

Relationships between Exercise and Three Components of Mental Well-Being in Corporate
Employees

Date of submission: 05/05/04

Date of resubmission: 16/11/04

Abstract

Objectives: The main purpose of the present study was to examine the relationships between exercise participation and three components of mental well-being (physical self, work-related, and global) in a sample of corporate employees. As a subsidiary and exploratory question, we also examined whether these well-being components are more strongly related to structured exercise participation scores compared to total levels of physical activity.

Design: Cross-sectional survey.

Method: The participants were 312 employees from an information technology company ($n=204$ males and $n=108$ females). Structural equation modelling was used to examine links between exercise participation and the three well-being components within a hierarchical framework, featuring global well-being constructs at the apex and specific elements of well-being at lower levels.

Results: Support was found for the *a priori* model in that there were direct paths from exercise to physical self and enthusiasm at work. Furthermore, there were indirect paths between exercise and global well-being components through measures of the physical self and enthusiasm at work. The results of an alternative model using physical activity as opposed to exercise were generally similar.

Conclusion: The support found for the exercise and well-being model indicates that exercise is associated directly and indirectly with high well-being in various facets of employees' lives. Thus, this study extends previous research that has examined associations between exercise and isolated indicators of employee well-being. Finally, the results pertaining to physical activity suggest that workplace exercise promotion programmes should incorporate and promote lifestyle physical activity.

Key words: Physical activity, mental health, hierarchical, work, physical self.

1 Relationships between Exercise and Three Components of Mental Well-Being in Corporate
2 Employees

3 There is accumulated research evidence that supports the efficacy of exercise in both the
4 treatment of mental illness (Craft & Landers, 1998) and the promotion of mental well-being
5 (Biddle, Fox, & Boutcher, 2000). Indeed, consistent positive effects of exercise on several
6 positive well-being variables, such as mood (Biddle, 2000), anxiety (Taylor, 2000) self-
7 perceptions and self-esteem (Fox, 2000) have been documented. In view of this evidence, the
8 limited volume of studies examining the effects of exercise on the mental well-being of
9 employees seems surprising, given the importance of employee well-being.

10 Health and well-being have important consequences for individual employees, as well as
11 for the organisation in which they work (Danna & Griffin, 1999), as these variables affect
12 illness-related absenteeism rates (Aldana, 2001; Anderson, Serxner, & Gold, 2001).

13 Furthermore, gains in employee health and well-being are generally agreed to go beyond
14 financial profits since they can be perceived as a sign that the employees are valued by their
15 company. Health promotion programmes may therefore work to improve the image of a
16 company as an organisation that cares about the welfare of its employees, and this may attract
17 productive employees (DiNubile & Sherman, 1999). Lastly, according to Danna and Griffin
18 (1999), well-being should be an important focus of research in the workplace because
19 individuals' experiences at work may also spill over into domains outside working life.

20 In workplaces that offer health promotion activities, employee exercise programmes are
21 widespread. These programmes have been offered in the workplace for some time now,
22 especially in the US (Shephard, 1996), and their implementation has mostly been based on
23 increasing the physical fitness of employees (e.g. Dishman, Oldenburg, O'Neal, & Shephard,
24 1998). Research that has examined well-being outcomes of exercise in the work setting
25 suggests that employees 'feel better' as a result of exercise participation (Shephard, 1996),

1 however the extent to which such feelings have broader implications for their mental well-
2 being at work and in their lives in general is unclear. Therefore, the main aim of the present
3 study, is to examine relationships between exercise participation and well-being indicators of
4 the working and non-working lives of employees.

5 One of the challenges facing researchers in this area is the inconsistency across studies
6 in the measurement of mental well-being of employees. Despite such inconsistencies, recent
7 conceptualisations suggest that mental well-being is a multi-dimensional construct. For
8 example, based on a systematic review of the literature on well-being in the workplace, Danna
9 and Griffin (1999) suggested that employee well-being is best expressed as incorporating
10 context-free or global elements of life experience (e.g., life satisfaction and happiness),
11 alongside generalised work-related experiences (e.g., job satisfaction), and situation-specific
12 elements of well-being in the workplace (e.g., satisfaction with pay and co-workers). Outside
13 the work context, Diener, Suh, Lucas, and Smith (1999) have also emphasised the multi-
14 dimensional nature of subjective well-being, Diener et al. (1999) conceptualised well-being as
15 comprising of the global element of life satisfaction, as well as more domain-specific
16 satisfactions and affect . Taken together, Danna and Griffin's (1999) and Diener et al.'s
17 (1999)suggestions imply that assessment of mental well-being should not only be conducted
18 at the global level but also in specific life domains.

19 Obviously, work life is an important life domain. Therefore, in the present study, the
20 relationships between exercise involvement and variables that might be relevant to well-being
21 in the workplace were of primary interest. Two key threads were established around a)
22 perceptions of the self, and b) life satisfaction. Both global and specific elements of each were
23 considered.

24 Self-esteem, regarded as the critical global indicator of the self-system (Marsh, 1997),
25 serves a pivotal function in employees' lives, due to its close association with mental health

1 and emotional adjustment. Specifically, low levels of self-esteem are often implicated in
2 mental illness, such as depression (American Psychiatric Association, 1994), and are
3 associated with poor health behaviours (Torres & Fernandez, 1995). In contrast, high levels of
4 self-esteem are associated with several positive traits, such as independence, leadership and
5 adaptability (Wylie, 1989). Research evidence also suggests that self-esteem moderates the
6 relationship between stress and illness (Rector & Roger, 1996). This is a particularly
7 important finding given that the Health and Safety Executive (2004) estimates that
8 approximately half a million employees in the UK experience work-related stress which can
9 result in various illnesses.

10 There is also research evidence suggesting that self-esteem is significantly related to job
11 performance. According to Judge, Erez and Bono (1998), self-esteem is linked to job
12 performance because employees with positive views of themselves are more motivated to
13 perform well in their jobs. At an empirical level, a meta-analysis by Judge and Bono (2001)
14 found a moderate correlation of .26 between the two variables. Although this relationship is
15 not particularly strong, Judge and Bono (2001) concluded that, based on existing evidence,
16 self-esteem is one of the best dispositional predictors of job performance. Clearly, self-esteem
17 is important to the individual's health and functioning at work. Therefore, research on factors
18 associated with increased self-esteem in the workplace is worthwhile.

19 Although global self-esteem is underpinned by self-perceptions in many different life
20 domains (e.g., work, family, spiritual, social and physical; Marsh, 1997), physical self was of
21 interest in the present study because of the consistently high relationships between aspects of
22 the physical self and self-esteem (Fox, 1997). The salience of the physical self seems to arise
23 from the unique property of the body in acting as an interface between the self and the
24 tangible world. In fact, the physical self has sometimes been considered as the 'public self'
25 serving as the display board for culturally valued characteristics (Fox, 1997). Furthermore, the

1 physical self incorporates well-studied constructs such as body image, perceptions of physical
2 competence and self-confidence. Indeed, such variables may be important in work roles
3 requiring public presence. Furthermore, physical self-worth, which is a global indicator of
4 salient aspects of different aspects of the self, has mental well-being properties in its own
5 right. For example, physical self-worth has shown to relate with well-being indicators, such as
6 positive affect and emotional adjustment, even when global self-esteem and social desirability
7 are statistically controlled (Sonstroem & Potts, 1996; Van de Vliet et al., 2002). The issue of
8 whether physical self-perceptions are directly related to positive affect at work is of interest,
9 because it will indicate a previously unidentified spill-over between the physical and the work
10 self.

11 One important means by which physical self-perceptions are enhanced is through
12 exercise involvement. Indeed, physical self-perceptions have consistently been related to
13 exercise from adolescence onwards (Fox, 2000). Furthermore, randomised controlled trials
14 have indicated that improvements in physical self-perceptions through exercise can generalise
15 to global self-esteem (Fox, 2000; Taylor & Fox, in press). The physical self is therefore a
16 potential mediator between exercise involvement and self-esteem. This mediating role, also
17 shown in Sonstroem and Morgan's (1989) Exercise and Self-Esteem Model, has been
18 supported in various studies using structural equation modelling (e.g., Sonstroem, Harlow &
19 Josephs, 1994; Sonstroem, Harlow, Gemma & Osborne, 1991). However, this mediating
20 property of physical self-worth, has not been examined in employee populations.

21 Besides self-esteem, life satisfaction is another important aspect of employee subjective
22 well-being (Danna & Griffin;1999). Life satisfaction has been shown to relate to job
23 satisfaction (Judge & Watanabe, 1993), general mental health (Janman, Jones, Payne, & Rick,
24 1988) and performance at work (Judge, Thoresen, Bono, & Patton, 2001). Similar to self-
25 esteem, life satisfaction is a global indicator of well-being that is based on interactions in

1 several life domains (Diener, Sapyta, & Suh, 1998). Thus satisfaction with the body, social or
2 family relationships and financial circumstances may all contribute to global life satisfaction.
3 Satisfaction with physical functioning and appearance may also be important when judging
4 levels of life satisfaction due to the cultural prominence of certain body types. Physical
5 activity may improve satisfaction with the physical self. This was demonstrated in a
6 randomised controlled trial by Rejeski et al. (2001) using more than 800 sedentary
7 individuals. The authors found that increases in physical activity levels were positively
8 associated with subjective well-being and that satisfaction with physical functioning and
9 appearance served as significant mediators in this relationship. Whether satisfaction with the
10 physical aspects of the self plays a mediating role between exercise and life satisfaction in
11 employees has yet to be explored.

12 In addition to self-esteem and life satisfaction, affect constitutes another key element of
13 subjective well-being (Diener et al., 1999). Affect experienced in the work setting has
14 particularly important implications for employees and worksites. More specifically, positive
15 affect at work is consistently related to job performance, measured by supervisor ratings
16 (Rust, 1999) and reduced absenteeism (Pelled & Xin, 1999). In addition, positive affect at
17 work is one of the main predictors of job satisfaction, even when statistically controlling for
18 dispositional happiness (Weiss, Nicholas, & Daus, 1999). These results make intuitive sense,
19 as happier employees are less likely to be absent from work and are more motivated to work.

20 The relationship between exercise participation and positive affect experienced at work
21 has received some research attention. For example, Daley and Parfitt (1996) showed that
22 participation in employee exercise programmes is related to mood states. Furthermore, in the
23 general population it has been found that even single sessions of exercise can produce more
24 positive mood and a sense of energy and vigour (Biddle, 2000). Since exercise can predict
25 indicators of positive affect at work, and given that positive affect is a main predictor of job

1 satisfaction (Weiss et al., 1999), it is interesting to examine whether positive affect serves as a
2 mediating variable linking exercise and job satisfaction. Indeed, although previous studies
3 have examined associations between participation in workplace exercise programmes and job
4 satisfaction, they have not tested variables that may explain this link (e.g. Daley & Parfitt,
5 1996; Kirkcaldy, Cooper, Shephard, & Brown, 1994).

6 An additional important issue to consider in the relationship between exercise and
7 mental well-being is the type of physical activity that is being examined. It is generally agreed
8 that physical activity refers to any bodily movements that result in energy expenditure
9 (Shephard, 1994). As such, it includes not only structured exercise and sport programmes but
10 also incidental activity such as walking or cycling to work. In contrast, exercise and sport
11 participation are seen as sub-components of physical activity that are intentional and self-
12 directed. Currently, little is known about which components of physical activity are more
13 strongly related to mental well-being variables. To date, the focus of research in this area has
14 been on structured exercise as opposed to physical activity. However, one of the problems
15 facing exercise practitioners is that sedentary or insufficiently active employees tend not to
16 take part in worksite exercise programmes (Shephard, 1999). If it can be demonstrated that
17 habitual physical activity is related to employee well-being as strongly as exercise is, this
18 could have important implications for workplace programmes which could pay more
19 emphasis on lifestyle physical activity. Such types of activity (e.g., walking) may be more
20 attractive to employees who are currently sedentary or insufficiently active as opposed to
21 structured exercise programmes.

22 In view of the above, this research attempts to provide initial insight into key
23 indicators of well-being in the workplace and their potential links with exercise participation.
24 Building on both the subjective well-being and the self literatures, a multidimensional and
25 hierarchical view of these constructs was taken with global constructs at the highest level and

1 domain-specific constructs at a lower level. In this paper, life satisfaction and self-esteem
2 were measured as global indicators of well-being. Job satisfaction, job affect (enthusiasm),
3 physical self-worth and physical satisfaction were seen as lower level indicators in the
4 domains of work and the self respectively (see Figure 1). In line with the model by Sonstroem
5 and Morgan (1989), exercise participation was hypothesised to have stronger relationships
6 with domain-level constructs than with global constructs. Based on Sonstroem and Potts'
7 (1996) as well as Van de Vliet et al.'s (2002) findings linking physical self-worth with general
8 affective states, we further explored the possibility that physical self-worth was directly
9 related to affect (enthusiasm) at work. All hypothesised direct paths are presented in Figure 1.
10 A similar model was specified using total physical activity as opposed to exercise, in order to
11 examine whether lifestyle physical activity is related in the same way as exercise is with well-
12 being and self indices.

13 We also hypothesised that any relationships between exercise and global measures of
14 well-being would be mediated through domain-level variables. Based on the aforementioned
15 literature, the following indirect paths were hypothesised: exercise to self-esteem through
16 physical self-worth, exercise to life satisfaction through physical satisfaction, and exercise to
17 job satisfaction through enthusiasm at work.

18 We were also interested to examine whether groups high or low in levels of exercise
19 participation differed significantly in each of the three components of well-being (i.e.,
20 physical, work-related and global). The groups were created using quintile scores because the
21 use of quintiles allows for a more detailed analysis of the relationships between exercise and
22 mental well-being compared to when fewer groups are used. With quintiles, differences in
23 well-being between individuals with subtle differences in exercise levels can be explored.
24 This may be particularly important because little is known regarding what levels of exercise
25 are associated with favourable well-being in the workplace. Therefore, the results from this

1 analysis could have implications for exercise promotion practices in the workplace. Similar
2 analyses were carried out with physical activity quintile groups to compare the pattern of
3 results for exercise and total physical activity.

4 Method

5 *Participants and Procedure*

6 A multi-questionnaire pack was uploaded on the World Wide Web and was piloted on a small
7 sample of employees ($n = 15$) from a large information technology company. Based on the
8 results of the pilot study, small modifications were made to ensure that the web-pages became
9 more user-friendly. Then, an e-mail was sent to all employees ($N = 940$) at the site to let them
10 know of the web address of the questionnaire and to request their participation. Participation
11 was voluntary and all participants were guaranteed confidentiality and anonymity. Three
12 hundred and twelve employees ($n = 204$ males; $n = 108$ females) took part in this study. This
13 represents a 33.19% response rate to the initial email invitation. The mean age of the
14 participants was 34.11 years ($SD = 8.07$). Compared to the mean age of 37.80 years for the
15 workforce population of this company, the participants in the present study were slightly
16 younger. In addition, the gender distribution in this study (approximately 65% males and 34%
17 females) was relatively similar to that of the whole workforce (app. 76% males and 24%
18 females), although there was a slight over-representation of females in the sample. The job
19 role profiles of those who participated in the study were: managers/supervisors 13.14%;
20 engineers 28.21%; specialists and analysts 17.63%; production/technical staff 6.09%; clerical
21 workers 10.58%; others 23.72%. This breakdown of role profiles is very similar to the role
22 profile breakdown of the whole workforce.

23 *Instruments*

24 *Life satisfaction.* The Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, &
25 Griffin, 1985) was used to measure global life satisfaction. This questionnaire consists of five

1 items (e.g. "In most ways my life is close to my ideal"), presented in seven-point scales,
2 ranging from 1 ("strongly disagree") to 7 ("strongly agree"). The instrument has been widely
3 used and high levels of reliability and validity have been reported (Diener et al., 1985). The
4 internal reliability co-efficient for this scale in the present study was $\alpha = .88$.

5 *Self-esteem.* The global self-worth (six items) subscale from the Adult Self-Perception
6 Profile (ASPP; Messer & Harter, 1986) was used. The items are presented in a structured
7 alternative format with "sort of true for me" and "really true for me" options. This has been
8 shown to minimise the tendency for socially desirable responding (Messer & Harter, 1986).
9 The items are scored from 1 to 4, with 1 representing the least adequate self-judgement and 4
10 representing the most adequate self-judgement. Messer and Harter (1986) have found
11 adequate levels of reliability and validity for the scale. A high alpha co-efficient was also
12 found in the present study ($\alpha = .88$).

13 *Job satisfaction.* A shortened version of Brayfield and Rothe's (1951) Job Satisfaction
14 questionnaire, used by Judge, Locke, Durham and Kluger (1998), was also employed in this
15 study. This version consists of five items and the response scale ranges from 0 ("strongly
16 disagree") to 10 ("strongly agree"). An example item is "I feel fairly well satisfied with my
17 present job". High reliability and validity levels have been found for this version of the scale
18 (Judge et al., 1998). In this study the reliability co-efficient for the scale was $\alpha = .87$.

19 *Job affect.* The Job Affect Scale (JAS; Brief, Burke, George, Robinson, & Webster,
20 1988) was used to assess job affect within the past week. The scale consists of 20 items and is
21 based on Watson and Tellegen's (1985) consensual mood structure. A confirmatory factor
22 analysis of the scale by Burke, George, Brief, Roberson and Webster (1989) showed that the
23 twenty mood descriptors should be conceptualised as four unipolar factors: nervousness (6
24 items), relaxation (4 items), enthusiasm (6 items), and fatigue (4 items). Participants are asked
25 to indicate the extent to which they felt each of the mood descriptors at work during the past

1 week using a scale ranging from 1 (“very slightly or not at all”) to 5 (“very much”). Ten of
2 the items are indicators of negative affect and the other ten items are indicators of positive
3 affect at work. Brief et al. (1988) did not examine the internal reliability of the scale. In the
4 present study the Cronbach’s alpha coefficients for each of the subscales were: Enthusiasm, α
5 = .81; Relaxation, α = .80; Nervousness, α = .84; Fatigue, α = .83¹.

6 *Physical self-worth.* The physical self-worth subscale from The Physical Self-Perception
7 Profile (PSPP; Fox, 1990) consists of six items with the response format organised as four-
8 point structured alternatives. The PSPP is a widely used scale which has received strong
9 support for its reliability and validity across a wide range of populations (Byrne, 1996). A
10 high internal reliability rating was found for this scale (α = .89).

11 *Physical satisfaction.* The Physical Satisfaction Scale is a four-item scale designed by
12 Thøgersen, Fox and Ntoumanis (2002). It measures the degree of satisfaction with health, and
13 appearance-related factors (i.e., overall appearance, weight, and shape/body build). The
14 response format consists of a five-point scale ranging from 1 (“completely dissatisfied”) to 5
15 (“completely satisfied”). Previous factor analysis extracted one factor that explained 60.21%
16 of the variance (Thøgersen et al., 2002). The internal reliability for this scale in the present
17 study was α = .81. The physical satisfaction scores in the participants from the present study
18 had a mean of 3.17 (SD = .75).

19 *Physical activity.* Baecke’s Habitual Physical Activity Questionnaire (Baecke, Burema,
20 & Frijters, 1982) was used to measure self-reported levels of physical activity. This
21 questionnaire measures physical activity in three different domains: work (including e.g. main
22 occupation, frequency of sitting, standing and sweating at work), exercise/sport (referred to as
23 exercise in the present study), and leisure-time (excluding exercise and sport, but including
24 walking and cycling). It also allows the calculation of a total index of physical activity from
25 all three domains, which ranges between 3 (no physical activity) and 15 (high level of

1 physical activity). Adequate psychometric properties for this questionnaire have been reported
2 in various studies (Baecke et al., 1982). The Cronbach alpha coefficient for Baecke et al.'s
3 (1982) scale in the present study was .70.

4 In the present study, respondents could record up to four different exercise activities (as
5 in Sternfeld, Ainsworth, & Quesenberry, 1999), that is, tennis, squash, aerobic dance and
6 football. Each exercise score was derived by multiplying its intensity code by a frequency
7 code corresponding to the number of hours per week and months per year it was practiced
8 (see Baecke et al, 1982). For example, one person may play football 1 to 2 hours per week, 4
9 to 6 months of the year. The intensity code assigned to football is 1.76, 1-2 hours per week is
10 assigned the code 1.5, and 4-6 months per year has the code 0.42. These are then multiplied to
11 obtain the exercise score for football: $1.76 \times 1.5 \times 0.42 = 1.11$. Then the scores for each
12 activity are summed and divided by the number of activities performed. The resulting scores
13 are then converted into an exercise index score that ranges between 1 (no exercise) to 5 (very
14 high level of exercise). This is achieved by assigning exercise scores of 0 the value of 1,
15 scores between .01 and 4 the value of 2, scores between 4 and 8 the value of 3, scores
16 between 8 and 12 the value of 4, and scores greater than 12 the value of 5.

17 An example of how the leisure-time index follows: A woman may believe that she *often*
18 (assigned the score of 4) watches television, she *seldom* (given the score of 2) walks, she
19 *never* (assigned the score of 1) cycles, and that she walks/cycles less than five minutes per
20 day (given a score of 1) to and from work and the shops. Baecke et al.'s (1982) formula for
21 calculating the leisure-time index is: $[(6 - \text{amount of television watched during leisure-time}) +$
22 $\text{amount of walking during leisure-time} + \text{amount of cycling performed during leisure-time} +$
23 $\text{minutes per day of walking and/or cycling to and from work and shopping}] / 4$. Therefore, in
24 the aforementioned example, the leisure-time index would be: $[(6-4) + 2 + 1 + 1] / 4 = 1.5$.

1 To test the exercise and well-being model in Figure 1, the exercise index was
2 transformed into metabolic equivalent hours per week (MET hours per week). This procedure
3 has been used in several other studies (e.g. Sternfeld et al., 1999) because it standardises
4 exercise intensity, frequency and duration across different activities. One MET is the oxygen
5 consumption required at rest, or approximately 1kcal/kg/hr. MET values were assigned to
6 each reported type of exercise based on Ainsworth et al.'s (2000) tables. As an example,
7 doubles tennis is assigned a MET intensity value of 5. To derive the MET hours per week
8 score, the MET value is multiplied by codes assigned to the frequency and the duration of
9 doubles tennis played per week. The total exercise participation in MET hours per week is
10 derived by summing the individual MET hours per week scores across all types of exercise
11 assessed.

12 In order to examine differences between different exercise levels in the three
13 components of well-being (i.e., physical, work-related and global), the exercise index was
14 used to create exercise quintiles (0-20th quintile = ex-group 1, n = 63; 20-40th quintile = ex-
15 group 2, n = 58; 40-60th quintile = ex-group 3, n = 62; 60-80th quintile = ex-group 4, n = 62;
16 80-100th quintile = ex-group 5, n = 59). For the supplementary analyses using total physical
17 activity rather than exercise, the combined physical activity scores across domains were
18 divided into physical activity quintiles (pa-group 1: n = 67, 2: n = 55, 3: n = 59, 4: n = 62, 5: n
19 = 58).

20 *Data Analyses*

21 Structural equation modelling analysis (SEM) was employed, using EQS 5.7, to test
22 the hypothesised links between exercise and the global and domain-specific indicators of
23 well-being and the self. Missing data were treated using listwise deletion. In order to evaluate
24 the adequacy of the model, several indexes of fit were examined: the chi square (χ^2) value, the
25 Comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI), the Standardised Square

1 Root Mean Residual (SRMR), and the Root Mean Square Error of Approximation (RMSEA)
2 with its 90% confidence interval (CI) (for a description of these indices see Hair, Anderson,
3 Tatham, & Black, 1998). A simulation study by Hu and Bentler (1999) showed that a good
4 model fit is achieved when the NNFI and the CFI values are close to or above .95, the SRMR
5 is close to or below .08, and the RMSEA is close to or below .06. Furthermore, a close fit of
6 the model to the intended population is implied when the lower bound of the 90% CI of the
7 RMSEA includes the value of .05. In addition, MANOVA tests were carried out to examine
8 differences between the exercise groups in the three well-being components (i.e., physical,
9 work-related and global). Similar structural equation modelling and MANOVA analyses were
10 carried out for physical activity.

11 Results

12 *Descriptive Statistics*

13 The means of exercise and physical activity levels for the total sample and for each of
14 the exercise and physical activity groups are provided in Table 1. Further, the mean levels of
15 the total sample for the physical well-being constructs were: Physical self-worth: 2.54 ($SD =$
16 $.41$; observed range: 1.50-3.50); physical satisfaction: 3.17 ($SD = .75$; 1.17-5.00). For work-
17 related well-being, the mean levels were: Job satisfaction: 7.09 ($SD = 1.80$; 1-10);
18 nervousness: 1.79 ($SD = .72$; 1-4.50); fatigue: 2.23 ($SD = .83$; 1-5); relaxation: 2.79 ($SD =$
19 $.77$; 1-4.50), and enthusiasm: 2.78 ($SD = .76$; 1-4.83). Finally, for global well-being, the mean
20 levels of life satisfaction: 4.61 ($SD = 1.27$; 1-7) and for self-esteem the mean score was: 2.95
21 ($SD = .60$; 1-4).

22

23 *Relationships between Exercise and Components of Mental Well-Being*

24 Structural equation modelling (SEM) was used to examine the fit of the data to the
25 hypothesised model (see Figure 1). The data were analysed using maximum likelihood

1 analysis. Almost all variables in the model were measured with latent factors which were
2 represented through their indicator items (the latter are not presented in Figure 1 for
3 presentation simplicity reasons). The only exception was exercise participation which was not
4 measured with a latent factor because it was a single-item variable.

5 The measurement part of the hypothesised model fit the data relatively well: χ^2 (449) =
6 724.96 ($p < .001$); NNFI = .93; CFI = .94; SRMR = .06; RMSEA = .05 (.04 - .05). Inspection
7 of the standardised residual matrix and the modification indices suggested that the deletion of
8 two indicator items, one each from the job satisfaction and enthusiasm scales would improve
9 the model fit. These items were deleted and the re-estimated measurement model had a very
10 good fit: χ^2 (390) = 594.61 ($p < .001$); NNFI = .95; CFI = .95; SRMR = .06; RMSEA = .04
11 (.04 - .05). The deletion of problematic item indicators is regarded as a legitimate process in
12 measurement evaluation as it retains the general structure of the original hypothesised factor
13 model, but with only the best available indicators (Hofmann, 1995). Adding the structural
14 model to the measurement model produced the model in Figure 1 which had a good fit: χ^2
15 (423) = 647.67 ($p < .001$); NNFI = .94; CFI = .95; SRMR = .07; RMSEA = .05 (.04 - .05).

16 All hypothesised parameters in the model were significant and the standardised loadings
17 were relatively high ($M = .74$; $SD = .13$). There was support for direct relationships between
18 exercise and physical self-worth ($\beta = .32$), and exercise and physical satisfaction ($\beta = .14$). In
19 addition, exercise was directly related to enthusiasm at work ($\beta = .18$). Physical self-worth
20 was also directly associated with enthusiasm at work ($\beta = .22$). Furthermore, physical
21 satisfaction was related to physical self-worth ($\beta = .62$) and self-esteem ($\beta = .18$). Support
22 was also found for all hypothesised indirect relationships. Specifically, exercise showed
23 indirect and significant relationships with a) self-esteem through physical self-worth ($\beta = .16$),

1 b) life satisfaction through physical satisfaction ($\beta = .18$), and c) job satisfaction through
2 enthusiasm at work ($\beta = .18$).

3 The model with total physical activity, rather than exercise as the independent variable,
4 had very similar path coefficients and fit indices: $\chi^2(424) = 653.11$ ($p < .001$); NNFI = .94;
5 CFI = .95; SRMR = .07; RMSEA = .05 (.04 - .05). The only difference was that the path
6 between physical activity and physical satisfaction was non-significant ($b = .06$).

7 *Differences between Exercise Quintiles in Well-Being Components*

8 Three MANOVA's were conducted to examine the hypothesis that significant
9 differences would exist between exercise quintiles (ex-groups 1 to 5) in the three components
10 of well-being. The significance level for each MANOVA test was set at $p = .016$ using the
11 Bonferroni adjustment to control for Type I error. The first MANOVA examining the
12 differences between exercise groups (ex-groups 1-5) in physical well-being was significant:
13 Pillai's criterion = .200; $F(8, 596) = 8.29$; $p < .001$. Significant univariate differences existed
14 among exercise groups in both physical self-worth and physical satisfaction (see Table 2). All
15 differences were in the expected direction with participants engaging in more exercise
16 generally reporting greater levels of physical well-being. Specifically, a post hoc Tukey test
17 revealed significant differences in physical self-worth existed between ex-groups 1 and 3
18 ($p < .05$), between ex-groups 1 and 4 ($p < .001$), between ex-groups 1 and 5 ($p < .001$), between
19 ex-groups 2 and 4 ($p < .001$), and finally between ex-groups 2 and 5 ($p < .001$). A similar
20 pattern was found for physical satisfaction. The significant differences were located between
21 ex-groups 1 and 3 ($p < .05$), between ex-groups 1 and 4 ($p < .001$), between ex-groups 1 and 5
22 ($p < .001$), between ex-groups 2 and 4 ($p < .001$), between ex-groups 2 and 5 ($p < .001$), between
23 ex-groups 3 and 4 ($p < .05$), and between ex-groups 3 and 5 ($p < .05$).

24 The second MANOVA, which examined differences between exercise groups in work-
25 related well-being, was also significant: Pillai's criterion = .153; $F(20, 1184) = 2.35$; $p < .001$.

1 However, significant univariate differences were found only for enthusiasm at work ($p <$
2 $.001$), with a trend for nervousness at work ($p = .07$). Specifically, enthusiasm at work
3 increased with increasing levels of exercise (see Table 3). Univariate analyses revealed that
4 the significant differences in enthusiasm at work were located between ex-groups 1 and 5 ($p <$
5 $.05$), between ex-groups 2 and 3 ($p < .05$), between ex-groups 2 and 4 ($p < .01$), and between
6 ex-groups 2 and 5 ($p < .001$). Finally, a MANOVA was carried out to examine differences
7 between the exercise groups in global well-being. However, this MANOVA was not
8 significant: Pillai's criterion = .046; $F(8, 596) = 1.736$; $p > .05$ (see Table 4).

9 Additional analyses using physical activity instead of exercise as the independent
10 variable revealed similar results, as both MANOVA's for physical well-being and work-
11 related well-being were significant (Physical well-being: Pillai's criterion = .133; $F(8, 590) =$
12 5.25 ; $p < .001$; Work-related well-being: Pillai's criterion = .193; $F(20, 1172) = 2.97$; $p <$
13 $.001$). Significant univariate differences in physical well-being existed in both physical self-
14 worth and physical satisfaction. Specifically, post-hoc tests revealed that, for physical self-
15 worth, the differences were located between pa-groups 1 and 3 ($p < .05$), pa-groups 1 and 4 (p
16 $< .01$), pa-groups 1 and 5 ($p < .001$), and pa-groups 2 and 5 ($p < .01$), with those reporting
17 higher levels of physical activity also reporting higher levels of physical self-worth. For
18 physical satisfaction, the univariate analyses revealed that differences were located between
19 pa-groups 1 and 4 ($p < .01$), pa-groups 1 and 5 ($p < .001$), pa-groups 2 and 4 ($p < .05$), and pa-
20 groups 2 and 5 ($p < .001$). with those being more physically active reporting higher levels of
21 satisfaction with their physical selves.

22 For work-related well-being, univariate differences were found for enthusiasm and
23 relaxation at work. Post-hoc tests revealed that the significant differences in enthusiasm at
24 work were located between pa-groups 1 and 4 ($p < .01$), pa-groups 1 and 5 ($p < .001$), pa-
25 groups 2 and 4 ($p < .05$), pa-groups 2 and 5 ($p < .001$), and pa-groups 3 and 5 ($p < .01$), with

1 participants engaged in higher levels of physical activity feeling more enthusiastic at work.
2 For relaxation, the only significant difference between the groups was located between pa-
3 groups 4 and 5 ($p < .05$), with the most physically active group feeling most relaxed at work.

4 In contrast to the findings pertaining to exercise quintiles, it was also revealed that the
5 physical activity groups differed significantly in global well-being: Pillai's criterion = .072; F
6 (8, 590) = 2.749; $p < .01$. The univariate analyses revealed that this was the case for life
7 satisfaction with significant differences located between pa-groups 2 and 5 ($p < .05$) and pa-
8 groups 3 and 5 ($p < .05$), again with the most physically active group demonstrating the
9 highest level of life satisfaction.²

10 Discussion

11 In the present study, a multidimensional and hierarchically organised SEM model was
12 presented in order to examine the interrelationships between exercise (as well as total physical
13 activity) and three components of well-being in corporate employees. The results provided
14 support for the organisational structure of the model which represents a first attempt at
15 simultaneously specifying relationships between exercise and well-being variables from
16 several domains of employees' lives. Thus, the present study extends previous studies which
17 examined the relationships between exercise and isolated indicators of employee well-being.
18 Hence, the model may help to inform the choice of well-being indicators in future research
19 examining the relationship between exercise (as well as total physical activity) and well-being
20 of employees.

21 The model specified direct and indirect links between exercise and mental well-being.
22 All of the specified direct relationships were supported. With regard to the relationship
23 between exercise and physical well-being, a moderate sized direct path ($\beta = .32$) was found
24 between exercise and physical self-worth. This finding is in agreement with research findings
25 across a range of populations which indicate the efficacy of exercise in enhancing physical

1 self-worth (Fox, 2000). Fox's (2000) review suggested that weight training and certain types
2 of aerobic activity are the most effective in improving physical self-perceptions. It would be
3 interesting if future research tested the effects of different types of activity in physical self-
4 perceptions in the workplace.

5 Although exercise was also significantly related to physical satisfaction in the model,
6 the size of the link was rather small ($\beta = .14$). Several studies (e.g., King, Taylor, Haskell &
7 DeBusk, 1989; Yarnold, Stille, & Martin, 1995) have found support for the positive effect of
8 exercise on measures of health and appearance, employing indicators similar to the physical
9 satisfaction items used in the present study. However, it is possible that satisfaction with
10 health, appearance, fitness or shape/body build are differentially related to exercise and that
11 aggregate measures of physical satisfaction, such as the one used in the present study, may
12 mask such diverse relationships. Future research should examine the employee characteristics
13 that determine the importance placed by individuals on different indicators of physical
14 satisfaction.

15 Exercise participation was directly linked with enthusiasm at work with exerciser
16 employees reporting being more enthusiastic. This finding is consistent with previous
17 empirical studies in the work context (e.g. Daley & Parfitt, 1996), and with generic reviews
18 and meta-analyses on exercise and affect (e.g. Biddle, 2000). Positive affective states at work
19 have been found to reduce absenteeism (Pelled & Xin, 1999) and increase organisational
20 spontaneity (George & Brief, 1992). If indeed exercise promotes positive affective states at
21 work, the case for exercise promotion in the workplace is strengthened. Given the
22 implications of this finding, future research should employ quasi-experimental (i.e., field-
23 based) designs to examine whether any dose-response relationships exist between exercise
24 and enthusiasm at work.

1 The findings from the present study are the first to suggest that physical self-worth is
2 significantly related to enthusiasm at work. This finding extends those by Sonstroem and
3 Potts (1996) and Van de Vliet et al. (2002) into the work context. It illustrates that
4 independent of global self-esteem, physical self-worth may have emotional adjustment
5 properties by enhancing positive affect. In other words, it is possible that feeling physically
6 attractive, strong or in good physical condition, whichever is more pertinent to the individual,
7 may make the individual to feel more active, happier and more enthusiastic at work.
8 Interestingly, this finding could indicate the importance of self-presentation in the work
9 context. Exercise activities that are more strongly related to physical self-perceptions, such as
10 weight training (Fox, 2000), may be particularly important to implement in the workplace.
11 Future studies should use longitudinal experimental designs to examine whether changes in
12 physical self-worth *cause* changes in enthusiasm and positive affect at work.

13 The model proposed in the study also specified some indirect paths between exercise
14 and more global indicators of well-being in the work and general life domains. All these paths
15 were significant, providing an indication of the mediating variables that may explain the links
16 between exercise and work-related and global indicators of employee well-being.
17 Specifically, one such mediating variable was physical self-worth through which exercise was
18 related to global self-esteem. This finding supports Sonstroem and Morgan's (1989) Exercise
19 and Self-Esteem Model which argues that exercise can result in small increases in global self-
20 esteem. High self-esteem is important because it can act as a buffer against the deleterious
21 effects of stress (Rector & Roger, 1996), making people more resistant to stress-related
22 illnesses and absenteeism. However, apart from individual benefits, increased employee self-
23 esteem also has implications for the success of corporations through improved job
24 performance (Judge & Bono, 2001). As a consequence, behaviours such as exercise that are

1 shown to be related to self-esteem should be promoted in the workplace as these can benefit
2 the individual and the organisation as a whole.

3 The results of the present study also supported the hypothesis that exercise is indirectly
4 related to job satisfaction. Past research has found positive and significant relationships
5 between exercise and job satisfaction (e.g. Daley & Parfitt, 1996; Kirkcaldy et al., 1994).
6 However, these studies did not indicate why exercise may be related to job satisfaction. In
7 contrast, the findings of the present study revealed that enthusiasm at work is a possible
8 mediator in the relationship between exercise and job satisfaction. From a theoretical point of
9 view, this finding makes sense as positive affect is one of the most important predictors of job
10 satisfaction (Weiss et al., 1999), and exercise has the ability to enhance affect (Biddle, 2000).
11 From a practical point of view, our finding suggests that exercise programmes focused on
12 enhancing positive affect at work may also help participants feel more satisfied at work. The
13 conditions (e.g., motivational factors) under which physical activity and exercise may foster
14 positive affect in the workplace should be examined by future research. Furthermore, due to
15 the cross-sectional design of the present study, future longitudinal research should aim to
16 tease out the cross-lagged paths linking exercise, positive affect, and job satisfaction.

17 The findings from the present study also illustrated that exercise is indirectly related to
18 how satisfied employees feel with their lives in general and that physical satisfaction may be
19 one of the mediating links explaining this relationship. Indeed, this finding supports that of
20 Rejeski et al. (2001) who found that satisfaction with physical functioning and appearance
21 served as significant mediators in the relationship between physical activity and subjective
22 well-being. For many people, bodily function and appearance are important, and if exercise
23 provides them with the means to achieve such goals, their life satisfaction may be enhanced.
24 As Little (1989) argued, “well-being will be enhanced to the extent that individuals are
25 engaged in personal projects that are meaningful, well-structured, supported by others, not

1 unduly stressful, and which engender a sense of efficacy” (p. 20). Therefore, future research
2 should establish the optimal conditions for achieving the psychological benefits of exercise,
3 by examining the effects of different exercise settings, exercise types, and people's perceived
4 social support for exercise.

5 The present study also sought to examine whether employees reporting different levels
6 of exercise and physical activity would differ in three components of mental well-being. To
7 this end, exercise (and physical activity) quintiles were created. The mean levels of
8 exercise/physical activity engagement for the exercise and physical activity quintiles revealed
9 a wide spread of scores. Hence, it appears that the participants represented fairly well the
10 continuum of sedentary to regular exercisers. This is further shown by comparing our results
11 with those reported in the studies by van Baak et al. (2003) and Philippaerts, Westerterp and
12 Lefevre (2001), both of which employed Baecke et al.'s (1982) questionnaire. Specifically,
13 the present study showed that those in the 0-20th and 20-40th exercise quintiles reported less
14 exercise and leisure-time physical activity compared to the obese participants in the van Baak
15 et al. study. Furthermore, those individuals in the first two quintiles reported less total
16 physical activity than those reported by van Baak et al. (2003) and Philippaerts et al. (2001).
17 In contrast, participants in the upper quintiles (ex-groups 3-5) reported engaging in more
18 exercise and physical activity compared to the participants in the other two studies. We
19 believe that it is a strength of the present study that participants with noticeably different
20 levels of exercise and physical activity were included.

21 The results of the MANOVA analyses using exercise as the independent variable
22 revealed that the exercise quintiles differed significantly in physical well-being and
23 enthusiasm at work with those participants reporting higher levels of exercise generally
24 having a more favourable well-being profile. A closer inspection of these results reveal that
25 the indicators of well-being did not differ significantly between the two most inactive groups,

1 however, significant differences emerged between the 20-40th and the 40-60th exercise
2 quintiles. These results therefore suggest that even moderate amounts of structured exercise
3 are associated with feeling more enthusiastic at work and feeling better about one's physical
4 self.

5 Likewise, the MANOVA findings using total physical activity as the independent
6 variable demonstrated that the significant differences in physical well-being and enthusiasm
7 emerged between the 40-60th and the 60-80th quintile. Again, this indicates that moderate
8 levels of physical activity may be enough for employees to feel better about their physical
9 selves, more enthusiastic at work and report increased levels of life satisfaction. This pattern
10 of results was not evident for relaxation at work., The finding that even moderate amounts of
11 physical activity is related with positive self-perceptions, physical satisfaction and enthusiasm
12 corroborates previous findings in the literature (Biddle, 2000; Brown et al., 1995; King,
13 Taylor & Haskell, 1993; Rejeski et al., 2001). The results by Rejeski et al. (2001) also
14 demonstrated that increases in subjective well-being through physical activity were not due to
15 changes in fitness status, implying that such increases could be achieved through moderate
16 physical activity. Clearly, our results have implications for physical activity promotion
17 practices at the workplace. Usually, structured exercise programmes at the workplace are of
18 relatively high intensity. However, these programmes, have been criticised for attracting
19 employees who are already physically active (Shephard, 1999) and not those in greater need
20 (i.e. sedentary employees) who may perceive such programmes to be of too high intensity. If,
21 indeed, moderate physical activity can induce positive changes in well-being, corporations
22 should aim to implement programmes that support lifestyle physical activity (e.g., active
23 commuting to work) as well as exercise, thereby making these programmes attractive to a
24 wider range of employees.

1 It is interesting to note the differences and similarities in the results using exercise and
2 physical activity as the independent variables. Specifically, in the SEM analyses the fit
3 indices between the two models were very similar. The only difference was that the path
4 between physical activity and physical satisfaction was non-significant. This result seems to
5 indicate that engaging in incidental activity is not related to the satisfaction people feel with
6 their health, weight, appearance and shape or body build. However, no firm conclusions can
7 be made at this stage, as the MANOVA findings, in contrast to the SEM results, showed that
8 the physical activity groups did differ in physical satisfaction. In contrast, the results for
9 exercise were more clear-cut because exercise participation was associated with physical
10 satisfaction in both the SEM and MANOVA analyses.

11 The second difference between the exercise and physical activity results was that there
12 were significant differences in global well-being among the physical activity groups but not
13 among the exercise groups. At this point, there are no clear logical explanations as to why
14 such differences emerged. However, this issue is worthy of more research attention,
15 particularly as it has implications for activity and mental health promotion policies.

16 There are some limitations associated with the present study. First, the response rate was
17 relatively low, although previous research has established that web-based surveys have in
18 general lower response rates than mail-out surveys (Solomon, 2001). One might argue that the
19 low response rate might have resulted in a non-representative sample. However, this is not
20 very likely as we identified distinct exercise/physical quintile groups with significant
21 differences in mental well-being. Secondly, due to the cross-sectional nature of this study,
22 causal inferences cannot be made. Future research should aim to employ longitudinal
23 experimental designs to examine whether exercise participation affects the global well-being
24 of employees and whether over time there are reciprocal effects. It should be acknowledged
25 that SEM cannot be used to make causal inferences with cross-sectional data. Although we do

1 not make causal claims in this study, our hypotheses regarding the direct and indirect effects
2 in our models were based on relevant theory (e.g., Sonstroem & Morgan, 1989; Diener et al.,
3 1999) and research (e.g., Weiss et al., 1999).

4 In sum, the present study used a comprehensive and theoretically-based approach to
5 examine exercise and well-being in employees. It is hoped that findings from the present
6 study may facilitate our understanding of the role of exercise participation and physical
7 activity on the emotional and cognitive functioning of corporate employees. Our findings
8 provide support for the need to promote exercise and lifestyle physical activity as a means of
9 enhancing the positive well-being of corporate employees.

References

- Ainsworth, B.E., Haskell, W.L., Whitt, M.C., Irwin, M.L., Swartz, A.M., Strath, S.J., O'Brien, W.L., Bassett, D.R., Schmitz, K.H., Emplaincourt, P.O., Jacobs, D.R., & Leon, A.S. (2000). Compendium of physical activities: An update of activity codes and MET intensities. *Medicine and Science in Sports and Exercise*, 32 (Suppl.), S498-S516.
- Aldana, S.G. (2001). Financial impact of health promotion programs: A comprehensive review of the literature. *American Journal of Health Promotion*, 15, 296-320.
- American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.
- Anderson, D.R., Serxner, D.A., & Gold, D.B. (2001). Conceptual framework, critical questions, and practical challenges in conducting research on the financial impact of worksite health promotion. *American Journal of Health Promotion*, 15, 281-288.
- Baecke, J.A.H., Burema, J., & Frijters, J.E.R. (1982). A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *The American Journal of Clinical Nutrition*, 36, 936-942.
- Biddle, S.J.H. (2000). Emotion, mood and physical activity. In S.J.H. Biddle, K.R. Fox, & S.H. Boutcher (Eds.), *Physical activity and psychological well-being* (pp. 63-87). London: Routledge.
- Biddle, S.J.H., Fox, K.R., & Boutcher, S.H. (2000). *Physical activity and psychological well-being*. London: Routledge.
- Brayfield, A.H., & Rothe, H.F. (1951). An index of job satisfaction. *Journal of Applied Psychology*, 35, 307-311.
- Brief, A.P., Burke, M.J., George, J.M., Robinson, B.S., & Webster, J. (1988). Should negative affectivity remain an unmeasured variable in the study of job stress? *Journal of Applied Psychology*, 73, 193-198.

- Brown, D.R., Wang, Y., Ward, A., Ebbeling, C.B., Fortlage, L., Puleo, E., Benson, H., & Rippe, J.M. (1995). Chronic psychological effects of exercise and exercise plus cognitive strategies. *Medicine and Science in Sports and Exercise*, *27*, 765-775.
- Burke, M.J., George, J.M., Brief, A.P., Roberson, L., & Webster, J. (1989). Measuring affect at work: Confirmatory analyses of competing mood structures with conceptual linkage to cortical regulatory systems. *Journal of Personality and Social Psychology*, *57*, 1091-1102.
- Byrne, B.M. (1996). *Measuring self-concept across the life span: Issues and instrumentation*. Washington, DC: American Psychological Association.
- 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 and Exercise Psychology*, *20*, 339-357.
- Daley, A.J., & Parfitt, G. (1996). Good health-is it worth it? Mood states, physical well-being, job satisfaction and absenteeism in members and non-members of a British corporate health and fitness club. *Journal of Occupational and Organizational Psychology*, *69*, 121-134.
- Danna, K., & Griffin, R.W. (1999). Health and well-being in the workplace: A review and synthesis of the literature. *Journal of Management*, *25*, 357-384.
- Diener, E., Emmons, R.A., Larsen, R.J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment*, *49*, 71-75.
- Diener, E., Sapyta, J.J., & Suh, E. (1998). Subjective well-being is essential to well-being. *Psychological Inquiry*, *9*, 33-37.
- Diener, E., Suh, E.M., Lucas, R.E., & Smith, H.L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, *125*, 276-302.

- DiNubile, N.A., & Sherman, C. (1999). Exercise and the bottom line: Promoting physical activity and fiscal fitness in the workplace: A commentary. Retrieved June 1, 2000, from http://www.physsportsmed.com/issues/1999/02_99/dinubile.htm.
- Dishman, R.K., Oldenburg, B., O'Neal, H., & Shephard, R.J. (1998). Worksite physical activity interventions. *American Journal of Preventive Medicine*, *15*, 344-361.
- Fox, K.R. (1990). *The Physical Self-Perception Profile Manual*. DeKalb, IL: Office for Health Promotion, Northern Illinois University.
- Fox, K.R. (1997). The physical self and processes in self-esteem development. In K.R. Fox (Ed.), *The physical self: From motivation to well-being* (pp. 111-139). Champaign, IL: Human Kinetics.
- 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.
- George, J.M., & Brief, A.P. (1992). Feeling good-doing good: A conceptual analysis of the mood at work-organizational spontaneity relationship. *Psychological Bulletin*, *112*, 310-329.
- Hair, J.F., Anderson, R.E., Tatham, R.L., & Black, W.C. (1998). *Multivariate data analysis* (5th ed.). Upper Saddle River, NJ: Prentice Hall.
- Health and Safety Executive (2004). Work-related stress. Retrieved October 17, 2004 from <http://www.hse.gov.uk/stress/>
- Hofmann, R. (1995). Establishing factor validity using variable reduction in confirmatory factor analysis. *Educational and Psychological Measurement*, *55*, 572-582.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling*, *6*, 1-55.

- Janman, K., Jones, J.K., Payne, R.L., & Rick, J.T. (1988). Clustering individuals as a way of dealing with multiple predictors in occupational stress research. *Behavioral Medicine, 14*, 17-29.
- Judge, T.A., & Bono, J.E. (2001). Relationship of core self-evaluations traits – self-esteem, generalized self-efficacy, locus of control, and emotional stability – with job satisfaction and job performance: A meta-analysis. *Journal of Applied Psychology, 86*, 80-92.
- Judge, T.A., Erez, A., & Bono, J.E. (1998). The power of being positive: The relation between positive self-concept and job performance. *Human Performance, 11*, 167-187.
- Judge, T.A., Locke, E.A., Durham, C.C., & Kluger, A.K. (1998). Dispositional effects on job and life satisfaction: The role of core evaluations. *Journal of Applied Psychology, 83*, 17-34.
- Judge, T.A., Thoresen, C.J., Bono, J.E., & Patton, G.K. (2001). The job satisfaction-job performance relationship: A qualitative and quantitative review. *Psychological Bulletin, 127*, 376-407.
- Judge, T.A., & Watanabe, S. (1993). Another look at the job satisfaction-life satisfaction relationship. *Journal of Applied Psychology, 78*, 939-948.
- King, A.C., Taylor, C., & 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.
- King, A.C., Taylor, C.B., Haskell, W.L., & DeBusk, R.F. (1989). Influence of regular aerobic exercise on psychological health: A randomized, controlled trial of healthy middle-aged adults. *Health Psychology, 8*, 305-324.
- Kirkcaldy, B.D., Cooper, C.L., Shephard, R.J., & Brown, J.S. (1994). Exercise, job satisfaction and well-being among superintendent police officers. *European Review of Applied Psychology, 44*, 117-123.

- Little, B.R. (1989). Personal projects analysis: Trivial pursuits, magnificent obsessions, and the search for coherence. In D.M. Buss, & N. Cantor (Eds.), *Personality psychology: Recent trends and emerging directions* (pp. 15-31). New York: Springer.
- Marsh, H.W. (1997). The measurement of physical self-concept: A construct validation approach. In K.R. Fox (Ed.), *The physical self: From motivation to well-being* (pp. 27-58). Champaign, IL: Human Kinetics.
- Messer, B., & Harter, S. (1986). *Manual for the Adult Self-Perception Profile*. Denver, CO: University of Denver.
- Pelled, L.H., & Xin, K.R. (1999). Down and out: An investigation of the relationship between mood and employee withdrawal behavior. *Journal of Management*, *25*, 875-895.
- Philippaerts, R.M., Westerterp, K.R., & Lefevre, J. (2001). Comparison of two questionnaires with a tri-axial accelerometer to assess physical activity patterns. *International Journal of Sports Medicine*, *22*, 34-39.
- Rector, N.A., & Roger, D. (1996). Cognitive style and well-being: A prospective examination. *Personality and Individual Differences*, *21*, 663-674.
- Rejeski, W.J., Shelton, B., Miller, M., Dunn, A.L., King, A.C., & Sallis, J.F. (2001). Mediators of increased physical activity and change in subjective well-being: Results from the Activity Counselling Trial (ACT). *Journal of Health Psychology*, *6*, 159-168.
- Rust, R. (1999). Discriminant validity of the "big five" personality traits in employment settings. *Social Behavior and Personality*, *27*, 99-108.
- Shephard, R.J. (1994). *Aerobic fitness and health*. Champaign, IL: Human Kinetics.
- Shephard, R.J. (1996). Worksite fitness and exercise programs: A review of methodology and health impact. *American Journal of Health Promotion*, *10*, 436-452.

- Shephard, R.J. (1999). Do work-site exercise and health programs work? *The Physician and Sportsmedicine Online* (February 1999). Retrieved February 17, 2002, from http://www.physsportsmed.com/issues/1999/02_99/shepherd.htm.
- Solomon, D.J. (2001). Conducting web-based surveys. *Practical Assessment, Research, and Evaluation*, 7 (19). Retrieved October 15, 2001, from <http://ericae.net/pare/getvn.asp?v=7&n=19>.
- Sonstroem, R.J. (1998). Physical self-concept: Assessment and external validity. *Exercise and Sports Sciences Reviews*, 26, 133-164.
- Sonstroem, R. J., Harlow, L. L., Gemma, L. M., & Osborne, S. (1991). Test of structural relationships within a proposed exercise and self-esteem model. *Journal of Personality Assessment*, 56, 348-364.
- Sonstroem, R. J., Harlow, L. L., & Josephs, L. (1994). Exercise and self-esteem: Validity of model expansion and exercise associations. *Journal of Sport and Exercise Psychology*, 16, 29-42.
- Sonstroem, R.J., & Morgan, W.P. (1989). Exercise and self-esteem: Rationale and model. *Medicine and Science in Sports and Exercise*, 21, 329-337.
- Sonstroem, R.J., & Potts, S.A. (1996). Life adjustment correlates of physical self-concepts. *Medicine & Science in Sports and Exercise*, 28, 619-625.
- Sternfeld, B., Ainsworth, B.E., & Quesenberry, C.P. (1999). Physical activity patterns in a diverse population of women. *Preventive Medicine*, 28, 313-323.
- Taylor, A.H. (2000). Physical activity, anxiety, and stress. In S.J.H. Biddle, K.R. Fox, & Boutcher, S.H. (Eds.), *Physical activity and psychological well-being* (pp. 10-45). London: Routledge.
- Taylor, A.H., & Fox, K.R (in press). Changes in physical self-perceptions: Findings from a randomised controlled study of a GP exercise referral scheme. *Health Psychology*.

- Thøgersen, C., Fox, K.R., & Ntoumanis, N. (2002). Testing the mediating role of physical acceptance in the relationship between physical activity and self-esteem: An empirical study with Danish public servants. *European Journal of Sports Science*, 2, 1-13.
- Torres, R., & Fernandez, F. (1995). Self-esteem and the value of health as determinants of adolescent health behavior. *Journal of Adolescent Health Care*, 16, 60-63.
- Van Baak, M.A., van Mil, E., Astrup, A.V., Finer, N., van Gaal, L.F., Hilsted, J., Kopelman, P.G., Rössner, S., James, W.P., & Saris, W.H.M. (2003). Leisure-time activity is an important determinant of long-term weight maintenance after weight loss in the Sibutramine Trial on Obesity Reduction and Maintenance (STORM trial). *American Journal of Clinical Nutrition*, 78, 209-214.
- Van de Vliet, P., Knapen, J., Onghena, P., Fox, K.R., David, A., Morres, I., Van Coppenolle, H., & Pieters, G. (2002). Relationships between self-perceptions and negative affect in adult Flemish psychiatric in-patients suffering from mood disorders. *Psychology of Sport and Exercise*, 3, 309-322.
- Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin*, 98, 219-235.
- Weiss, H.M., Nicholas, J.P., & Daus, C.S. (1999). An examination of the joint effects of affective experiences and job beliefs on job satisfaction and variations in affective experiences over time. *Organizational Behavior and Human Decision Processes*, 78, 1-24.
- Wylie, R.C. (1989). *Measures of self-concept*. Lincoln, NE: University of Nebraska Press.
- Yarnold, P.R., Stille, F.C., & Martin, G.J. (1995). Cross-sectional psychometric assessment of the functional status questionnaire: Use with geriatric versus nongeriatric ambulatory medical patients. *International Journal of Psychiatry in Medicine*, 25, 305-317.

Footnote

1. We included only enthusiasm in the model presented in Figure 1, because positive affect is more likely to relate to job satisfaction (Weiss et al., 1999), and because enthusiasm has conceptually similar items with vigour which is consistently related to exercise behaviour (Biddle, 2000).
2. One of the reviewers requested the examination of sex differences. Although this was not the purpose of the study, we considered the role of sex when examining the differences in well-being among the different quintile groups. Separate MANOVA analyses for each gender revealed similar findings with the MANOVA's presented in the Results, with a few exceptions. Specifically, for females, there was no significant difference among the exercise quintiles in work-related well-being. However, when examining differences in work-related well-being in the same sex group using total physical activity, significant differences were found. Specifically, the pa-groups differed in all job affect variables with more physically active groups reporting more favourable levels of affect. The role of sex could not be examined in the SEM because the sample was not large enough to conduct multi-sample analysis.

Table 1

Descriptive Statistics for Exercise and Physical Activity Levels of the total sample and quintiles

	Total sample	Ex-groups 1-5					Pa-groups 1-5				
		1	2	3	4	5	1	2	3	4	5
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Work index	2.28 (.29)	2.36 (.32)	2.22 (.28)	2.24 (.27)	2.26 (.28)	2.34 (.27)	2.11 (.25)	2.30 (.32)	2.28 (.27)	2.37 (.24)	2.37 (.29)
Exercise index	2.76 (1.19)	1.14 (.40)	2.00 (.00)	2.84 (.37)	3.48 (.50)	4.37 (.49)	1.91 (.88)	2.25 (1.02)	2.71 (.97)	3.15 (1.14)	3.93 (.72)
Leisure-time index	2.87 (.70)	2.63 (.59)	2.63 (.54)	2.82 (.69)	3.11 (.71)	3.18 (.76)	2.20 (.44)	2.60 (.45)	2.78 (.41)	3.11 (.45)	3.77 (.52)
Total PA index	7.93 (1.59)	6.14 (.75)	6.84 (.65)	7.90 (.84)	8.85 (.98)	9.89 (.97)	6.22 (.84)	7.15 (.84)	7.77 (.84)	8.63 (.96)	10.07 (.87)

Notes. Ex-group and pa-group 1 = 0-20th quintile, 2 = 20-40th quintile, 3 = 40-60th quintile, 4 = 60-80th quintile, 5 = 80-100th quintile.

The possible range of scores for the work-, exercise-, and leisure-time index is 1 to 5, whereas for the total PA index is 3 to 15.

Table 2

MANOVA Results for Exercise (df = 4, 298) and Physical Activity (df = 4, 295) Quintiles in Physical Well-Being Measures

	Exercise quintiles										<i>F</i>	<i>p</i>
	1		2		3		4		5			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Physical self-worth	2.34 _a	.05	2.38 _a	.05	2.56 _b	.05	2.70 _b	.05	2.72 _b	.05	13.02	<.001
Physical satisfaction	2.77 _a	.09	2.90 _a	.09	3.12 _b	.09	3.50 _c	.09	3.53 _c	.09	15.38	<.001
	Physical Activity quintiles											
Physical self-worth	2.35 _a	.35	2.45 _a	.44	2.55 _b	.42	2.63 _b	.38	2.75 _b	.36	9.48	<.001
Physical satisfaction	2.93 _a	.69	2.93 _a	.86	3.15 _a	.64	3.35 _b	.77	3.49 _b	.61	7.28	<.001

Note. Quintiles with the same subscripts in the same row do not differ significantly at $p < .05$

Table 3

MANOVA Results for Exercise (df = 4, 297) and Physical Activity (df = 4, 294) Quintiles in Work-Related Well-Being Measures

	Exercise quintiles										<i>F</i>	<i>p</i>
	1		2		3		4		5			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Job satisfaction	7.04 _a	.24	6.93 _a	.23	7.30 _a	.24	7.02 _a	.23	7.17 _a	.24	.38	.82
Nervousness	1.93 _a	.09	1.73 _a	.09	1.60 _a	.09	1.92 _a	.09	1.82 _a	.09	2.23	.07
Fatigue	2.35 _a	.11	2.21 _a	.10	2.12 _a	.11	2.23 _a	.11	2.25 _a	.11	.62	.65
Relaxation	2.60 _a	.10	2.75 _a	.10	2.83 _a	.10	2.81 _a	.10	2.92 _a	.10	1.42	.23
Enthusiasm	2.65 _a	.09	2.42 _a	.09	2.82 _b	.10	2.95 _b	.09	3.03 _b	.09	6.97	<.001
Physical activity quintiles												
Job satisfaction	6.62 _a	1.82	6.92 _a	1.67	7.08 _a	1.74	7.35 _a	1.82	7.49 _a	1.94	2.29	.06
Nervousness	1.83 _a	.79	1.93 _a	.75	1.63 _a	.59	1.80 _a	.67	1.82 _a	.78	1.24	.29
Fatigue	2.42 _a	.97	2.24 _a	.80	2.22 _a	.72	2.22 _a	.78	2.04 _a	.76	1.65	.16
Relaxation	2.69 _{ab}	.77	2.67 _{ab}	.85	2.94 _{ab}	.72	2.62 _a	.73	3.02 _b	.71	3.38	.01
Enthusiasm	2.50 _a	.67	2.58 _a	.72	2.64 _a	.71	2.98 _b	.73	3.18 _b	.75	10.10	<.001

Note. Quintiles with the same subscripts in the same row do not differ significantly at $p < .05$

Table 4

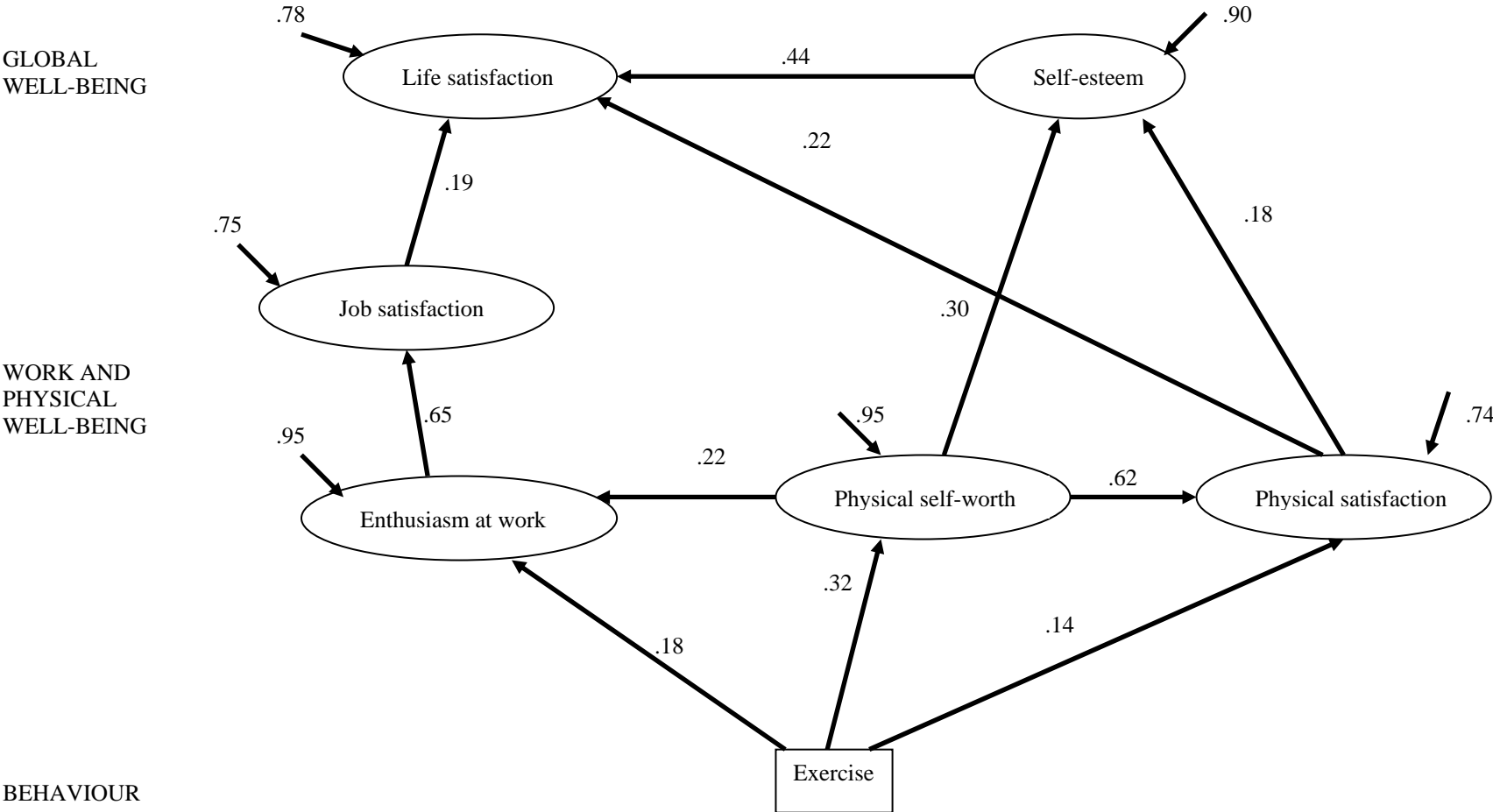
MANOVA Results for Exercise (df = 4, 298) and Physical Activity (df = 4, 295) Quintiles in Global Well-Being Measures

	Exercise quintiles										<i>F</i>	<i>p</i>
	1		2		3		4		5			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Self-esteem	2.80 _a	.08	2.92 _a	.08	2.94 _a	.08	3.04 _a	.08	3.04 _a	.08	1.61	.17
Life satisfaction	4.15 _a	.16	4.46 _{ab}	.16	4.77 _{ab}	.16	4.81 _b	.16	4.78 _b	.16	3.14	.02
	Physical Activity quintiles											
	1		2		3		4		5			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Self-esteem	2.78 _a	.70	2.91 _a	.60	2.98 _a	.53	3.01 _a	.51	3.07 _a	.63	3.84	.005
Life satisfaction	4.44 _{ab}	1.30	4.31 _a	1.21	4.36 _a	1.35	4.81 _{ab}	1.22	5.04 _b	1.11	2.21	.07

Note. Quintiles with the same subscripts in the same row do not differ significantly at $p < .05$

Figure Caption

Figure 1. Structural equation modelling of the relationships between exercise and components of mental well-being: $\chi^2 (423) = 647.67 (p < .001)$; NNFI = .94; CFI = .95; SRMR = .07; RMSEA = .05 (.04 - .05).



Note: Only direct paths are presented.