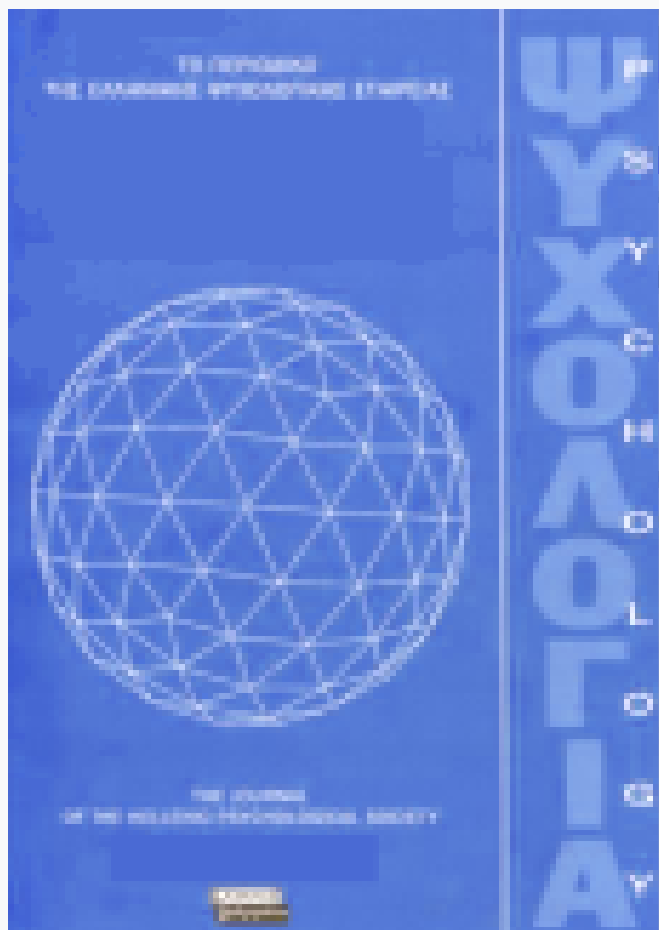


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## Physical activity and mental health in older adults: Current evidence and future perspectives

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### ABSTRACT

The case for physical activity in older adults has been built largely on its impact on physical health. However, there is a growing research interest in its potential to influence aspects of mental health. The aim of this paper was to summarise evidence regarding the contribution of physical activity to aspects of older adults' mental health and to present some current research needs and perspectives. Research indicates that there is a positive impact of physical activity on the maintenance of cognitive performance, on improvement of mood, self-perceptions and life satisfaction and on the decrease of depressive symptoms and feelings of loneliness. However, better research designs, clearer conceptual frameworks and improved instrumentation is necessary before a cause and effect relationship can be fully established and the mechanisms underpinning any effect can be identified.

*Key words:* Older adults, Physical activity, Subjective well-being.

Statistical reports on ageing populations reveal that over the past three decades the number of older adults (60 years of age and over) has rapidly grown. This is due to the increasing life expectancy, decreasing fertility rates and advances in medical care (Arsenault & Anderson, 1998). Old age is seen by many as an undesirable period of life that is characterised by inevitable physical, cognitive, social, and emotional decline (McGuire, Boyd, & Tedrick, 1999).

It was the Roman philosopher and statesman Cicero (106-43 BC) who in his essay *De Senectute* (44 BC/1979) maintained that old age is not

a phase of decline and loss but, if approached properly, offers many opportunities for positive change and productive functioning. Rowe and Kahn (1987, 1997) distinguished between "usual ageing" – what most people normally experience – and "successful ageing" – when the individual avoids functional loss or enhances functional abilities.

Medics have also made the distinction between "normal", "optimal" and "sick" ageing (Baltes & Baltes, 1990). Normal ageing refers to the absence of biological or mental pathology, optimal ageing exists when there is

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development- enhancement and sick ageing implies an ageing process determined by syndromes of illness. Successful ageing consists of optimising life expectancy while at the same time minimising physical, psychological and social morbidity, overwhelmingly concentrated in the final years of life (Fries, 1990). According to Baltes and Baltes (1990), "the greater one's reserve capacities, be they physical, mental, or social reserves, the more likely successful ageing will take place" (p. 20).

The Heidelberg Guidelines for Promoting Physical Activity among Older Persons (World Health Organisation, 1997) acknowledge the positive influence of physical activity on the physical health and psychological well-being of older adults. In a published position stand, the American College of Sports Medicine (1998) also stressed the importance of physical activity to successful ageing. Accumulated studies have provided strong evidence on the association of physical activity with better cardiovascular function, lower blood pressure, decreased risk of cardiovascular disease, prevention of osteoporosis, improved joint mobility, increased muscle strength and flexibility, reduction in accidental falls and better weight control in older adults (Daley & Spinks, 2000; Pescatello, 1999; Shephard, 1997; Smith & Tommerup, 1995; Spirduso, 1995).

Although the case for physical activity in older adults has been built largely on its impact on physical health, there is growing research interest in its potential to influence aspects of mental health. The first motto of the Gerontological Society of America in 1955 called for "adding life to years, not just more years to life" and in recent years this has provided the basis for research into the effect of physical activity on the mental well-being aspects of ageing (Spirduso, 1995). Reviewing the literature for over a 10-year period for adults over 45 years of age, McAuley and Rudolph (1995) located 38 studies 73.7% of which presented "some evidence of a relationship between levels of physical activity and enhanced

well-being" (p. 79). Biddle and Faulkner (in press) over a shorter period (1995-beginning of 2000) located 30 studies concerning adults over 60 years of age; 86.7% of them reported positive results. Interestingly, both reviews did not show any negative effects.

The purpose of this review was to briefly summarise the existing literature on the influence of physical activity participation on the mental health of older adults aged 60 years and over. Almost all the studies reviewed here have focused on the impact of involvement in forms of programmed or group exercise such as brisk walking, swimming, aerobic exercise, strength/balance/stretching and flexibility training. A second purpose of this paper was to present some current needs and future perspectives in this area of research.

### **The influence of physical activity in the mental health of older adults**

As with many areas of research in social psychology, there remains a problem of definitional congruence when examining the literature. Many studies have focused on the assessment of negative emotional states such as depression and anxiety and their absence is taken as an indicator of well-being (McAuley & Rudolph, 1995). In their meta-analysis, Arent, Landers, and Etnier (2000) stressed that although it might seem to be a semantic issue, physical activity could be much more appealing to the older adults if it were presented as a means for improving positive states rather than as a way for merely decreasing the negative ones. According to Grant (2000), "Mental health is the emotional and spiritual resilience which enables us to enjoy life and to survive pain, disappointment and sadness. It is a positive sense of well-being and underlying belief in our own and others' dignity and worth". The literature in physical activity and older adults, during the last five years, appears to show greater recognition of the importance of increasing the posi-



tive elements of mental health, such as cognitive ability, self-esteem, self-confidence, positive mood, subjective well-being and life satisfaction (Biddle & Faulkner, *in press*).

The following sections will provide a summary of the impact of physical activity on specific well-being constructs.

### Cognitive function

Decrease in cognitive performance is an inevitable consequence of advancing age (Dustman, Emmerson, & Shearer, 1990). Also, a wide variety of disease states are associated with decreases in cognitive performance and this is more pronounced in older adults (Birren, Woods, & Williams, 1980).

The maintenance of an active lifestyle can compress morbidity and mortality in older adults (American College of Sports Medicine, 1998; Smith & Tommerup, 1995) and this prolonged state of functional health in itself is likely to assist in cognitive performance. Physical activity is one of the few non-pharmacological interventions that could compensate for the steady decrease in cognitive performance that often accompanies ageing (Biddle & Faulkner, *in press*). Although the mechanisms explaining the relationship between physical activity, ageing, and cognitive performance are unclear and the methodological barriers many, there is some positive evidence from cross-sectional and intervention studies (Boutcher, 2000).

Cross-sectional studies testing reaction time have shown that physically fit older adults process cognitive information more efficiently than less fit individuals of the same chronological age and similar to younger fit adults (Boutcher, 2000; Chodzko-Zajko & Moore, 1994; Spirduso, 1995). Their findings, detected by several different methods of assessing fitness (like self-report inventories as well as more traditional laboratory tests of physiological fitness and aerobic capacity) have been similar irrespectively of

exercise modalities (Arito & Oguri, 1990; Hawkins, Kramer, & Capaldi, 1992). In a meta-analysis of cross-sectional studies, Thomas, Landers, Salazar, and Etnier (1994) reported a significant but moderate effect size ( $ES = 0.31$ ;  $SD = 0.54$ ). However, Biddle and Faulkner (*in press*), in a further review of cross-sectional studies, published since 1995, reported results that are less supportive of the consistency of the relationship.

Inconsistent results are also presented in 14 intervention studies reviewed by Boutcher (2000), where five studies reported increased performance and nine did not show any significant change. The biggest increases in cognitive performance were found in people who had the greatest increase in aerobic fitness. In a meta-analysis, Etnier et al. (1997) found that the overall effect size for intervention studies was considerable and significant for 45 to 60 year old adults ( $ES = 1.02$ ;  $SD = 1.15$ ) and significant but small for older adults 60 to 90 years of age. Out of the 14 studies reported by Boutcher (2000), only four included strength training in the intervention protocol stressing the need for more substantial evidence regarding the importance of different modes of physical activity on the cognitive performance of older adults.

Research so far has suggested a number of other mechanisms besides improved aerobic fitness that may underpin the possible physical activity-cognitive performance relationship. However, these remain speculative at this stage (Boutcher, 2000; Chodzko-Zajko & Moore, 1994). Well-designed experimental studies and qualitative process-oriented studies are necessary to unravel the complex interaction of programme-related variables with their possible effect on different aspect of cognitive functioning. So far quite a restricted view has been taken of the important questions of whether exercise/fitness can keep people mentally agile, alert, quick and focussed.



### Mood, affect and feeling states

These constructs tend to be used interchangeably and are important indicators of how life is experienced and accommodated. Earlier reviews of studies addressing the relationship between physical activity and mood in older adults were not optimistic about the effect of exercise. Fillingim and Blumenthal in 1993 reported that "research has not consistently borne out that exercise holds psychological benefits for the elderly" (p. 247). However, McAuley and Rudolph in 1995, concluded that there are "overwhelmingly" positive results and there is need for establishing causality.

Biddle and Faulkner (in press) described nine studies (7 experimental-2 non-experimental) since 1995 that investigated the influence of long term exercise on affect in older adults and all but one (Jette et al., 1998) reported small but significant effects. Pierce and Pate (1994) also found improved mood in one of the few studies addressing the acute effects of a single bout of intense exercise.

In the first meta-analytic review of 32 studies on the effects of exercise on mood in older adults, Arent et al. (2000) concluded that exercise is associated with improved mood in the older adults. In studies comparing *experimental-versus control groups* there is an evident relationship of exercise to enhanced mood ( $ES = 0.34$ ) with low intensity exercise, self-selected duration of exercise bouts and protocols lasted < 12 weeks presenting the most effective results in the improvement of mood. The finding that improved mood was not necessarily related to increased number of weeks of participation might indicate one way in which older participants respond differently than do younger participants to exercise. Furthermore, it points out that future research should examine whether these findings interact with initial fitness levels (McAuley, Mihalko, & Bane, 1996). In studies comparing *pretest-posttest gains*, exercisers had a significant better global mood ( $ES = 0.38$ ) than

control groups ( $ES = 0.06$ ). Finally, in studies comparing *active-inactive older adults*, physically active older adults demonstrated an enhanced global mood in comparison with their physically inactive counterparts (Arent et al., 2000).

Following the criteria for evaluating scientific literature for public policy issues (Dunn & Blair, 1997), Arent et al. (2000) concluded that despite the methodological limitations, there is strong evidence that physical activity is related to enhanced mood in older adults. They suggest that future research should focus on the dose-response relationship between physical activity and mood.

Recently, this question was addressed by McAuley, Blissmer, Katula, and Duncan (2000) who found a negative dose-response relationship between acute exercise and affect in older people suggesting that greater benefits take place at lower intensity levels. However, the validity of these findings has been questioned by Ekkekakis and Petruzzello (1999). They stressed the need for protocols tracking affective change across time, during and after exercise, and they recommended the study of the distinction between 'self-selected' versus imposed exercise doses and the examination of aerobic fitness or activity levels in future dose-response studies. Further examination of the impact of the several types of activities is also required as findings stress the influence of strength training programs over that of cardiovascular training alone. Finally, there is need to further explore the possible mechanisms that cause the "feeling good" effect of participation in physical activities. The process of exercise and the situation in which it takes place rather than exercise *per se* may be more important (Fox, 1999) and social influences may be particularly salient for older adults.

### Life satisfaction and well-being

Global self-assessments of life satisfaction and well-being are often used as indicators of life



adjustment and mental health. McAuley and Rudolph (1995) reported equivocal results for the effect of physical activity on life satisfaction but stressed the need for adequate operational definitions and appropriate measurement tools. Indeed, in several studies examining this relationship the term life satisfaction, quality of life and subjective well-being has been used interchangeably, a point that needs to be kept in mind when appraising the literature as distinctions between these terms do appear.

Cross-sectional data have shown that active older adults appear to have higher levels of life satisfaction than inactive older adults (Clark, Long, & Schiffman, 1999; Hilleras, Jorm, Herlitz, & Winblad, 1999; Menec & Chipperfield, 1997; Ruuskanen & Ruoppila, 1995). In experimental and quasi-experimental studies, walking, strength training and stretch and flexibility programs have demonstrated a positive influence in life satisfaction (King et al., 2000; Mihalko & McAuley, 1996). Interestingly, studies that used health related quality of life measures, such as the Medical Outcomes Study SF-36 (McNair, Lorr, & Droppleman, 1971), did not report any changes resulting from participation in physical activity, questioning the appropriateness of such measures in the exercise and physical activity environment (Damush & Damush, 1999; Kutner, Barnhart, Wolf, McNeely, & Xu, 1997). In conclusion, it could be said that experimental studies show a moderate positive effect of physical activity on life satisfaction and perceived health of older adults. However, there is need for well-defined operational definitions and use of measures sensitive to outcomes from participation in physical activities.

### **Self-esteem and physical self-perceptions**

Self-esteem is widely accepted as one of the strongest predictors of subjective well-being and an important element of quality of life (Diener, 1984). High self-esteem has been related to life

satisfaction, independence and adaptability whereas low self-esteem is a feature of clinical depression, and is associated with trait anxiety, suicidal ideation and low perceived personal control (Fox, 2000). However, there is a similar lack of definitional precision in this area of work. Often global constructs such as self-concept and self-esteem are used interchangeably. More specific self-perception measures such as body image, physical self-efficacy and sports competence are numerous and diverse making studies difficult to compare. The newer comprehensive physical self-perception measures such as the Physical Self-Description Questionnaire (PSDQ) (Marsh, Richards, Johnson, Roche, & Tremayne, 1994; Marsh, this issue) and the Physical Self-Perception Profile (PSPP) (Fox & Corbin, 1989) are just starting to be used.

In the only four unpublished controlled studies, Fox (2000) found that although flexibility programs did not produce positive results, strength and fitness programmes produced positive self-concept changes. In a review of 38 studies by McAuley and Rudolph (1995) for adults over 45 years of age, there was a complete absence of direct measures of self-esteem.

In a 3-months program, 83 older adults took part in either a home-based or class-based program (Mutrie & Davison, 1994). The Physical Self-Perception Profile (Fox & Corbin, 1989) was administered pre- post and 6 months after the programme and positive changes were reported in both groups. Participants in the class-based group reported greater improvement in physical self-perceptions, perhaps stressing the importance of the social aspects of participation in physical activities.

The most recent randomized controlled trial examined the growth and form of multidimensional self-esteem using the PSPP, self-efficacy and global esteem measures over a 12-month period (6-month exercise intervention and 6-month follow-up) in 174 older adults engaged in either a walking or stretching/toning program (McAuley, Blissmer, Katula, Duncan, & Mihalko,



2000). The results showed a curvilinear pattern of growth in esteem with significant increases at all levels of self-perceptions upon completion of the intervention followed by significant declines at 6 months post-intervention in both groups. Frequency of activity and changes in physical fitness, body fat, and self-efficacy were related to improvements in perceptions of attractive body, strength, and physical condition (PSPP). These findings underline the need for trials that utilize comprehensive assessments of self-perceptions at different levels of specificity (Fox, 1998).

Strength training and group exercise programs have produced the better results so far and future research should focus on the types of physical activity and the characteristics of the exercise environment that influence the levels of self-esteem in older adults. Finally, consideration of the specific characteristics and needs of this age group (need for independence, personal control, sense of belonging) is necessary in order to explore the pathways through which physical activity influences their self-perceptions.

### **Self-efficacy**

A sense of control is important to positive physical and psychological health in later years of life (Schulz & Heckhausen, 1996). Unlike self-perception constructs, that is, generalised statements of perceived competence or adequacy, self-efficacy beliefs reflect the individual's perceptions or assessments of their ability to perform specific behaviors successfully (Bandura, 1982). This has been found to be positively correlated with levels of physical activity (Gill, Kelley, Williams, & Martin, 1994) and predictive of adherence to exercise in asymptomatic (McAuley, 1993) and clinical populations (Kaplan, Atkins, & Reinsch, 1984). In addition, self-efficacy is related with fear of falling and slower gait speeds (McAuley, Mihalko, & Rosengren, 1997; Rosengren, McAuley, & Mihalko, 1998).

As people grow older, performance of every-

day activities requires greater effort and perseverance (McAuley et al., 1999). Low efficacious individuals tend to curtail their range of activities, demonstrate less effort and experience greater anxiety and depression (Bandura, 1986). This results in less experience with successful performance and as a consequence, there is an increase of the likelihood of older adults perceiving themselves as being unable to perform several activities.

In 38 respective studies reviewed by McAuley and Rudolph (1995), four used self-efficacy measures and all reported positive results. Longer study protocols appeared to be more effective and McAuley and Rudolph concluded that greater exposure to exercise participation appears to improve perceptions of personal capabilities and this in turn leads to positive changes in well-being. Since that review, seven studies have reported positive self-efficacy effects in older adults (Bosscher, Vanderaa, Vandasler, Deeg, & Smit, 1995; Katula, Blissmer, & McAuley, 1999; King & Brassington, 1997; King et al., 2000; McAuley et al., 1999; Parkatti, Deeg, Bosscher, & Launer, 1998; Tsutsumi, Don, Zaichkowsky, & Delizonna, 1997).

The determination of how older adults maintain high levels of efficacy and the extent to which compromised efficacy can be enhanced are primary issues in the study of aging (Bandura, 1997). As self-efficacy has been quite consistently associated with participation in physical activities there is need to further explore this relationship. In particular, the importance of different modes of activity clearly requires consideration in further research particularly in relation to its potential role in initiating change in more generalised perception such as perceived physical self-worth and global self-esteem.

### **Depression**

Depressive symptoms are reported by approximately 15-25% of the older population



(Friedhoff et al., 1992; Koenig & Blazer, 1996). Pharmacological and psychological treatments are the most frequently used treatment for depression in older adults (Gerson, Belin, Kaufman, Mintz, & Jarvik, 1999). However, drug treatments are expensive, not always desired by patients, and cognitive behavioural therapy is often in short supply (Mutrie, 2000). In comparison, physical activity appears to be an alternative low cost treatment, with minimal side effects. Its potential use as an adjunctive treatment for depression has become an important public health issue (American College of Sports Medicine, 1998; Department of Health, 1999; Morgan, 1997).

Epidemiological studies have reported a moderate inverse relationship between physical activity and depression and they also offer some evidence regarding a dose-response relationship (Camacho, Roberts, Lazarus, Kaplan, & Cohen, 1991; Farmer et al., 1988; Lampinen, Heikkinen, & Ruoppila, 2000; Ruuskanen & Ruoppila, 1995; Stephens, 1988). The evidence is stronger where programmed exercise has been assessed. Broader definitions of physical activity as recreation or leisure have produced less conclusive results (Bennett, 1998; Dupuis & Smale, 1995; Morgan & Bath, 1998).

Although several meta-analyses on the effect of physical activity interventions on depression have been conducted none have focused specifically on older adults (Craft & Landers, 1998; Kugler, Seelbach, & Kruskemper, 1994; McDonald & Hodgdon, 1991; North, McCullagh, & Tran, 1990).

Among the non-randomised experimental studies with older adults, a significant effect for aerobic and non-aerobic forms of exercise on depressive symptoms has been found by King, Taylor, and Haskell (1993); McMurdo and Burnett (1992); whereas Blumenthal et al. (1991) and Gitlin et al. (1992) failed to find significant change. However, these latter studies involved older adults reporting low levels of depression at the baseline.

In a recent randomised controlled trial (RCT)

in older adults with moderately elevated depressive symptoms (Beck Depression Inventory > 12), Singh, Clements, and Fiatarone (1997) reported 2 to 3 times greater improvements in depression scores in the exercise group compared to the control group. Extending the RCT for ten more weeks, the exercise group reported a significant further reduction in depression and less musculoskeletal symptoms compared to control group (Singh & Fiatarone Singh, in press).

Mutrie (2000) stressed the lack of research in the comparative effects of exercise treatment with drug treatment. In this neglected area, Blumenthal et al. (1999) conducted a study with an exercise group, an antidepressant therapy group and a combination of exercise and antidepressant group. All the groups reported significant reduction in depression symptoms with no significant differences among them suggesting the effectiveness of exercise and its potential role as a form of treatment either in conjunction with traditional forms of therapy or as a main tool for achieving reduction in depressive symptoms.

The evidence from meta-analyses and narrative reviews show an important antidepressant effect for exercise despite the inconsistent results from epidemiological studies (Biddle & Faulkner, in press). Regardless of the possible antidepressant effects and the notion that "depression and poor physical function are mutually reinforcing" (Penninx et al., 1998; p.1725), the physical health benefits alone justify the need for promoting physical activity to the older adults. It is also important to note that there has been no documentation of a negative effect of physical activity on depression scores (Mutrie, 2000). However, further research is needed in order to explore the existing theories (Morgan, 1997; North et al., 1990) and their potential application to older adults. Cost-effectiveness studies comparing exercise with existing treatments for clinical depression are required before health services are likely to embrace activity promotion as a viable alternative. Furthermore, the impact of lifestyle physical activity as opposed to formal exer-



cise regimens requires more attention as it is possibly more feasible in terms of delivery and adoption in older adults.

### **Loneliness and social isolation**

According to data from Europe and the United States (Weeks, 1994), approximately 40% of older adults experience some degree of loneliness. Older adults who have friends are known to meet various developmental challenges such as widowhood, with better outcomes than individuals who do not have friends (Connidis & Davies, 1990). The loss of ability to accomplish tasks, such as going for shopping or using public transportation, may isolate older adults from friends in the community and decrease the frequency of social contacts (Newsom & Schulz, 1996).

Participation in group physical activities provides opportunities for older adults to foster new friendships, to enhance social and intercultural interactions and to widen available social networks (Department of Health, 1999). There is also the belief that physical activity helps older adults to maintain independence and self-sufficiency and empowers them to sustain or acquire new roles in order to become more active members in society. A reduction in demand for health and social services, a better public image of older people and appreciation of their value to society are considered to be important societal outcome from the participation of older adults in physical activities (Health Education Authority, 1999).

A qualitative study among people over the age of 50 (Finsch, 1997) reported that participation in physical activities offer important social benefits to older adults. Respondents emphasized that physical activity regardless of its various forms (joining a club, exercising as a group of friends or simply walking outside in the community) is a way to help counter loneliness and isolation because "... if you go out [walking]

you most likely bump into somebody, have a little chat". Older adults use exercise as a way to meet people and expand their network and this is an important motive for them to perceive a possible tiring and exhausting activity as something tolerable or enjoyable. These perceptions stress the relationship between physical activity and social aspects of older adults' well-being and justify the importance they have received in the physical activity guidelines in England (Health Education Authority, 1999) and Japan (Ohta, Tabata, & Mochizuki, 2000).

In a cross-sectional survey, Ohno et al. (2000) reported that being healthy and physically active is associated with high social activity in old age for both men and women and concluded that maintaining social activity is an essential component of successful ageing. Furthermore, Everard, Lach, Fisher, and Baum (2000) reported that low-demand leisure activities may replace work activities after retirement or changes in family demands and they can be important for successful ageing because of their effects on mental health.

Environmental and social influences appear to be significant determinants of exercise behavior (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Sallis & Owen, 1999). Given the increased importance upon social structures and support as antecedents of mental health (Fees, Martin, & Poon, 1999), McAuley, Blissmer, Kattula, and Duncan (2000) examined the influence of exercise environment regarding opportunities for social interaction among older adults. Not surprisingly, the group exercise environment produced a more positive effect than the individual exercise condition. Turner, Rejeski, and Brawley (1997) maintain that the social composition of the exercise environment may provide one of the key mechanisms for the influence of exercise on affect.

The qualities of the exercise leader, the quality of the facilities, the characteristics of fellow exercisers and the individual characteristics of the participants in the physical activities could



play an important role in the way that physical activity might enhance the social aspects of well-being in the older adults. Although the current literature stresses that the process of physical activity as a whole enables older people to enjoy higher levels of well-being, there is a need for further studies into factors which facilitate exercise adoption in the socially isolated and also the identification of exercise characteristics which maximise the social interaction effect.

### Further research needs

This summary of the literature clearly demonstrates the potential of physical activity to enhance the lives of older adults through improved mental health. However, there are a number of issues that require further examination. First, the support for the relationship of physical activity and well-being in older adults comes from relatively few randomised controlled trials and derives, by and large, from studies of inferior design. Little epidemiological evidence has been produced on older people, although the depression literature indicates that remaining active might be protective from mental illness. There remains too strong a reliance on cross-sectional studies so a cause-and-effect relationship is not conclusively established. In addition, few mechanisms, with the possible exception of social effects, have been convincingly demonstrated. Therefore, there is need for more well-designed randomised controlled trials before it is possible to establish strong enough evidence to fully convince those who deliver policy and practice in health and social services that exercise is a cost-effective alternative to existing treatments and interventions.

Second, several researchers (Brown, 1992; Fillingim & Blumenthal, 1993; McAuley & Rudolph, 1995; O' Connor et al., 1993) have commented on the limited quality of the literature, which is highly dependent on quantitative perspectives based on inadequate instrumentation. Biddle and Faulkner (in press) specifically state that

"qualitative research is strongly recommended for illuminating the role of exercise in the lives of the elderly". This comes in accordance with the notion that the richness of the subjective experience of older adults has not been fully documented and analysed (Bytheway, 1996; Sherrard, 1994) and with the call for more research that explores the depth of their lived experience (Ruth & Coleman, 1996; Sherrard, 1998). Ageing is a very individualised and differentiated process with regard to mental, behavioural, and social outcome variables (Baltes & Baltes, 1990; McPherson, 1994). Well-conducted and documented qualitative research that uses a variety of techniques, including case study design, is required if these differences are to be understood and accommodated.

Third, terms such as mood, affect (positive and negative), psychological benefits, and well-being are often used interchangeably when the effects of physical activity on the well-being of older adults are being assessed (Arent et al., 2000). There is little consensus among existing studies on the key constructs that should be used to assess mental well-being or on which instruments are the most appropriate. The importance of this problem is well illustrated in Brown (1992; p.187) where psychological well-being is defined as "whatever an investigator has identified in his/her investigation" whereas Seraganian when addressing the exercise/mental health literature (1993; p. 385) stressed that "the absence of a unifying superstructure is noticeable". A further example is seen in the area of subjective well-being where terms such as life satisfaction, happiness, morale, positive affect, negative affect, cognitive evaluations, sense of well-being, psychological well-being, perceived well-being and quality of life have been used interchangeably even though not necessarily and not always synonymous (Andrews & Robinson, 1991).

The last section comprises a brief description of a research which utilizing qualitative and quantitative research techniques has attempted to ad-



dress this imprecision. The construct of subjective well-being is likely to be particularly salient in older adults and may be influenced in many ways by physical activity participation.

### **Subjective well-being and the influence of physical activity: A contemporary research approach**

Subjective well-being has been seen as an important element of successful aging (Rowe & Kahn, 1987). Andrews and Robinson (1991) define subjective well-being as "a psychological summing up of the quality of an individual's life in a society" (p. 61), and Diener, Suh, Lucas, and Smith (1999), stress that «subjective well-being is a broad category of phenomena that includes people's emotional responses (pleasant-unpleasant affects), domain satisfactions, and global judgements of life satisfaction» (p. 277).

These broad definitions of subjective well-being cause difficulties in physical activity research, as it is not clear which aspects can be potentially influenced by physical activity. Therefore, further exploration of the key dimensions of life involvement that contribute to the global subjective well-being of older adults, particularly for people who participate in regular physical activities, is required. The delineation of key dimensions would allow more insight into the potential routes through which physical activity may impact upon the global statements of subjective well-being of older adults and thus their mental health.

### **Determining the components of subjective well-being**

The ageing research shows that different domains may have different value for the quality of life of older people or there are domains that are unique to the older adults' quality of life (George & Bearon, 1980; Katz & Gurland, 1991).

Stathi, Fox, and McKenna (in press) decided to use qualitative interview techniques to identify the sources of subjective well-being and the potential contribution of physical activity to each element in active older adults. According to older adults' responses, physical activity appears to influence positively four dimensions of well-being.

**Developmental well-being.** Older adults need to maintain a busy and active life and be independent in order to pursue personal goals and aspirations. According to their responses, physical activity offers a sense of "achievement" and makes them feel "pleased" for themselves. Physical activity gives them "a purpose", as "having something to look forward to" and "having somewhere to go" is very important to them.

**Physical well-being.** Getting older worries respondents who notice that their body "is running down" and that every year their physical abilities "are getting less". What they believe, however, is that they "would have deteriorated much more" if they "did not have the exercise". For respondents with specific health problems such as arthritis, "physical activity is to slow down the effects" of their disease. Physical activity helps respondents to keep "loose", "comfortable" and "trim". Furthermore, physical activity offers "a better breath control" and through exercise "sleeping is better". In addition, older adults recognise the necessity of exercise as it helps them to keep "mobility" and "function" because after participating in an exercise program they "perform better" and they "bend and stretch with no problem".

**Mental well-being.** Physical activity plays a multiple role in respondents' mental well-being, as it keeps them "mentally alert", it "takes away the problems" and helps them to "focus better" on what they are doing. Through physical activity, "life looks better" and respondents mention that exercise is "as much a mental thing as a physical thing" and it helps them to do things with a much more "positive" and "young" attitude. In advancing age "it is very easy to give up



in life" and physical activity helps respondents to feel "lively" and "forcible".

**Social well-being.** Active older adults feel that one of the most important outcomes of participating in physical activities is the opportunity to "meet people" and "broaden" their social life. Especially after retirement, the danger of isolation becomes bigger, as "you could be cooped in your home and do not meet anyone". Through participation in physical activities, older adults have the opportunity to meet a lot of "different people" and this is important "when usually you do not get out of the house". Physical activity also, makes elderly "have a different approach to people" and be more open and less reserved in making new friends.

The findings support the multidimensionality of subjective well-being and its definition as a "broad concept comprising a wide range of distinct dimensions such as life satisfaction, positive affect, happiness, personal growth, satisfying social relationships, and autonomy" (Kunzmann, Little, & Smith, 2000, p. 511). Older adults feel that their physical activity participation contributes to their mental health through maintenance of a busy and active life, mental alertness, positive attitude towards life and avoidance of stress, negative function and isolation. However, the complexity of subjective well-being and the multiple roles of physical activity stress the need to extend qualitative research to sedentary older adults and also to institutionalised elderly, in order to further explore the relationship between well-being and physical activity in the later years of life.

### **Developing an exercise-sensitive measure of subjective well-being**

One problem in judging the effects of exercise on the mental health is that diverse measures of psychological well-being are used across studies (Biddle, Fox, Boutcher, & Faulkner, 2000).

According to McAuley and Rudolph (1995), what is very important is whether the measures employed adequately assess the stimulus properties of the exercise environment. Exercise experience contains unique elements that produce distinct feeling states not necessarily tapped by traditional psychological measures. States as fatigue, which is associated with exercise participation, is mentioned as an important psychological response only in the Profile of Mood States (McNair et al., 1971), which along with the Multiple Affect Adjective Check List (Zuckerman & Lubin, 1965) are the most common measures used in assessing changes in mood through participation in physical activities. However, the Multiple Affect Adjective Check List (MAACL) assesses only anxiety, depression and hostility. Similarly, the Profile of Mood States (POMS) is comprised of five negative mood scales and only one positive scale (vigour). Studies using the MAACL, therefore, cannot be considered adequate for the study of psychological well-being or mood and those using the POMS are limited due to the single positive mood subscale.

Specifically, the physical activity and ageing research has been based on instruments that were not specifically designed for older adults. Widely used health-related quality of life measures such as the Medical Outcomes Study Short Form SF36, the Quality of Well-being Scale and the Sickness Impact Profile were designed for the general population (Frytak, 2000). Furthermore, although many specific questionnaires (anxiety-depression) have been used, there are not many instruments that tap multiple dimensions of well-being and quality of life. If so, these instruments are usually lengthy and time-consuming (Sickness Impact Profile) causing difficulties in older adults especially when they require self-administration. The Vitality Plus Scale (Myers et al., 1999) is a new instrument designed for the physical activity environment using a qualitative approach for the generation of items reflecting the perceptions of older adults. However, it fo-



cuses mainly on the physical aspects of well-being and requires extensive psychometric testing.

Stathi and Fox (2001) have utilised their qualitative work on the identification of elements of subjective well-being to produce a multidimensional subjective well-being profile that has the capacity to be sensitive to change initiated by physical activity participation. Using an inductive approach from the content analysis of the previously described interviews, scale items were generated collaboratively with a volunteer sample of active older adults around the four subjective well-being dimensions:

**Developmental well-being:** Being able to develop yourself, adjust to changes in your life and maintain an independent life.

**Physical well-being:** Feeling that you have good physical health and a body that is fit and functioning well.

**Mental well-being:** Being mentally alert and having a positive rather than a negative attitude about yourself and your life in general.

**Social well-being:** Being able to enjoy a socially active life and avoid feeling isolated.

The results from a study with 148 older adults provided preliminary support for the independence of the four scales representing the four subjective well-being dimensions. These scales also demonstrated good internal reliability. However, this research is ongoing and there is need for further research to establish subscale stability and factor structure through confirmatory analysis. Finally, validation studies are needed to further establish the discriminant and construct validity of the instrument and its sensitivity to assessing change in exercise interventions.

## Conclusion

For the first time in human history, society has been characterized as "ageing" and "greying" and terms such as "successful ageing" have received a good deal of attention.

The way forward requires the exploration of the characteristics and the dynamics of this highly heterogeneous age group which conventionally and for convenience reasons is called 'older adults'.

Despite the absence of definitive evidence that physical activity actually causes the improved psychological states observed following exercise, there is overwhelming evidence that participation of older adults in physical activities is accompanied by improvement in aspects of mental health. Physical activity contributes positively to the maintenance of cognitive performance, to the enhancement of mood and self-perceptions, and the improvement of satisfaction with life. It also assists with a decrease in depressive symptoms and feelings of loneliness. Although the positive effect of physical activity on mental health is often moderate in magnitude, it appears to be independent of the several methodological limitations and has been confirmed through qualitative research.

Physical activity can not make every older adult a "Ulyssean Adult" – a term based on Ulysses who was over 50 years of age when he began the adventures described in the *Odyssey* (McGuire et al., 1999). However, it can contribute to a better sense of well-being and an improved quality of life with the 'feeling good' effect of physical activity being reported by many participating older adults. More sophisticated research designs with carefully defined populations and instruments sensitive to physical activity benefits will help establish the case for investment in physical activity programs for the sake of improved physical and mental health of older adults.

## References

- American College of Sports Medicine. (1998). Exercise and physical activity - Position stand. *Medicine and Science in Sport and Exercise*, 30, 992-1008.



- Andrews, F. M., & Robinson, J. P. (1991). Measures of subjective well-being. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes* (pp. 61-114). New York: Academic.
- Arent, S. M., Landers, D. M., & Etnier, J. L. (2000). The effects of exercise on mood in older adults: A meta-analytic review. *Journal of Aging and Physical Activity*, 8, 407-430.
- Arito, H., & Oguri, M. (1990). Contingent negative-variation and reaction-time of physically-trained subjects in simple and discriminative tasks. *Industrial Health*, 28, 97-106.
- Arsenault, N., & Anderson, G. (1998). New learning horizons for older adults. *Journal of Physical Education, Recreation and Dance*, 69, 27-31.
- Baltes, P. B., & Baltes, M. M. (1990). *Successful aging: Perspectives from the behavioral sciences*. Cambridge: Cambridge University Press.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37, 122-147.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Bennett, K. M. (1998). Customary physical activity and gender as precursors for late life personal disturbance. *British Journal of Clinical Psychology*, 37, 189-197.
- Biddle, S. J. H., & Faulkner, G. E. (in press). Psychological and social benefits of physical activity. In K. M. Chan, W. Chodzko-Zajko, W. Frontera, & A. Parker (Eds.), *Active aging*. Champaign, IL: Human Kinetics.
- Biddle, S. J. H., Fox, K. R., Boutcher, S. H., & Faulkner, G. E. (2000). The way forward for physical activity and the promotion of psychological well-being. In S. J. H. Biddle, K. R. Fox, & S. H. Boutcher (Eds.), *Physical activity and psychological well-being* (pp. 154-168). London: Routledge.
- Birren, J. E., Woods, A. M., & Williams, M. V. (1980). Behavioural slowing with age: Causes, organisation, and consequences. In L. W. Poon (Ed.), *Aging in the 1980s: Psychological issues* (pp. 293-308). Washington, DC: American Psychological Association.
- Blumenthal, J. A., Babyak, M. A., Moore, K. A., Craighead, E., Herman, S., Khatri, P., Waugh, R., Napolitano, M. A., Forman, L. M., Appelbaum, M., Doraiswamy, P. M., & Krishnan, K. R. (1999). Effects of exercise training on older patients with major depression. *Archives of Internal Medicine*, 159, 2349-2356.
- Blumenthal, J. A., Emery, C. F., Madden, D. J., Schniebol, S., Walshridde, M., George, L. K., McKee, D. C., Higginbotham, M. B., Cobb, F. R., & Coleman, R. E. (1991). Long-term effects of exercise on psychological functioning in older men and women. *Journals of Gerontology. Series A: Biological Sciences and Medical Sciences*, 46, 352-361.
- Booth, M. L., Owen, N., Bauman, A., Clavisi, O., & Leslie, E. (2000). Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Preventive Medicine*, 31, 15-22.
- Boscher, R. J., Vanderaa, H., Vandasier, M., Deeg, D. J. H., & Smit, J. H. (1995). Physical performance and physical self-efficacy in the elderly: A pilot-study. *Journal of Aging and Health*, 7, 459-475.
- Boutcher, S. H. (2000). Cognitive performance, fitness, and ageing. In S. J. H. Biddle, K. R. Fox, & S. H. Boutcher (Eds.), *Physical activity and psychological well-being* (pp. 118-129). London: Routledge.
- Brown, D. R. (1992). Physical activity, aging, and psychological well-being - An overview of the research. *Canadian Journal of Sport Sciences*, 17, 185-193.
- Bytheway, B. (1996). The experience of later life. *Ageing and Society*, 16, 613-621.
- Camacho, T. C., Roberts, R. E., Lazarus, N. B., Kaplan, G. A., & Cohen, R. D. (1991).



- Physical activity and depression - Evidence from the Alameda County Study. *American Journal of Epidemiology*, 134, 220-231.
- Chodzko-Zajko, W. J., & Moore, K. A. (1994). Physical fitness and cognitive functioning in aging. *Exercise and Sport Science Reviews*, 22, 195-220.
- Cicero, M. T. (44 B.C.). *Cato major - De senectute* [Cato major - About old age] (J. Logan, trans.). Philadelphia, PA: Benjamin Franklin.
- Clark, S. D., Long, M. M., & Schiffman, L. G. (1999). The mind-body connection: The relationship among physical activity level, life satisfaction, and cognitive age among mature females. *Journal of Social Behavior and Personality*, 14, 221-240.
- Connidis, I. A., & Davies, L. (1990). Confidants and companions in later life: The place of family and friends. *Journal of Gerontology: Social Sciences*, 45, 141-149.
- Craft, L. L., & Landers, D. M. (1998). The effect of exercise on clinical depression and depression resulting from mental illness: A meta-analysis. *Journal of Sport & Exercise Psychology*, 20, 339-357.
- Daley, M. J., & Spinks, W. L. (2000). Exercise, mobility and aging. *Sports Medicine*, 29, 1-12.
- Damush, T. M., & Damush, J. G. (1999). The effects of strength training on strength and health-related quality of life in older adult women. *Gerontologist Care*, 39, 705-710.
- Department of Health. (1999). *White Paper. Saving lives: Our healthier nation*. London: HMSO.
- Diener, E. (1984). Subjective well-being. *Psychological Bulletin*, 95, 542-575.
- Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, 125, 276-302.
- Dunn, A. L., & Blair, S. N. (1997). Exercise prescription. In W. P. Morgan (Ed.), *Physical activity and mental health* (pp. 49-62). Washington, DC: Taylor & Francis.
- Dupuis, S. L., & Smale, B. J. A. (1995). An examination of the relationship between psychological well-being and depression and leisure activity participation among older adults. *Society and Leisure*, 18, 67-92.
- Dustman, R. E., Emmerson, R. Y., & Shearer, D. E. (1990). Electrophysiology and aging: Slowing, inhibition, and aerobic fitness. In M. L. Howe, M. J. Stones, & C. J. Brainerd (Eds.), *Cognitive and behavioural performance factors in atypical aging* (pp. 103-149). New York: Springer.
- Ekkekakis, P., & Petruzzello, S. J. (1999). Acute aerobic exercise and affect - Current status, problems and prospects regarding dose-response. *Sports Medicine*, 28, 337-374.
- Etnier, J. L., Salazar, W., Landers, D. M., Petruzzello, S. J., Han, M., & Nowell, P. (1997). The influence of physical fitness and exercise upon cognitive functioning: A meta-analysis. *Journal of Sport & Exercise Psychology*, 19, 249-277.
- Everard, K. M., Lach, H. W., Fisher, E. B., & Baum, M. C. (2000). Relationship of activity and social support to the functional health of older adults. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 55, 208-212.
- Farmer, C., Locke, B., Moscicki, E., Dannenberg, A., Larson, D., & Radloff, L. (1988). Physical activity and depressive symptoms: The NHANES-I epidemiological follow-up study. *American Journal of Epidemiology*, 128, 1340-1351.
- Fees, B. S., Martin, P., & Poon, L. W. (1999). A model of loneliness in older adults. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences*, 54(4), P231-P239.
- Fillingim, R. B., & Blumenthal, J. A. (1993). Psychological effects of exercise among the elderly. In P. Seraganian (Ed.), *Exercise Psychology* (pp. 237-253). New York: Wiley.
- Finsch, H. (1997). *Physical activity 'at our age'. Qualitative research among people over the age of 50*. London: Health Education Author-



- ity.
- Fox, K. R. (1998). Advances in the measurement of the physical self. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 295-310). Morgantown, WV: Fitness Information Technology.
- Fox, K. R. (1999). The influence of physical activity on mental well-being. *Public Health Nutrition*, 2, 411-418.
- Fox, K. R. (2000). The effects of exercise on self perceptions and self-esteem. In S. J. H. Biddle, K. R. Fox, & S. H. Boutcher (Eds.), *Physical activity and psychological well-being* (pp. 88-117). London: Routledge.
- Fox, K. R., & Corbin, C. B. (1989). The Physical Self-Perception Profile - Development and preliminary validation. *Journal of Sport & Exercise Psychology*, 11, 408-430.
- Friedhoff, A. J., Ballenger, J., Bellack, A. S., Carpenter, W. T., Chui, H. C., Dobrof, R., Fitzpatrick, J. J., Freeman, R., Heninger, G. R., Lavori, P. W., Merikangas, K. R., Raschko, R., Storandt, M., & Williams, M. E. (1992). Diagnosis and treatment of depression in late life. *Journal of the American Medical Association*, 268, 1018-1024.
- Fries, J. F. (1990). Medical perspectives upon successful aging. In P. B. Baltes & M. M. Baltes (Eds.), *Successful aging: Perspectives from the behavioral sciences* (pp. 35-49). Cambridge: Cambridge University Press.
- Frytak, J. R. (2000). Assessment of quality of life in older adults. In L. R. Kane & R. A. Kane (Eds.), *Assessing older persons. Measures, meaning, and practical implications*. New York: Oxford University Press.
- George, L. K., & Bearon, L. B. (1980). *Quality of life in older persons*. New York: Human Sciences Press.
- Gerson, S., Belin, T. R., Kaufman, A., Mintz, J., & Jarvik, L. (1999). Pharmacological and psychological treatments for depressed older patients: A meta-analysis and overview of recent findings. *Harvard Review of Psychiatry*, 7, 1-28.
- Gill, D. L., Kelley, B. C., Williams, K., & Martin, J. J. (1994). The relationship of self-efficacy and perceived well-being to physical-activity and stair climbing in older adults. *Research Quarterly for Exercise and Sport*, 65, 367-371.
- Gitlin, L. N., Lawton, M. P., Windsor-Landsberg, L. A., Kleban, M. H., Sands, L. P., & Posner, J. (1992). In search of psychological benefits: Exercise in healthy older adults. *Journal of Aging and Health*, 4, 174-192.
- Grant, T. (2000). *Physical activity and mental health: National consensus statements and guidelines for practice*. London: Health Education Authority.
- Hawkins, H. L., Kramer, A. F., & Capaldi, D. (1992). Aging, exercise, and attention. *Psychology and Aging*, 7, 643-653.
- Health Education Authority. (1999). *Guidelines promoting physical activity with older people*. London: Author.
- Hilleras, P. K., Jorm, A. F., Herlitz, A., & Winblad, B. (1999). Activity patterns in very old people: A survey of cognitively intact subjects aged 90 years or older. *Age and Ageing*, 28, 147-152.
- Jette, A. M., Rooks, D., Lachman, M., Lin, T. H., Levenson, C., Heislein, D., Giorgetti, M. M., & Harris, B. A. (1998). Home-based resistance training: Predictors of participation and adherence. *Gerontologist*, 38, 412-421.
- Kaplan, R. M., Atkins, C. J., & Reinsch, S. (1984). Specific efficacy expectations mediate exercise compliance in patients with COPD. *Health Psychology*, 3, 223-242.
- Katula, J. A., Blissmer, B. J., & McAuley, E. (1999). Exercise intensity and self-efficacy effects on anxiety reduction in healthy older adults. *Journal of Behavioral Medicine*, 22, 233-247.
- Katz, S., & Gurland, B. J. (1991). Science of the quality of life in elders: Challenge and opportunity. In J. E. Birren, J. E. Lubben, J. C. Rowe, & D. E. Deutchman (Eds.), *The concept and measurement of quality of life in the frail elderly* (pp. 335-343). San Diego, CA:



Academic.

- King, A. C., & Brassington, G. (1997). Enhancing physical and psychological functioning in older family caregivers: The role of regular physical activity. *Annals of Behavioral Medicine*, 19, 91-100.
- King, A. C., Pruitt, L. A., Phillips, W., Oka, R., Rodenburg, A., & Haskell, W. L. (2000). Comparative effects of two physical activity programs on measured and perceived physical functioning and other health-related quality of life outcomes in older adults. *Journal of Gerontology. Series A: Biological Sciences and Medical Sciences*, 55(2), 74-83.
- King, A. C., Taylor, C. B., & Haskell, W. L. (1993). Effects of differing intensities and formats of 12 months of exercise training on psychological outcomes in older adults. *Health Psychology*, 12, 292-300.
- Koenig, H. G., & Blazer, D. G. (1996). Minor depression in late life. *American Journal of Geriatric Psychiatry*, 4, S14-S21.
- Kugler, J., Seelbach, H., & Kruskemper, G. M. (1994). Effects of rehabilitation exercise programs on anxiety and depression in coronary patients - A meta-analysis. *British Journal of Clinical Psychology*, 33, 401-410.
- Kunzmann, U., Little, T. D., & Smith, J. (2000). Is age-related stability of subjective well-being a paradox? Cross-sectional and longitudinal evidence from the Berlin Aging Study. *Psychology and Aging*, 15, 511-526.
- Kutner, N. G., Barnhart, H., Wolf, S. L., McNeely, E., & Xu, T. S. (1997). Self-report benefits of Tai Chi practice by older adults. *Journals of Gerontology. Series B: Psychological Sciences and Social Sciences*, 52, 242-246.
- Lampinen, P., Heikkinen, R. L., & Ruoppila, I. (2000). Changes in intensity of physical exercise as predictors of depressive symptoms among older adults: An eight-year follow-up. *Preventive Medicine*, 30, 371-380.
- Marsh, H. W., Richards, G. E., Johnson, S., Roche, L., & Tremayne, P. (1994). Physical Self-Description Questionnaire - Psychometric properties and a multitrait-multimethod analysis of relations to existing instruments. *Journal of Sport & Exercise Psychology*, 16, 270-305.
- McAuley, E. (1993). Self-efficacy and the maintenance of exercise participation in older adults. *Journal of Behavioral Medicine*, 16, 103-113.
- McAuley, E., Blissmer, B., Katula, J., & Duncan, T. E. (2000). Exercise environment, self-efficacy, and affective responses to acute exercise in older adults. *Psychology & Health*, 15, 341-355.
- McAuley, E., Blissmer, B., Katula, J., Duncan, T. E., & Mihalko, S. L. (2000). Physical activity, self-esteem, and self-efficacy relationships in older adults: A randomized controlled trial. *Annals of Behavioral Medicine*, 22, 131-139.
- McAuley, E., Katula, J., Mihalko, S. L., Blissmer, B., Duncan, T. E., Pena, M., & Dunn, E. (1999). Mode of physical activity and self-efficacy in older adults: A latent growth curve analysis. *Journal of Gerontology. Series B: Psychological Sciences and Social Sciences*, 54, 283-292.
- McAuley, E., Mihalko, S. L., & Bane, S. M. (1997). Exercise and self-esteem in middle-aged adults: Multidimensional relationships and physical fitness and self-efficacy influences. *Journal of Behavioral Medicine*, 20, 67-83.
- McAuley, E., Mihalko, S. L., & Rosengren, K. (1997). Self-efficacy and balance correlates of fear of falling in the elderly. *Journal of Aging and Physical Activity*, 5, 329-340.
- McAuley, E., & Rudolph, D. (1995). Physical activity, aging, and psychological well-being. *Journal of Aging and Physical Activity*, 3, 67-96.
- McDonald, D. G., & Hodgdon, J. A. (1991). *Psychological effects of aerobic fitness training: Research and theory*. New York: Springer.
- McGuire, F. A., Boyd, R. K., & Tedrick, R. T. (1999). *Leisure and Aging: Ulyssean living in later life* (2nd ed.). Champaign, IL: Sagamore.



- McMurdo, M. E. T., & Burnett, L. (1992). Randomized controlled trial of exercise in the elderly. *Gerontology*, 38, 292-298.
- McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *EdITS Manual for the Profile of Mood States (POMS)*. San Diego, CA: Educational and Industrial Testing Service.
- McPherson, B. D. (1994). Sociocultural perspectives on aging and physical activity. *Journal of Aging and Physical Activity*, 2, 329-353.
- Menec, V. H., & Chipperfield, J. G. (1997). Remaining active in later life - The role of locus of control in seniors' leisure activity participation, health, and life satisfaction. *Journal of Aging and Health*, 9, 105-125.
- Mihalko, S. L., & McAuley, E. (1996). Strength training effects on subjective well-being and physical function in the elderly. *Journal of Aging and Physical Activity*, 4, 56-68.
- Morgan, K., & Bath, P. A. (1998). Customary physical activity and psychological well-being: A longitudinal study. *Age and Ageing*, 27, 35-40.
- Morgan, W. P. (1997). *Physical activity and mental health*. Washington, DC: Taylor & Francis.
- Mutrie, N. (2000). The relationship between physical activity and clinically defined depression. In S. J. H. Biddle, K. R. Fox, & S. H. Boutcher (Eds.), *Physical activity and psychological well-being* (pp. 46-62). London: Routledge.
- Mutrie, N., & Davison, R. (1994). Physical self-perceptions in exercising older adults. *Journal of Sports Sciences*, 12, 203.
- Myers, A. M., Malott, O. W., Gray, E., Tudor-Locke, C., Ecclestone, N. A., Cousins, S. O., & Petrella, R. (1999). Measuring accumulated health-related benefits of exercise participation for older adults: The vitality plus scale. *Journals of Gerontology. Series A: Biological Sciences and Medical Sciences*, 54(9), 456-466.
- Newsom, J. T., & Schulz, R. (1996). Social support as a mediator in the relation between functional status and quality of life in older adults. *Psychology and Aging*, 11, 34-44.
- North, T. C., McCullagh, P., & Tran, Z. V. (1990). Effect of exercise on depression. *Exercise and Sport Science Reviews*, 18, 379-415.
- O'Connor, J. P., Aenchenbacher III, E. L., Dishman, K. R. (1993). Physical activity and depression in the elderly. *Journal of Aging and Physical Activity*, 1, 34-58.
- Ohno, Y., Aoki, R., Tamakoshi, A., Kawamura, T., Wakai, K., Hashimoto, S., Kawakami, N., & Nagai, M. (2000). Successful aging and social activity in older Japanese adults. *Journal of Aging and Physical Activity*, 8, 129-139.
- Ohta, T., Tabata, I., & Mochizuki, Y. (2000). Japanese National Physical Activity and Health Promotion Guidelines. *Journal of Aging and Physical Activity*, 8, 178-193.
- Parkatti, T., Deeg, D. J. H., Boscher, R. J., & Launer, L. L. J. (1998). Physical activity and self-rated health among 55- to 89-year-old Dutch people. *Journal of Aging and Health*, 10, 311-326.
- Penninx, B., Guralnik, J. M., Ferrucci, L., Simonick, E. M., Deeg, D. J. H., & Wallace, R. B. (1998). Depressive symptoms and physical decline in community-dwelling older persons. *Journal of the American Medical Association*, 279, 1720-1726.
- Pescatello, L. S. (1999). Physical activity, cardio-metabolic health and older adults - Recent findings. *Sports Medicine*, 28, 315-323.
- Pierce, E. F., & Pate, D. W. (1994). Mood alterations in older adults following acute exercise. *Perceptual and Motor Skills*, 79, 191-194.
- Rosengren, K. S., McAuley, E., & Mihalko, S. L. (1998). Gait adjustments in older adults: Activity and efficacy influences. *Psychology and Ageing*, 13, 375-386.
- Rowe, J. W., & Kahn, R. L. (1987). Human aging - Usual and successful. *Science*, 237, 143-149.
- Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist*, 37, 433-440.
- Ruth, J.-E., & Coleman, P. (1996). Personality and aging: Coping and management of the self in later life. In J. E. Birren & K. W. Schaie



- (Eds.), *Handbook of the psychology of aging* (4 ed., pp. 308-322). San Diego, CA: Academic.
- Ruuskanen, J. M., & Ruoppila, I. (1995). Physical activity and psychological well-being among people aged 65 to 84 years. *Age and Ageing*, 24, 292-296.
- Sallis, J. F., & Owen, N. (1999). *Physical activity and behavioral medicine*. Beverly Hills, CA: Sage.
- Schulz, R., & Heckhausen, J. (1996). A life span model of successful aging. *American Psychologist*, 51, 702-714.
- Seraganian, P. (1993). *Exercise psychology*. USA: Wiley.
- Shephard, R. J. (1997). *Aging, physical activity and health*. Champaign, IL: Human Kinetics.
- Sherrard, C. A. (1994). Elderly well-being and the psychology of social-comparison. *Ageing and Society*, 14, 341-356.
- Sherrard, C. (1998). Strategies for well-being in later life: A qualitative analysis. *British Journal of Medical Psychology*, 71, 253-263.
- Singh, N. A., Clements, K. M., & Fiatarone, M. A. (1997). A randomized controlled trial of progressive resistance training in depressed elders. *Journals of Gerontology. Series A: Biological Sciences and Medical Sciences*, 52, 27-35.
- Singh, N. A., & Fiatarone Singh, M. A. (in press). Exercise and depression in the older adult: A brief review. *Nutrition in Clinical Care*.
- Smith, E. L., & Tommerup, L. (1995). Exercise - a prevention and treatment for osteoporosis and injurious falls in the older adult. *Journal of Aging and Physical Activity*, 3, 178-192.
- Spiriduso, W. (1995). *Physical dimensions of aging*. Champaign, IL: Human Kinetics.
- Stathi, A., & Fox, K. R. (2001). The preliminary development of a self-assessment instrument to measure dimensions of subjective well-being in active older adults. In A. Papaioannou, M. Goudas, & Y. Theodorakis (Eds.), *Proceedings of the 10th World Congress of Sport Psychology* (Vol. 1, pp. 163-165). Thessaloniki, Greece: Christodoulidis.
- Stathi, A., Fox, K. R., & McKenna, J. (2002). Physical activity and dimensions of subjective well-being in older adults. *Journal of Aging and Physical Activity*, 10, 76-92.
- Stephens, T. (1988). Physical activity and mental health in the United-States and Canada - Evidence from 4 population surveys. *Preventive Medicine*, 17, 35-47.
- Thomas, R. J., Landers, M. D., Salazar, W., & Etnier, J. (1994). Exercise and cognitive function. In C. Bouchard, R. J. Shephard, & T. Stephens (Eds.), *Physical activity, fitness and health* (pp. 521-529). Champaign, IL: Human Kinetics.
- Tsutsumi, T., Don, B. M., Zaichkowsky, L. D., & Delizonna, L. L. (1997). Physical fitness and psychological benefits of strength training in community dwelling older adults. *Applied Human Science: Journal of Physiological Anthropology*, 16, 257-266.
- Turner, E. E., Rejeski, W. J., & Brawley, L. R. (1997). Psychological benefits of physical activity are influenced by the social environment. *Journal of Sport & Exercise Psychology*, 19, 119-130.
- Weeks, D. J. (1994). A review of loneliness concepts, with particular reference to old-age. *International Journal of Geriatric Psychiatry*, 9, 345-355.
- World Health Organisation. (1997). The Heidelberg guidelines for promoting physical activity among older persons. *Journal of Aging and Physical Activity*, 5, 2-8.
- Zuckerman, M., & Lubin, B. (1965). *Manual for the multiple affect adjective check list*. San Diego, CA: Educational and Industrial Testing Service.