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EDITORIAL

Physical Activity in Patients with Cardiovascular Disease: Challenges in Measurement and Motivation

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Despite the well-established benefits of physical activity for the primary [1] and secondary [2] prevention of cardiovascular disease, population physical activity levels remain suboptimal; a recent Australian survey found that 47% of adults were not undertaking sufficient physical activity to meet national guidelines [3]. This problem is also evident in people following a cardiac event, with approximately 50% of patients failing to meet modest activity targets (≥3 days/week) at one year following a cardiac event [4]. Being able to accurately quantify the amount of physical activity people undertake would provide a starting point to help address this problem, but herein lie two challenges. The first challenge is that physical activity questionnaires, which are commonly employed in epidemiological research, are limited for measuring physical activity on an individual level [5] due to a lack of sensitivity for measuring light or moderate activity [6] and inability to accurately assess energy expenditure [7]. The second challenge is that accurate measurement of physical activity *per se* is not sufficient to understand the problem of lack of physical activity. Hence, it is also important to understand why many individuals lack the motivation to be physically active.

In recent years, a wide range of new devices have become available for physical activity monitoring, but data on their reliability in patients with cardiovascular disease is lacking. The well written narrative review in this edition of *Heart, Lung and Circulation* by Alharbi et al. endeavours to address this issue by considering eight studies that compared two or more physical activity measures with at least one direct measure. Overall, there were eight specific self-reported measures assessed (questionnaires and diaries) and 10 direct measures (indirect calorimetry and different types of accelerometers and pedometers). Direct measures were deemed more valid and reliable than self-reported measures, with the latter tending to overestimate activity levels compared with accelerometry, a finding that is well documented in healthy cohorts [8]. Physical activity diaries had slightly higher validity coefficients and didn't overestimate physical activity compared with an accelerometer. However, the authors highlighted methodological limitations that may have contributed to the discordant results and concluded that it was not possible to recommend a specific physical activity measure in cardiac rehabilitation, based on the articles reviewed. This should not deter further investigation into how to most accurately assess physical activity in research and clinical practice of cardiac rehabilitation. With wearable technological constantly evolving, it is likely that direct physical activity monitors will become increasingly accessible, affordable and reliable methods of monitoring physical activity. Evaluation of these new technologies in a cardiac rehabilitation setting will be eagerly anticipated.

For new physical activity monitoring technology to be an effective component of cardiac rehabilitation, it is also important to consider how their use can be leveraged to improve adherence to physical activity guidelines. Pedometers have previously been found to be effective in increasing physical activity, compared with a control group who received physical activity brochures but no other dedicated intervention [9]. The feedback provided by pedometers in terms of step count assists in self-monitoring of progress and in goal setting (two very popular behaviour change techniques), providing physical activity targets that patients can aim for. Accordingly, new generation physical activity monitors that provide real time feedback, alerts for underachieving and reinforcement

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when goals are obtained have the potential to support patients in meeting desired levels of physical activity, assuming of course that such feedback is provided in ways that are perceived informational and supportive by the users. However, relying on activity monitors alone is unlikely to be a panacea for improving physical activity in the absence of a more comprehensive and theory-based approach to behaviour modification.

It is important to identify contextual and personal motivational factors that hamper or support efforts to engage in physical activity. Such factors alongside cultural norms, the built and natural environment, and national policies (e.g., active transportation) determine levels of physical activity. Several motivational theories and models have been used to understand personal and contextual determinants of physical activity adherence in cardiac rehabilitation. As an example, we focus here on self-determination theory (SDT) [10]. According to this theory, individuals in positions of authority (in health care, positions such as doctors, nurses, exercise physiologists and physiotherapists) can have a powerful influence on the motivation of the individuals they interact with via the type of communication style they adopt [11]. For example, in cardiac rehabilitation an exercise physiologist or physiotherapist can have a powerful influence on the motivation of their patients to be more physically active by communicating with them in ways that support their basic psychological needs. Social environments that support the basic needs for competence, autonomy, and relatedness, foster individuals' self-determined motivation for behaviour engagement. In the context of cardiac rehabilitation, when exercise physiologists or physiotherapists communicate with patients in ways that are supportive of their autonomy, competence and relatedness, then patients are likely to report self-determined motivation for physical activity which will subsequently lead to increased activity levels. Motivationally supporting instructional styles are characterised by the provision of choice of activities (within boundaries), meaningful rationale for activities, perspective taking statements, optimal challenge, constructive feedback, genuine praise, and acknowledgment of negative feelings. It is important to clarify that a motivationally adaptive style is not a style which simply offers encouragement and positive feedback. It is a style which aims to promote patients' self-determined motivation and empowers them for health behaviour change. For example, the exercise physiologist might discuss with patients different options and preferences for physical activity and the need for a healthy lifestyle, be empathetic with patients' reluctance or negative feelings associated with physical activity, and provide advice and explanations that are meaningful, personally relevant and non-judgemental. Unfortunately, a communication style can also undermine patient motivation if it conveys indifference, rejection or if it is controlling [12]. An exercise physiologist can be controlling by communicating demands and expectations (e.g., ''now that it has been three months since your heart attack, you should be able to exercise for at least 30 mins on five occasions per week''), by using pressuring or guilt-inducing language (e.g., ''do you want to die and miss seeing your grandchildren grow up?''), by being un-empathetic or avoiding to provide rationales for certain behaviours (e.g., ''you need to record your frequency and intensity of physical activity'' [without explaining why it is important to do so]). A controlling communication style can undermine patients' needs for autonomy, competence and relatedness, and result in a lack of self-determined motivation for behaviour change. Such controlled motivation is characterised by feelings of pressure, guilt, and the need to obtain approval from/appease others. Although it can be powerful source of motivation, because it is not coming from within, it is not likely to persist over the long-term. Hence, patients motivated by this type of motivation are primary candidates for dropout from exercise programs in cardiac rehabilitation and are less likely to maintain physical activity commensurate with best-practice in the long term. A meta-analysis [13] of studies that have used SDT to promote health behaviour change (e.g., medication adherence, physical activity, healthy eating, smoking cessation) has found that motivationally supportive communication styles promote higher quality motivation which then promotes better physical (e.g., more physical activity, better diet and medication adherence, smoking abstinence), and mental health (e.g., less depression and anxiety, more vitality and life satisfaction). Rahman et al. (2015) tested SDT in a 12-week cardiac rehabiltion class; their findings provided support for the role of psychological need satiscation and self-determined motivation in improving well-being and physical activity of patients. New systems in cardiac rehabilitation that incorporate motivationally adaptive styles of communication, linked with feedback from new generation physical activity monitors, should be explored in determining ways to support patients in achieving physical activity goals.

Regular physical activity is an integral component of the primary and secondary prevention of cardiovascular disease but physical activity levels continue to be too low for health benefit in approximately half the adult population. Increasing physical activity and reducing sedentary behaviour have long been keystones of cardiac rehabilitation programs, but many patients don't achieve and maintain physical activity goals consistent with evidence-based guidelines for improving health outcomes, despite the dedicated efforts of health professionals. The opportunity to bring together new technology and an ever improving understanding of how best to motivate people to engage in regular physical activity, heralds new opportunities to address this perennial challenge.

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