Physical fitness training after stroke-a crucial and exciting field for service development and research

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In this issue, Krawcyk and colleagues report one year follow up data from the High-Intensity Training in Patients with Lacunar Stroke (HITPALS) [1]. High-intensity interval training (HIIT) involves repeated intervals of high-intensity activity interspersed with rest or active lower-intensity recovery intervals; HIIT can achieve similar fitness benefits as continuous endurance workouts, but in shorter periods of time [2]. Krawcyk et al had previously shown that HIIT performed at home, guided by weekly motivational phone calls for three months, was feasible and safe in patients with lacunar stroke, but that there was no effect on cardiorespiratory fitness [2]. The current paper demonstrates that by one year activity levels had declined to baseline levels [1], suggesting that barriers to activity maintenance need to be addressed.

Physical fitness training (or exercise), which includes aerobic, strength and balance training, is already strongly recommended in all major stroke guidelines [3] and detailed suggestions about the frequency, intensity, time and type (FITT principles) already exist [4]. These strong recommendations are based on evidence from randomised controlled trials and systematic reviews, including the Cochrane review of physical fitness training after stroke [5], which showed that fitness training reduced disability, increased fitness, balance, physical function and walking ability. Importantly, the risk of adverse events (e.g. cardiac events and falls) is negligible and is outweighed by the benefits. Furthermore, risk modelling studies have suggested that fitness training can reduce stroke recurrence [6].

In HITPALS, why did activity levels decline to baseline levels after the motivational telephone calls had ended? The reasons are likely to be complex, and perhaps stroke survivors do require ongoing support, because of their stroke related impairments-which are not just physical but can include fatigue and apathy. More generally, perceived barriers to exercise amongst stroke survivors include transport to exercise, cost, health problems and stroke-related impairments, embarrassment (of exercising in a group), and fear of recurrent strokes [7]. Motivating factors include the desire to return to normal activities, and, for group activities, the support from peers and professionals.

Why is physical fitness training not yet widely embedded into stroke services-given the multiple benefits described in the background section in Krawcyk's paper? Perhaps the benefits of physical activity are not sufficiently well covered in health care professionals' curricula, or perhaps fitness training is seen as the domain of exercise physiologists or exercise instructors, who are not part of the stroke team? Stroke survivors and their family may not be aware that physical inactivity is a risk factor for stroke, and that exercise improves recovery after stroke. Implementation research is now needed to explore how to embed fitness training into routine stroke care-as has been successfully done for survivors of cardiac events who are routinely offered exercise based cardiac rehabilitation as part of

standard care. Practical recommendations about implementation are now available [8], and the international Stroke Recovery and Rehabilitation Alliance has established an exercise and physical activity group to facilitate sharing of information about exercise and education of stroke clinicians, to help break through the implementation impasse Exercise and Physical Activity - ISRRA (strokerecoveryalliance.com) [9].

What can we learn from Krawcyk et al about the design of trials of fitness training after stroke? First, the team should be commended on including outcome measures that of central importance to stroke survivors including fatigue, cognition, mental wellbeing, depression and chronic stress; and also detailed measures of physical fitness. Going forward, perhaps there needs to be consensus about a feasible battery of outcome measures; that addresses the priorities of stroke survivors as well as trialists; this would also facilitate the meta-analysis of exercise trials. Second, the team had to screen 3098 patients to recruit 71 with mild lacunar stroke; patients with a current or previous large vessel stroke, >50% ipsilateral carotid stenosis, atrial fibrillation, dysnoea and dementia were all excluded. Multimorbidity is becoming increasingly common [10], and the single disease paradigm, on which many health services are based, and in which stroke researchers work, needs to be adapted to the challenges of multi morbidity. Trialists should consider how to include people with more than one index condition-this will require widening of inclusion criteria and adaptation of exercise interventions e.g. starting at very low intensity.

Kwakcyk et al in their discussions provide directions for future research, including the need for more research to identify the 'best' exercise prescription in terms of frequency, intensity, duration and type, and how to motivate stroke survivors to engage with exercise. There are also other important unanswered questions. How best can we deliver fitness training to stroke survivors who cannot walk? How can we adapt exercise programmes for stroke survivors with communication problems who are often excluded from trials, including exercise trials? To what extent does exercise training improve mental wellbeing, cognition and pain? Is there a role for exercise for stroke survivors who are bed bound and perhaps nearing the end of their lives-so called 'palliative rehabilitation'? What can we learn about implementation from the cardiac rehabilitation field?

Exercise training after stroke is an exciting and important area for both service development and research; and Krawcyk's paper is a timely contribution to this field. Whilst further research is needed, it is crucial that we do not miss the opportunity to implement what is already known [8,11].

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