exerc 2012; 44: 362–369.
11. Menting SG, Konings MJ, Elferink-Gemser MT, Hettinga FJ. Pacing behavior of elite youth athletes: analyzing 1500-m short-track speed skating. Int J Sports Physiol Perform 2019; 14: 222–231.
12. Blakemore SJ, Burnett S, Dahl RE. The role of puberty in the developing adolescent brain. Hum Brain Mapp 2010; 31: 926–933.
13. Hofmann W, Schmeichel BJ, Baddeley AD. Executive functions and self-regulation. Trends in Cognitive Sci 2012; 16: 174–180.
14. Kohl H, Fulton J. Caspersen C. Assessment of physical activity among children and adolescents: a review and synthesis. Prev Med 2000; 31: S54–S76.
15. Nader P. Moderate-to-vigorous physical activity from ages 9 to 15 years. JAMA 2008; 300: 295–305.
16. Eime R, Harvey J, Craike M, Polman RCJ. Understanding the context of the decline in female adolescent participation in physical activity. Res Q Exerc Sport 2014; 84: 157–166.
17. Woods CT, Rudd J, Robertson S, Davids K. Wayfinding: how ecological perspectives of navigating dynamic environments can enrich our understanding of the learner and the learning process in sport. Sports Med Open 2020; 6: 51
18. Hutzler Y, Korsensky O. Motivational correlates of physical activity in persons with an intellectual disability: a systematic literature review. J Intellect Disabil 2010; 54: 767–786.
19. Brick NE, MacIntyre TE, Campbell MJ. Thinking and action: a cognitive perspective on self-regulation during endurance performance. Front Physiol 2016; 7: 159.
20. Sakalidis KE, Burns J, Van Biesen D, Dreegia W, Hettinga FJ. The impact of cognitive functions and intellectual impairment on pacing and performance in sports. Psychol Sport Exerc 2020: 101840.
21. Barch DM, Dowd EC. Goal representations and motivational drive in schizophrenia: the role of prefrontal-striatal interactions. Schizophr Bull 2010; 36: 919–934.
22. Kirschner M, Aleman A, Kaiser S. Secondary negative symptoms – a review of mechanisms, assessment and treatment. Schizophr Res 2017; 186: 29–38.
23. Palmer BW, Dawes SE, Heaton RK. What do we know about neuropsychological aspects of schizophrenia? Neuropsychol Rev 2009; 19: 365–384.
24. Wahlbeck K, Westman J, Nordentoft M, Gissler M, Laursen TM. Outcomes of Nordic mental health systems: life expectancy of patients with mental disorders. Br J Psychiatry 2011; 199: 453–458.
25. Curtis J, Watkins A, Rosenbaum S, Teasdale S, Kalucy M, Samaras K et al. Evaluating an individualized lifestyle and life skills intervention to prevent antipsychotic induced weight gain in first-episode psychosis. Early Interv Psychia 2016; 10: 267–276.
26. Firth J, Cotter J, Elliott R, French P, Yung A. A systematic review and meta-analysis of exercise interventions in schizophrenia patients. Psychol Med 2015; 45: 1343–1361.
27. Gawande R, Ngoc To M, Pine E, Griswold T, Creedon TB, Brunel A, et al. Mindfulness training enhances self-regulation and facilitates health behaviour change for primary care patients: a randomized controlled trial. J Gen Intern Med 2019; 34: 293–302
28. Palmer BW, Dawes SE, Heaton RK. What do we know about neuropsychological aspects of schizophrenia? Neuropsychol Rev 2009; 19: 365–384.
29. Wahlbeck K, Westman J, Nordentoft M, Gissler M, Laursen TM. Outcomes of Nordic mental health systems: life expectancy of patients with mental disorders. Br J Psychiatry 2011; 199: 453–458.
30. Murphy SL, Smith DM, Lyden AK. Type of activity pacing instruction affects physical activity variability in adults with symptomatic knee or hip osteoarthritis. J Phys Act Health 2012; 9: 360–366.