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A narrative review of research on the effects of physical activity on people living with HIV and opportunities for health promotion in disadvantaged settings

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The article explores different types and effects of physical activity for people living with HIV. Considering the lack of studies done in African contexts and the disparity between research settings and natural settings, a narrative review of the literature was conducted and contextualised to South Africa. Various physical, psychological and social-cultural constraints impair the wellbeing of people living with HIV, in part by restricting their participation in physical activities. Apart from the well-studied immediate physiological benefits on health, we argue that physical-sportive group activities, such as sport or recreational games, can improve psychosocial factors and generate holistic health effects for people living with HIV. Group-activity effects could improve individuals' motivation and adherence to participating in physical activities, provided that positive interaction and non-stigmatisation are guaranteed. However, most studies in this field have been limited to the benefits of aerobic exercise and resistance training. There has been little research on the types and different effects of physical activity and adherence to physical activity of people living with HIV in African contexts. Based on an analysis of the different types and effects, we suggest opportunities for and challenges to implementing physical activities for people living with HIV, especially in disadvantaged settings, and also identify gaps in the research to date.

Keywords: Africa, disadvantaged settings, health behaviour, literature review, psychoneuroimmunology, quality of life, social support, sports psychology, therapeutic exercise

Introduction

Physical activity is recommended and used for the prevention and rehabilitation of an increasing number of illnesses, such as: cardiovascular and pulmonary diseases; metabolic diseases; immunological disorders; orthopaedic diseases and disabilities; neuromuscular disorders; and cognitive, emotional and sensory disorders and disabilities. Physical activity is considered an essential promoter of health and quality of life (Faulkner & Taylor, 2005; Biddle & Mutrie, 2008; American College of Sports Medicine, Durstine, Moore, Painter & Roberts, 2009; Hardman & Stensel, 2009). Schematically, three types of effects from different types of physical activity can be theoretically distinguished, although in practise they are not clearly separable (Nitsch & Nitsch, 1979; Knobloch, 2001):

- 1) Immediate effects (mainly bio-physiological effects), such as from habitual physical activity, exercise training, stretching and sports training, as used in medicine, physiotherapy, exercise therapy and physical health promotion.
- 2) Mediated effects (mainly psychosocial and educative effects), such as through sport, games and group

- exercises, as used mainly in therapy and rehabilitation, education, social integration, and mental health promotion.
- 3) Holistic effects (effects on unity of body/mind/soul), such as the result of psychomotor games, relaxation exercises, and body- and movement-centred techniques (like Tai Chi and yoga).

Thus, it is expected that the positive effects of physical activity as described in studies with other populations are also valuable for people living with HIV and foster resources to affront HIV-related risks and problems.

This article reviews and discusses opportunities and challenges for benefitting from the different types and effects of physical activity for people living with HIV in the context of South Africa, where HIV prevalence is high, with an estimated 17.8% prevalence among 15–49 year olds at the end of 2009 (UNAIDS, 2010). Questions regarding long-term adherence to physical activity are also addressed. Taking into consideration a paucity of studies in the African context and the disparity between research settings and natural situations, the article provides a structured analysis and framework for conducting contextualised research concerning physical activity and people living with HIV.

Methods

The article reviews relevant literature on the subject of physical activity and living with HIV, and contextualises the findings to South Africa. The objectives are to critically discuss the opportunities for, challenges to and relevance of implementing physical activities for people living with HIV in disadvantaged settings, and to highlight gaps in research on this topic to date.

A narrative review was chosen as the interpretative methodology in order to capture the varied literature in this wide-ranging field (cf. Dixon-Woods, Agarwal, Jones, Young & Sutton, 2005; Weed, 2005; McCreddie & Wiggins, 2008). The study sought to broaden the approach taken by evidence-based, systematic Cochrane reviews (e.g. O'Brien, Nixon, Glazier & Tynan, 2004; O'Brien, Nixon, Tynan & Glazier, 2010) and to contextualise the findings to South Africa. Therefore, quantitative and qualitative studies were included and synthesised through thematic analysis with a constant comparative approach and according to the introduced conceptual framework (cf. Jones, 2004; Dixon-Woods *et al.*, 2005; Greenhalgh, Robert, Mcfarlane, Bate, Kyriakidou & Peacock, 2005; Whittemore & Knafel, 2005; McCreddie & Wiggins, 2008).

The review draws on studies published between January 2000 and May 2011. The studies were identified using keyword searches of the following electronic databases: Academic Search™ Premier/Complete, Africa-Wide Information, Health Source, MEDLINE®, PubMed, Rehabilitation and Sports Medicine Source, SocINDEX™, SPORTDiscus™, Thomson Reuters Web of Science®, and Index to South African Periodicals. In addition, reference lists were scanned. The keywords 'physical activity,' 'exercise,' 'sport,' 'dance,' 'body' or 'movement,' and 'HIV' or 'AIDS' were used in the languages English, Spanish and German. In order to be included in the literature review, the published study must have included people living with HIV in relation to any kind of physical activity. Besides being an empirical study, no choice of research design was made. The selected studies were categorised and analysed according to the three types of effects of physical activity (i.e. immediate, mediated and holistic effects), which cover bio-physiological, psychosocial and educative dimensions. An additional theme used in the analysis was long-term practise and adherence to physical activity as a vital factor to achieve long-term health benefits. In all, these effects of the physical activity of people living with HIV are discussed in the South African context.

Findings and discussion

Immediate effects

Physical benefits and individualised exercise training

The impact of physical exercise on immune-system parameters is controversially discussed, as the sample sizes of the studies were mostly small and the effects noted seemed to differ in regard to HIV stage and treatment (e.g. Bopp, Phillips, Fulk, Dudgeon, Sowell & Hand, 2004; Ciccolo, Jowers & Bartholomew, 2004; Stringer, 2004; Hand, Lyerly & Dudgeon, 2009; Hand, Lyerly, Jaggars & Dudgeon, 2009; Derman, Whitesman, Dreyer, Patel, Nossel & Schweltnus,

2010; O'Brien *et al.*, 2010). Although a positive impact on the immunological parameters (CD4 cell count and viral load) has not been evidenced, physical exercise seems to be safe for people living with HIV (O'Brien *et al.*, 2010). A recent study suggests that aerobic exercise might increase production of natural autoantibodies and therefore slow down HIV-disease progression (Veljkovic, Dopsaj, Stringer, Sakarellos-Daitsiotis, Zevgiti, Veljkovic *et al.*, 2010). Conversely to discovering immunological changes in people with HIV, more evidence has been accumulated regarding the relevant benefits of physical activity and exercise training on the cardiovascular system, metabolism and skeletal muscle function of people living with HIV (e.g. Agin, Gallagher, Wang, Heymsfield, Pierson & Kotler, 2001; Jones, Doran, Leatt, Maher & Pirmohamed, 2001; Roubenoff, Abad & Lundgren, 2001; Smith, Neidig, Nickel, Mitchell, Para & Fass, 2001; Yarasheski & Roubenoff, 2001; Yarasheski, Tebas, Stanerson, Claxton, Marin, Bae *et al.*, 2001; Arey & Beal, 2002; Røge, Calbet, Møller, Ullum, Hendel, Gerstoft & Pedersen, 2002; Bopp, Phillips, Fulk & Hand, 2003; Cade, Fantry, Nabar & Keyser, 2003; Domingo, Sambeat, Pérez, Ordoñez, Rodriguez & Vázquez, 2003; Scevola, Di Matteo, Lanzarini, Uberti, Scevola, Bernini *et al.*, 2003; Driscoll, Meininger, Lareau, Dolan, Killilea, Hadigan *et al.*, 2004; Ramirez-Marrero, Smith, Meléndez-Brau & Santana-Bagur, 2004; Stringer, 2004; Malita, Karelis, Toma & Rabasa-Lhoret, 2005; Engelson, Agin, Kenya, Werber-Zion, Luty, Albu & Kotler, 2006; O'Brien, Nixon, Tynan & Glazier, 2006; Terry, Sprinz, Stein, Medeiros, Oliveira & Ribeiro, 2006; Florindo, De Oliveira Latorre, Jaime & Segurado, 2007; Robinson, Quinn & Rimmer, 2007; Spierer, DeMeersman, Kleinfeld, McPherson, Fullilove, Alba & Zion, 2007; Fédou, Fabre, Baillat, Reynes, Brun & Mercier, 2008; Leyes, Martínez & Forga, 2008; Loibl, Bogner & Halle, 2008; Scott-Sheldon, Kalichman, Carey & Fielder, 2008; Souza, Jacob-Filho, Santarém, Silva, Li & Burattini, 2008; Steele, Belza, Cain, Coppersmith, Lakshminarayan, Howard & Haselkorn, 2008; Thöni, Schuster, Walther, Nottin, Vinet, Boccara *et al.*, 2008; Hand, Lyerly & Dudgeon, 2009; Deresz, Sprinz, Kramer, Cunha, De Oliveira, Sporleder *et al.*, 2010; Farinatti, Borges, Gomes, Lima & Fleck, 2010; Lauriola, Codella, Lattuada, Caumo, Capitelli, Lazzarin & Luzi, 2010; Souza, Jacob-Filho, Santarém, Zomignan & Burattini, 2011; Yarasheski, Cade, Overton, Mondy, Hubert, Laciny *et al.*, 2011).

In a Cochrane Review, O'Brien *et al.* (2010, p. 23) surmised significant improvements of "cardiopulmonary outcomes (VO₂max), body composition (leg muscle area, percent body fat), and psychological status (depression-dejection subscale of the POMS [Profile of Mood States])." These effects are important in light of HIV-associated diseases, such as lipodystrophy, body changes, the side-effects of antiretroviral (ARV) medication, and comorbidities. In addition, the improvement of cardiopulmonary fitness and functional capacities have an important role in the management of daily life, wellbeing and quality of life of people living with HIV (Mutimura, Stewart, Crowther, Yarasheski & Cade, 2008; Myburgh & De Bruto, 2008; Gomes, Borges, Lima & Farinatti, 2010).

Most of the studies reviewed used individualised exercise training over a period of 12 weeks. Aerobic training utilised

mainly a treadmill or cycle ergometer, with a moderate intensity of 40–60% of VO_2 max, or a moderate to high intensity of 60–85% VO_2 max (Stringer, 2004; Hand, Lysterly & Dudgeon, 2009; O'Brien *et al.*, 2010). Some studies used progressive resistance training. A Cochrane Review by O'Brien *et al.* (2004) indicates that regular progressive resistance training is safe and improves factors of strength, weight and body composition, and might also contribute to an improvement of the cardiopulmonary fitness and psychological status of adults living with HIV. A combination of aerobic and progressive resistance training is widely recommended (Robinson *et al.*, 2007; Hand, Lysterly, Jagers & Dudgeon, 2009; Lazzarotto, Deresz & Sprinz, 2010; Souza *et al.*, 2011; Yahiaoui, McGough & Voss, 2012).

A limitation of the studies to date is that we know less regarding people “who are at more advanced stages of immunosuppression” (Derman *et al.*, 2010, p. 11). Some studies indicate that high-intensity exercise training (with 70–85% of VO_2 max) has no negative impact on the immune system of HIV-positive persons (O'Brien *et al.*, 2004 and 2010; Stringer, 2004; Robinson *et al.*, 2007; Farinatti *et al.*, 2010). Research with elite athletes has shown that immune deficiency after high-intensity sport might not have a long-term negative effect on the athlete. Studies with athletes and people affected by other immunosuppressive diseases, like cancer, show similar results (i.e. Pedersen, 2001; Lötzerich & Peters, 2007). However, it is considered that there is a vulnerable period (an ‘open window’) directly after high-intensity training, when the immune system is especially vulnerable to infections (Pedersen, 1999 and 2001; Hand, Lysterly & Dudgeon, 2009). Adequate nutrition intake after training seems to reduce this possible vulnerability. In addition, appropriate regeneration phases are crucial (Loibl *et al.*, 2008; Hand, Lysterly & Dudgeon, 2009). In the context of HIV in South Africa, social and economic constraints often inhibit adequate nutrition, as well as other protective elements, such as adequate living conditions and housing.

Little research has been done in Africa where the main burden of the HIV pandemic lies. “Conclusions drawn from women [infected by HIV] living in a Western society will not necessarily reflect those found in sub-Saharan Africa where socioeconomic factors and ethnicity could influence body composition changes” (Myburgh & De Bruto, 2008, p. 340). Mutimura *et al.* (2008, p. 377) conclude from a study with HIV-positive Rwandan subjects with body fat redistribution that “exercise training is an inexpensive and efficacious strategy for improving quality of life in HIV-positive African subjects, which may improve HAART adherence and treatment initiatives in resource-limited areas of sub-Saharan Africa.” There is a huge lack of research contextualised to Africa and disadvantaged settings especially.

Mediated effects

Psychosocial benefits and group interventions

Psychological factors related to an individual's HIV infection and treatment (for instance, anxiety, depression, low self-esteem, low self-efficacy, stress, trauma, fear and uncertainty) can negatively affect the person's overall health

status as well as treatment adherence (Fulk, Kane, Phillips, Bopp & Hand, 2004). In addition, major social-cultural challenges, such as stigmatisation, ruptures in social-resources networks, and isolation, are other determinants in the lives of people living with HIV (Mahajan, Sayles, Patel, Remien, Sawires, Ortiz *et al.*, 2008; Evans & Thomas, 2009). For instance, HIV-related stigma was shown to affect body image and weight management behaviour in South Africa (Matoti-Mvalo & Puoane, 2011) and in Tanzania (Ezekiel, Talle, Juma & Klepp, 2009). There is a major need for psychosocial support services (Gillett & Parr, 2010; Haffejee, Groeneveld, Patel & Bowman, 2010) since social support might act “as a buffer for relationships lost due to disclosure of HIV status” (Fulk *et al.*, 2004, p. 345).

It is widely accepted that physical activity can have various psychosocial benefits for people living with HIV, such as improvements to self-esteem, mood, body image, locus of control, stress management and depression (Rojas, 2001; Clingerman, 2003; Neidig, Smith & Brashers, 2003; Ciccolo, Jowers & Bartholomew, 2004; O'Brien *et al.*, 2004 and 2010; Du Toit & Van der Merwe, 2006; Loibl *et al.*, 2008; Mutimura *et al.*, 2008; Cade, Reeds, Mondy, Overton, Grassino, Tucker *et al.*, 2010; Derman *et al.*, 2010; Ferez, Pappous & Ruffié, 2010). Multidimensional measurements of quality of life have shown the positive effects of physical activity on psychosocial factors (Rojas, Schlicht & Hautzinger, 2003; Ciccolo *et al.*, 2004; Clingerman, 2004; Mutimura *et al.*, 2008).

Group exercise intervention “provides a psychological and socialization context for support and represents a potentially cost-effective way to manage quality of life issues for persons with chronic HIV disease” (Galantino, Shepard, Krafft, LaPerriere, Ducette, Sorbello *et al.*, 2005, p. 1091). Sport and recreational games constitute types of physical activity with a high level of social interaction, especially in team sports. Meanwhile, sport and HIV are mainly discussed by researchers in relation to HIV prevention through sports programmes (Delva, Michielsen, Meulders, Groeninck, Wasonga, Ajwang *et al.*, 2010; Kaufman, Welsch, Erickson, Craig, Adams & Ross, 2012) or in terms of the risk of HIV transmission during sports activities (Reddy & Coopoo, 2005; Clem & Borchers, 2007), while the topic of sports programmes to promote the health of people living with HIV has been widely ignored in South Africa. Besides the important physical effects, sport and games can promote psychosocial health benefits for people living with HIV (Florijn, 1996; Deimel, 1999; Rojas, 2001; Rojas, Schlicht & Hautzinger, 2003 and 2004; Loibl *et al.*, 2008; Ferez *et al.*, 2010).

In South Africa, “Young men and young women who belonged to sports clubs were less likely to be HIV-positive, and young women who belonged to sports clubs were more likely to use condoms with casual partners than [were] non-members” (Campbell, Williams & Gilgen, 2002, p. 41). The causal relations in this assertion are unclear, especially considering that people with HIV are in general less physically active (Fillipas, Bowtell-Harris, Oldmeadow, Cicuttini, Holland & Cherry, 2008; Kinsey, McVeigh & Chantler, 2008). In addition, due to the ambivalent nature of sport, sports teams can be quite exclusive (in connection

with sports skills, performance and peer-pressure), and only people with certain characteristics (active, extroverted) and opportunities (time, transportation, equipment) might join together (Coakley, 2007; Coalter, 2007; Ley & Rato Barrio, 2010). Negative perceptions and fear of HIV transmission in sport might inhibit a supportive environment in sports teams, as analysed in the South African context by Reddy & Coopoo (2005). Therefore, participating in sport per se does not guarantee psychosocial benefits — but sport *can* have positive psychosocial effects for people living with HIV (Florijn, 1996; Rojas, 2001; Rojas *et al.*, 2003 and 2004; Loibl *et al.*, 2008; Ferez *et al.*, 2010). Supposedly similar processes might be observed in sports teams as in other group settings: “Feedback and encouragement from members, as well as facilitators, can provide reinforcement and maintenance of positive behaviour changes” (Fulk *et al.*, 2004, p. 345).

More evidence has been gathered in other population groups and contexts about the determinants and potential of physical activity and sport to impact on psychosocial health (e.g. Faulkner & Taylor, 2005; Biddle & Mutrie, 2008; Hardman & Stensel, 2009). From a salutogenetic perspective, adequately implemented sport and games can reduce personal and social risk factors — for example, isolation. At the same time, sport and games with people living with HIV can promote their personal and social resources to affront stress and life challenges. Positive and significant life experiences and learning opportunities can be facilitated in sport and recreational games. For instance, experience gained through sports activities can influence the perception and valuation of one’s own capacities and help one understand and attribute meanings to life events and happenings. An improvement in these cognitive-affective factors can contribute to better stress management (Knobloch, 2001; Wagner & Brehm, 2006; Biddle & Mutrie, 2008; Loibl *et al.*, 2008; Ley & Rato Barrio, 2010 and 2011). These factors are important for people living with HIV, thus more research is needed in specific contexts.

Supportive, trustworthy, protective and constructive interaction in the group is a key factor for creating a positive impact, and care must be taken so that individuals and groups are not stigmatised (Fulk *et al.*, 2004; Galantino *et al.*, 2005; Gillett & Parr, 2010). Therefore, participation in either non-specific sports groups where one’s HIV status is unknown to the group or specific HIV-related sports groups where the individuals’ HIV status is unknown to the community could be created. In the latter case, these ideally function as self-supporting groups.

Understanding the determinants that promote positive processes in sports teams is crucial, but is unfortunately under-researched in regard to HIV. In total, the above-mentioned studies on the psychosocial benefits of physical activity with people living with HIV show major shortcomings in testing the proposed theories of change — for example, by tracking the intervention processes and determinants of the psychosocial effects. There is a major lack of evidence and few analytical studies to date about the factors responsible for mediated effects on the health of people living with HIV: for example, about the role of the coach, facilitator, healthcare worker or group leaders; the manner of

dealing with confidentiality issues and fears; mutual support and other group processes; use of social resources; active learning processes through playing; or behaviour change through sport and games. These processes should be considered in terms of the social-cultural context and the specific challenges that face people living with HIV. More intervention evaluation and contextualised research is needed which tracks not only health outcomes, but also the determinants of the psychosocial processes and mediator effects. Conversely to isolated laboratory settings, studies are needed in natural settings, hence looking at correlates in the social-ecological environment and at contextualised psychosocial determinants, such as in the processes of motivation, volition and the management of barriers.

Holistic effects

Integral benefits and the body–mind relationship

Body changes are prevalent in people living with HIV, and are therefore the focus of the medical treatment. However, “The body is multidimensional, and although its physical and biological aspects tend to be emphasised in the medical discourse, in caregiving activities, where both actions and emotions are orientated towards the body that is cared for, bodies are also phenomenologically and socially” (Makoae, 2009, p. 18; cf. Evans & Thomas, 2009). Visible body changes may be related to negative body image, fear of disclosure and stigma, and therefore will affect personal and social life (Chapman, 1998; Corless, Nicholas, McGibbon & Wilson, 2004; Huang, Harrity, Lee, Becerra, Santos & Mathews, 2006; Huang, Lee, Becerra, Santos, Barber & Mathews, 2006; Ezekiel *et al.*, 2009; Makoae, 2009; Puoane, Tsolekile & Steyn, 2010; Martinez, Kemper, Diamond & Wagner, 2011; Matoti-Mvalo & Puoane, 2011). Although the body is the focus of medical HIV treatment according to a bio-physiological perspective, it is not given much attention from a holistic perspective.

From a holistic perspective of the effects of physical activity on people living with HIV, psychoneuroimmunological models are of great interest. In this field the relationship of psychosocial factors and the immunity of people living with HIV is well described (e.g. LaPerriere, Ironson, Antoni, Schneiderman, Klimas & Fletcher, 1994; Uhlenbruck, 1995; Evans, Ten Have, Douglas, Gettes, Morison, Chiappini *et al.*, 2002; Antoni, 2003). Special attention has been given to the influence of psychological stress, trauma, and depression in people living with HIV on the body’s immune factors and, correspondingly, to the role of psychosocial interventions. Body- and movement-centred techniques, like yoga and Tai Chi, and mindful meditation or relaxation techniques have been used in a number of populations and in relation to different diseases, showcasing the holistic effects on body and mind, such as improvements to body image, self-perception, depression, stress management and immunity (Li & Chan, 2001; Galantino, 2002; Wessels-Bloom, 2004; Robins, McCain, Gray, Elswick, Walter & McDade, 2006; Galantino, Galbavy & Quinn, 2008; Weiss, Tobin, Antoni, Ironson, Ishii, Vaughn *et al.*, 2011).

A small amount of research has been conducted using body- and movement-centred techniques with people living with HIV. Tai Chi was found to improve functional outcomes

and quality of life in people living with HIV who carry it out as “a form of light resistance exercise that can be performed by patients who are unable to participate in more active programs” (Galantino *et al.*, 2005, p. 1086). In addition, “As a stress management strategy, Tai Chi may enhance one’s coping ability and potentially impact neuroendocrine responses and, ultimately, immune function [of people living with HIV]” (Robins *et al.*, 2006, p. 2). In a randomised study of a 10-week Tai Chi programme with 59 participants, statistically significant improvements in quality of life, HIV-related psychological distress, and appraisal-focused coping were found (Robins *et al.*, 2006). Qualitative data from interviews explained that “learning to experience the world from a mindful, balanced place and exploring stress responses through meaningful meditative movement encourage proactive instead of reactive responses to perceived stress” (Robins *et al.*, 2006, p. 6).

Cade *et al.* (2010, p. 377) suggested that “yoga’s approach to synchronizing breath inhalation, exhalation or held breath to movement in conjunction with focusing the mind on a specific region of the body optimises the interaction between the autonomic nervous system and endocrine system.” Thus, a randomised controlled study of a 20-week programme with HIV-infected people with pre-hypertension showcased the potential for supervised Ashtanga Vinyasa yoga (which involves the coordination and integration of breath with movement) to reduce cardiovascular risks, such as high blood pressure (Cade *et al.*, 2010). Other forms of yoga (e.g. restorative yoga) might provide different results. The study by Cade *et al.* (2010) also indicated challenges to evaluating the effects of body- and movement-centred techniques on individuals’ perceptions of wellbeing, especially when more body awareness is obtained, including the perception of pain. In addition, most people are not familiar with these kinds of physical activity, thus a time for becoming comfortable with the technique might be required before benefitting from the positive effects (Galantino, 2002; Galantino *et al.*, 2008; Cade *et al.*, 2010).

In general, mindful body- and movement-centred techniques seem to impact on psychosocial factors and immunity through the relationship of body and mind as described in psychoneuroimmunology. A well-prepared facilitator and an appropriate training atmosphere are seen as essential for success (Robins *et al.*, 2006). Further research is needed to gain a better understanding of the body–mind relationship and the potential holistic effects of these techniques.

Long-term effects

Adherence to physical activity

Studies in South Africa reveal that physical inactivity and obesity are strongly related to social-cultural beliefs, socioeconomic status and education (Sparling, Owen, Lambert & Haskell, 2000; Kruger, Venter, Vorster & Margetts, 2002; McVeigh, Norris & De Wet, 2004; Puoane, Tsolekile & Steyn, 2010). For example, there are major constraints for women, especially black women, taking part in sport and exercise programmes and adhering to regular physical activity (McVeigh *et al.*, 2004). In addition, limited space and desolate living conditions in disadvantaged communities fail

to offer a favourable environment for involvement in physical activities (McVeigh *et al.*, 2004). Consequently, a low level of physical activity is widespread among black women in disadvantaged communities. At the same time, this population group is especially affected by HIV (see UNAIDS, 2010), which indicates a double burden of risk. Therefore it is not surprising if physical-activity levels are low among people living with HIV in South Africa (cf. Kinsey, Chantler, McVeigh, Jordan & Nowak, 2007; Kinsey *et al.*, 2008).

In order to be beneficial, any physical activity should be practised over the long term, and ideally it should be an integrated part of an active healthy lifestyle. Therefore, physical activity must be in accordance with the needs, capacities, opportunities and interests of the person living with HIV. Apart from the determinants of motivation and volition (e.g. self-efficacy, risk perception, locus of control, barriers management), the social-cultural constraints to physical activity (e.g. stigma; social-cultural beliefs, habits and expectations; body image), as well as the availability of a conducive environment (e.g. appropriate infrastructure and materials) and the actual opportunity to practise physical activity (e.g. time and transportation) are also crucial (Biddle & Mutrie, 2008), especially in disadvantaged environments.

Often studies do not include people living in disadvantaged conditions, as they do not target them directly or fail to provide appropriate access and opportunities for them. In that way, the social-cultural constraints to participating in physical activities are widely ignored, both in research and actual interventions. In addition, psychosocial factors like depression might limit voluntary participation in a study and this is seldom considered in research protocols (Neidig, Smith & Brashers, 2003). As a consequence, many studies acquire participants with certain characteristics: “Participants (motivated volunteers) with good compliance and completion profiles. In real life, adherence to exercise and to medical treatment may fall well below desired levels and hinder the effectiveness of such programmes” (Petroczi, Hawkins, Jones & Naughton, 2010, p. 149).

Few studies include a follow-up of participants who drop out of programmes nor analyse the reasons and conditions for dropping out or non-adherence (Biddle & Mutrie, 2008; Derman *et al.*, 2010). In general, health-promotion sports programmes report dropout rates of up to 80%, with 50% of dropouts occurring in the first three months (Halle & Niebauer, 2008). In people living with HIV, dropout rates are estimated to be high (Deimel, 1999; Biddle & Mutrie, 2008; Loibl *et al.*, 2008; Derman *et al.*, 2010; Petroczi *et al.*, 2010). Indeed, some studies in the field of exercise and HIV show a high dropout rate, such as 75% during a 24-week exercise programme (MacArthur, Levine & Birk, 1993). Regarding a 40% loss of exercise participants with HIV in an individualised 12-week exercise programme, Neidig *et al.* (2003, p. 37) stated that “individuals who were lost from the study were often among the working poor and reported abrupt changes in employment, unreliable transportation, and increased family responsibilities.” Apart from socioeconomic and socio-cultural constraints, non-adherence to treatment or health programmes are often related to individual factors, such as self-efficacy, depression and psychosomatic

diseases. Petroczi *et al.* (2010, p. 152) mentioned that “actual physical fitness level or other physical characteristics” seem to be less influential on adherence to physical activity. Conversely, Stringer (2004, p. 468) suggested that “patients with chronic diseases such as HIV sometimes have decreased motivation to perform regular aerobic exercise.... This lack of activity results in a vicious cycle of decreased exercise, pain, slow recovery from activity, loss of lean body mass, anxiety of exercise, de-conditioning, and reduced gain from aerobic exercise sessions.”

Self-administrated exercise interventions for HIV-infected people at home might tackle social barriers like stigmatisation. A 16-week supervised home-based combined aerobic and resistance-training programme with HIV-positive women showed improvements in cardiovascular functioning and muscle strength (Dolan, Frontera, Librizzi, Ljungquist, Juan, Dorman *et al.*, 2006). In a 15-week home-based exercise intervention no improvements in physical endurance, immune status and health-related quality of life were found; meanwhile, duration, kind of training load, bias due to the different training and testing equipment, a high level of fitness at baseline, and specific characteristics of the sample were identified as study constraints (Baigis, Korniewicz, Chase, Butz, Jacobson & Wu, 2002). Time-consuming individual supervision and intervention design, and inadequate training equipment and space, could be limiting factors in such an approach in disadvantaged communities in South Africa.

The popularity of sport among youths in South Africa, and intrinsic motivating factors, such as recreation, catharsis and enjoyment, could contribute to better adherence to physical activity. Physical-sportive group activities could be adjusted to the above-mentioned social-cultural constraints in disadvantaged communities by: using modified sports and games according to existing spaces; offering protected places to play; promoting sport for females; using teams for resources and networking; and, promoting role models as sports leaders and coaches. Studies with other population groups reveal various factors that improve compliance in health-promoting sports programmes, including: advice given by a medical doctor or other highly esteemed person; the avoidance of overtraining and the negative consequences on physical wellbeing (pain, the ache of stiffness); physical activity in group settings; avoidance of monotony; enjoyment and recreation; using motivational games and sport; positive feedback and reinforcement from the facilitator and other participants; constancy and routine in programme delivery; and, a well-prepared and enthusiastic facilitator (cf. Biddle & Mutrie, 2008; Halle & Niebauer, 2008). For people living with HIV, practising sport in a group, and the supportive group dynamics, could increase motivation, helping to overcome other constraints and as such improve the individuals' adherence to physical activity. More research is needed on the effects of group interventions, the support processes in sports groups, and the determinants of adherence to physical activity.

Besides the limitations of measuring physical activity through self-report questionnaires and accelerometers (see Ramírez-Marrero, Rivera-Brown, Nazario, Rodríguez-Orengo, Smit & Smith, 2008; Fillipas, Cicuttini, Holland &

Cherry, 2009), some studies indicate that people living with HIV practise less physical activity in general as compared with people without HIV infection (Bopp *et al.*, 2004; Smit, Crespo, Semba, Jaworowicz, Vlahov, Ricketts *et al.*, 2006; Fillipas *et al.*, 2008; Kinsey *et al.*, 2008; Stein, 2008). The question arises then whether disease progression limits physical activity practises or whether physical activity reduces disease advancement. Although Bopp *et al.* (2004, p. 391) argued from their study that “physical activity was not affected by symptomology,” other authors have stated that physical condition and opportunistic diseases can limit physical exercise training (Stringer, 2004). A study in South Africa showed that people living with HIV who had a higher CD4 cell count also had higher total habitual physical activity levels and a greater sense of functional independence as compared with those with a lower CD4 cell count (Kinsey *et al.*, 2008). HIV-disease progression might endanger long-term adherence to physical activity. An acute opportunistic disease (e.g. tuberculosis) can be a contraindication for intense physical activity. However, physical activity can be adjusted to the individual's physical condition, above all by modifying the amount, making use of the different types of effects, and choosing appropriate types of activities.

Conclusions

The population most affected by HIV in South Africa suffers various context-specific socio-cultural and economic challenges as well as HIV-related physical, psychological and social constraints. These factors also hinder participation in and adherence to physical activities. This article discusses a range of opportunities for physical activity, and the different types and effects of physical activity for people living with HIV, contributing to overcoming a variety of challenges for this group. A review of the literature, according to a schematic separation of the different effects of physical activity, showcased the unused potential of implementing physical activities for people living with HIV.

Aerobic exercise and resistance training have been extensively studied and are shown to have immediate effects on physiological functioning, while the mediated and holistic effects of physical activity are seldom taken into consideration. Nevertheless, psychoneuroimmunological models and the corresponding findings, for example, support links between the psychosocial effects of physical activity, body–mind relationships, and immunity. Thus, further research in this direction is recommended.

Physical-sportive group interventions, such as sports activities, recreational games and group exercises, can achieve physiological improvements as a result of the same training principles as exercise. The additional group effects favour mediated psychosocial health benefits for people living with HIV. Facilitators and leaders and the internal group dynamics can play key roles in maximising the positive interactions and psychosocial effects, while minimising the HIV-related risks and challenges for the participants, such as stigmatisation. By utilising the different effects of physical activity, physical-sportive group interventions can contribute to improved health and quality of life in people living with HIV. In addition,

enjoyable and supportive group activities might improve individuals' motivation and tackle the psychosocial stressors that otherwise hinder their participation. In that way, long-term adherence to physical activity could be targeted.

People living with HIV should have the opportunity to choose from different types of physical activities according to their interests, capacities and personal challenges. Therefore, a wide range of physical activities should be promoted and opportunities created accordingly. This can be in the form of therapeutic, health-promoting and recreational sport or exercise groups. An interdisciplinary approach and community resources are key to creating such opportunities.

Our recommendations for a holistic, interdisciplinary and community-based approach include: offering a variety of types of physical activity; supporting the creation of self-supporting sports groups; building networks among different disciplines and stakeholders; and, connecting people living with HIV to community sports structures; meanwhile, this should be done guaranteeing non-stigmatisation, supportive environments, and capacitated facilitators and trainers.

Most studies on physical activity have been done in Western contexts and laboratory settings that differ from real-life situations, particularly disadvantaged settings. More research in natural settings is encouraged in order to analyse and contextualise the benefits and limits of the physical activity of people living with HIV. Therefore, researchers must do more to reach out to disadvantaged communities; additionally, reflection on possible sampling bias is crucial to avoid a sample of participants with only certain characteristics.

Other research gaps include analyses of the determinants of initiating and maintaining physical activity, as well as social-ecological barriers, challenges and influences in regard to social-cultural beliefs, stigma, social structures, physical environment and policies. Besides analysing adherence to physical activity, studies should also follow up dropouts in physical-activity interventions and investigate the determinants of non-adherence. Intervention research is essential to evaluate how these determinants can be influenced, especially in disadvantaged settings.

Furthermore, while studying the different effects of physical activity in people living with HIV, investigators could incorporate the following questions: Which types of physical activity are most pertinent and preferred by the participants in the given context? What conditions will facilitate individuals' participation in group exercise and sport? How can the risk of disclosure be minimised and stigma avoided? What key factors make sport and exercise groups supportive? What are the determinants of positive group dynamics and interaction? What are the mediating effects?

Finally, a holistic evaluation of the structure, processes and outcomes of an intervention are important for tracking the connections between these, as well as enabling the clear identification and testing of *theories of change*. Only then can we propose evidence-based and contextualised interventions and recommendations that make sustainable and relevant use of the different types of effects of physical activity in order to promote active and healthy lifestyles among people living with HIV.

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