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Thibault Deschamps, Cyril Forestier

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Commentary

Citius, Fortius, Altius, Cognitus – Understanding which psychological and cognitive components drive physical activity and exercise benefits in Parkinson Disease

Thibault DESCHAMPS[1] & **Cyril FORESTIER**[2]

AUTHOR AFFILIATION

[1] Laboratory "*Movement, Interactions, Performance*" (UR 4334), Nantes University France

[2] Laboratory "*Movement, Interactions, Performance*" (UR 4334), Le Mans University, France

CONTACT

Thibault DESCHAMPS
Nantes University
Laboratory « *Movement, Interactions, Performance* » (E.A. 4334)
25 bis boulevard Guy Mollet
BP 72206
44322 Nantes Cedex 3 (France)
Phone: +33 (0)2 51 83 72 14
E-mail: thibault.deschamps@univ-nantes.fr

Abstract

Based on recent studies addressing some issues of exercise benefits in patients with Parkinson disease, we humbly invite to debate interdisciplinary challenges to further engage people with Parkinson disease, and more broadly in patients with multiple chronic conditions, in physical activity for prolonged periods.

Commentary

With regard to a recent editorial,[1] we fully appreciate the "Olympic story" illustrated by the recently revised motto "*Citius, Fortius, Altius-communiter*" ("faster, higher, stronger-together"), urging the scientific community to collaboratively address some issues of exercise benefits in patients with Parkinson disease (PD), and more broadly in patients with multiple chronic conditions. No doubt more holistic and multidisciplinary approaches will advance the breakthroughs in diagnosis, treatment and research.

By highlighting the quality of the large prospective observational study by Yoon et al,[2] de Vries and co-authors elegantly refine the crucial issue of the volume in the physical activity programs targeting the improvement of motor functioning and general health in PD. Therefore, the increased opportunities for people with PD to benefit from physical activity interventions, particularly the volume over quite a long period, prompt us to mention the pivotal psychological and cognitive components involved in specially adapted exercises. The benefits of intensity and volume of physical activities, or any other recent physiotherapy interventions in PD, are questionable if and only if the patients are engaged in regular physical practice. We all know that it is not always sufficient, if ever, to simply tell patients they need to be active in noticing any change in exercise behaviours. We offer here a wider discussion of this very relevant and important issue.

"How to mitigate the difficulty of engaging participants in exercise regimens for prolonged periods"[1] needs to be re-contextualized to address psychological facilitators and barriers to physical activity. People with chronic conditions practice less than the general population; too few achieve the minimum health-enhancing physical activity recommendations.[3] Too few even participate in the proposed physical activity interventions, with a high drop-off rate and a low maintenance of programs.

A recent, exhaustive overview of the main theoretical frameworks have been proposed to challenge the psychological determinants of physical activity behaviour in the general population,[4] and identified several facilitators and barriers intended to help individuals to

initiate physical activity. Under the socio-cognitive framework, physical activity facilitators include intention and self-efficacy, while some examples of barriers are perceived difficulty and stigmatization. According to the humanistic framework, facilitators include intrinsic motivation, psychological needs satisfaction, and perceived vitality, while some barriers are extrinsic motivation, psychological needs threat, and perceived fatigue. Considering the dual-process framework, facilitators are positive automatic-affective valuation, automatic approach tendencies and habits, while barriers examples are negative automatic-affective valuation and automatic avoidance tendencies. Finally, the new conflict-resolution models put forward that physical activity facilitators confront physical activity barriers in daily life.[5] Such opposition produces motivational conflicts that must be resolved to favour a health-behaviour goal (e.g., physical activity) instead of a competing goal (e.g., sedentary activity). Among others, self-control has been acknowledged as strategies to adaptatively resolve motivational conflicts, thereby facilitating physical activity participation. However, conclusions on the relationships between these determinants and physical activity participation were mostly based on correlational studies, mainly conducted among general population. Evidences from interventional studies addressing the plurality of determinants, and/or the conflict-resolution strategies in PD are lacking, and should be expressly implemented to promote physical activity in patients with multiple chronic conditions. We argue that psychological facilitators and barriers to physical activity, its physiological components (with different intensity and volume training),[2] and practices that optimise the long-term participation in physical activity, must be seen as a unified clinical research entity rather than separate issues. This also includes the compelling necessity of improving the environmental and financial access to physical activity opportunities.

Furthermore, how can the cognitive processes of executive function foster the participants' engagement in physical practice in the long term? In addition to the effects of PA programs on cognitive performance in PD,[6] the theoretical and empirical question of a virtuous circle linking the maintenance of physical activity over time and exercise-related executive

improvement is increasingly being examined.[7] Through the positive self-regulation of healthy behaviours, a bidirectional relationship between physical activity and executive functioning arises. In a 10-year follow-up of people aged between 50 and 70 years, with executive assessments occurring every two years, it was shown that the magnitude of executive performance was a determinant of sustained engagement in meaningful physical activity; any change in executive performance was associated with a change in physical activity behaviour, and vice versa. In addition, low executive performance was strongly predictive of physical inactivity and sedentary lifestyle habits, with their respective and independent deleterious effects on health.[8] In the same vein, recent studies found that executive function improvements during physical activity programmes predict health-behaviour adherence. The participants with the greatest executive progress as a result of the programme were those who maintained the highest levels of physical activity during the following year.[9]

All other things being equal, the challenging question of the patients' engagement in a long-term physical activity can be answered to a certain extent by the ingredients involved in physical activity itself. Recent findings suggest that an important determinant for a beneficial outcome of physical activity is not just aerobic exercise with minimal cognitive demands, but first and foremost, cognitively enriched aerobic exercise (i.e., with cognitive and motor skill component). In this regard, a randomized controlled trial[10] showed that a 32-week intervention requiring both complex locomotor and cognitive exercise can maintain executive features and delay the cognitive decline in PD. These findings are crucial considering that executive dysfunction is frequently present from the early stages of PD.

Therefore, we propose "*Citius, Fortius, Altius, Cognitus-communiter*" ("faster, higher, stronger, more cognitive-together"). Let us move to a new frontier and strive for cognitively enriched aerobic exercise, preferably involving long-term intrinsically motivated, intentional and pleasurable physical activity.

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