Section: Original Research

Article Title: Dose-Response of Women's Health-Related Quality of Life (HRQoL) and Life Satisfaction to Physical Activity

Authors: Rochelle Eime, Jack Harvey, and Warren Payne

Affiliations: Eime and Harvey are with the School of Health Sciences, University of Ballarat, Ballarat, Victoria, Australia. Payne is with the Institute of Sport, Exercise and Active Living, Victoria University, Melbourne, Victoria, Australia.

Running Head: Dose-response of HRQoL to physical activity

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Abstract

Background: To examine the dose-response relationship between health related quality of life (HRQoL) and life satisfaction (outcomes) and duration of recreational physical activity (PA) (exposure). Further, to explore whether these relationships depend on type of PA.

Methods: 793 Australian rural-living women self-reported on: duration of recreational PA; HRQoL via SF-36 Mental Component Summary (MCS) and Physical Component Summary (PCS); and a life satisfaction scale. ANOVAs and ANCOVAs investigated differences in outcomes (MCS, PCS and life satisfaction) between tertiles of exposure to recreational PA, and types of PA (club sport, gymnasium, walking), with adjustment for potential confounders.

Results: A significant positive dose-response relationship was found between PCS and level of PA. Furthermore, this relationship depended on type of PA, with club-sport participants recording higher PCS than non-club-sport participants in all but the highest tertile of exposure. Life satisfaction and MCS were not significantly related to level of PA.

Conclusion: Physical health was positively associated with level of recreational PA, with club sport participation contributing greater benefits at low to moderate exposures than participation in gymnasium or walking activities.

Key words: mental health, physical health, sport, participation

Background

Recommended minimum levels of PA have historically been based on identified quantitative relationships with physical health benefits. Extensive research into the physical health benefits of physical activity (PA) has demonstrated dose-response relationships between the level of PA participation—defined in terms of either frequency, duration, intensity or volume (frequency × duration × intensity)—and physical health outcomes [1,2]. There is an inverse and generally linear relationship between total volume of PA and the incidence rates of all-cause mortality, total cardiovascular disease, coronary health disease and mortality, and Type 2 diabetes mellitus [1-3]. Understanding the dose-response relationship between total volume and intensity of PA, and the associated health benefits, has led to the prescription of levels of PA required to achieve physical health benefits [4].

More recently, the scope of health benefits has been extended beyond physical health to include mental health benefits, under the general rubric of health-related quality of life (HRQoL). However, although mental health benefits have been referenced in more recent guidelines, to date 'insufficient evidence precludes conclusions about the minimal or optimal types or amounts of physical activity for mental health' [5]. Instead of specifying a recommended level of PA for mental health benefits, mental health is often assessed in relation to the existing PA recommendations based on physical health benefits [6-10]. It has been found that meeting the PA recommendations was associated with HRQoL [11]. When examining the relationship between PA and HRQoL it has been consistently reported that no participation in moderate PA was associated with lower combined mental and physical HRQoL than was participation in moderate PA[6,9]. In women specifically, positive associations between walking and emotional health, and inverse associations between participation in moderate-intensity PA and symptoms of somatisation, have been reported [12]. Dunn et al. found little evidence of a dose-response relationship between mental health and PA, but concluded that this was due to a lack of studies rather than a lack of evidence per se [13]. One study has clearly identified a dose-response relationship between some types

of PA and aspects of mental health [14]. They reported a significant positive dose-response relationship between level of PA and emotional wellbeing. They reported that emotional wellbeing plateaued at a volume of PA equivalent to that required to attain health benefits as per the current public health recommendations for physical health [14].

It has been acknowledged that understanding of the dose-response to PA needs to be extended not only to include the mental as well as the physical health benefits, but also to address the differential effects of various types of PA [3,5,15-17]. Although previous studies of the dose-response relationship between PA and physical health have been based on various types of PA [16]and in some cases on more than one type of PA [14] to our knowledge no studies to date have considered whether the relationship varies according to the type of PA undertaken.

Further to the issue of mental health benefits of PA, there is evidence that women have poorer mental health than men [10]. Eime et al. (2010) [18] conducted a cross-sectional study of HRQoL and life satisfaction in women who participate in three types of PA that are popular in Australia: club sport, gymnasium activities (resistance training or exercise classes) and walking. They hypothesised that, given the social nature of club sport, club sports participants would have greater HRQoL and life satisfaction than participants in other types of PA. After adjustment for potential confounders, four of the eight subscales of the 36-item Short-Form Health Survey (SF-36) [19] the SF-36 mental health components summary score and a life satisfaction score were all significantly higher among the club sport participants than participants in other types of PA. Similarly, Asztalos et al., (2009) [12] found that sports participation was more strongly associated with reduced distress and reduced stress than were housework or active transport. These results support the notion that participation in PA in a sport club setting may offer mental health benefits in addition to the physical health benefits associated with participation in PA in other settings, through interaction between club members and more particularly through membership of a team [18].

However, the specific dose-response relationships between participation in PA and physical and mental health in particular types of sport and PA are unknown.

Purpose

This paper reports on the second phase of an analysis of the relationships between participation in sport and other recreational PA, HRQoL and life satisfaction in females. The results of the first phase of the analysis, which showed that there were significant differences in HRQoL and life satisfaction between participants undertaking different types of sport and PA, have been published elsewhere [18].

This second phase was focused on an analysis of dose-response relationships. Specifically we examined the dose-response relationships between:

- one "dose" or exposure measure—level of recreational PA;
- three "responses" or outcome measures—one of physical health, one of mental health, and one of life satisfaction.

We also explored whether any of these dose-response relationships depended on the type of PA undertaken i.e. whether type of PA undertaken was a moderating variable. The research was approved by the University of Ballarat Human Research Ethics Committee.

Methods

Design

This research was based on a cross-sectional survey of HRQoL and life satisfaction in female participants in three types of recreational PA—sport club (tennis or netball), gymnasium (resistance training or exercise classes), and leisure-time walking (alone, with up to three participants, or with a dog).

Participant recruitment

Study participants (hereafter referred to as respondents) were recruited from three settings—tennis and netball clubs; commercial public gymnasiums; and an established

walking track around a lake—in and around a rural city (population 88,137) in the state of Victoria, Australia. Women in each setting were approached by the researchers either before or after their activity and, if they were aged 18 years or over, invited to complete a written self-report survey, which took up to 10 minutes to complete.

Key variables

The exposure measure, level of recreational PA (hereafter referred to simply as PA), was calculated as the total self-reported duration (in minutes) of PA in sporting club, gymnasium and walking settings in the week before the survey.

Two of the three outcome measures were derived from the 36-item Short-Form Health Survey (SF-36) [19]. The SF-36 is a comprehensive, validated instrument for the measurement of HRQoL, which has been widely used in both clinical and general population studies. Its outcome measures consist of eight subscales (physical functioning; role-physical; bodily pain; general health; vitality; social functioning; role-emotional; and mental health) and two summary scores — the Physical Component Summary (PCS) for physical health, and the Mental Component Summary (MCS) for mental health [19,20]. We used the PCS and MCS scores, which are each population-normed with mean = 50 and standard deviation = 10. . The third outcome measure was the Life Satisfaction Score (LSS) from the Australian Longitudinal Study on Women's Health [21,22], with items regarding work, career, study, family relationships, partner / closest personal relationship, friendships, social activities, and where applicable parenthood/children. Responses are on a 4-point Likert scale: very dissatisfied, dissatisfied, satisfied, very satisfied. Responses were averaged to derive a mean score for life satisfaction, with a higher score indicating greater life satisfaction..

The exposure measure, level of PA, was highly positively skewed, and the correlations between the exposure and outcome measures, though statistically significant, were low in magnitude. For this reason, and to enable detection of non-linear relationships, the exposure data were categorized. Consistent with previous studies [16] each exposure measure was represented as tertiles of exposure (i.e. respondents were categorised into

three groups of approximately equal size with respect to level of PA. It should be noted that the PA tertiles are study-referenced tertiles based on the study sample of physically active women—they are not population-referenced tertiles.

The moderator of interest was the type of PA. However, many survey respondents participated in more than one of the three types of activity, and many sports club participants also participated in sports other than those conducted in the setting in which they were recruited and surveyed. Therefore, the moderating variable "Type of PA" was developed by allocating each respondent to one of three mutually exclusive groups. In light of the hypothesised benefit of involvement in structured PA settings such as sports clubs on HRQoL and life satisfaction [18], the groups were defined in descending order of the level of organisation and structure of the setting. The three types were:

- Sports club—all sports club participants (regardless of the type of sport or participation in gymnasium or walking);
- Gymnasium—gymnasium participants who were not sports club participants (but may have been walkers); and
- Walk— walkers who were not sports club or gymnasium participants.

The sports club type was made up predominantly of tennis and netball players, recruited in club settings, but also included a small number of participants in other sports recruited in the gymnasium or walking settings.

Analysis

Data screening was undertaken prior to the data analyses. Correlations between each of the three outcome measures (physical health, mental health and life satisfaction) were calculated. For each outcome measure, differences between tertiles of the exposure measure (level of PA) were first investigated in one-factor ANOVAs. To investigate the possibility of different dose-response effects for the three PA types, two-factor (tertile of level of PA, type of PA) analyses were also conducted. In each case, ANCOVA was also used to

adjust for the effects of age, education level, marital status, having children aged <16 years and perceived financial stress. Supplementary analyses were also conducted with gymnasium and walking participants collapsed into a "non-sports club" PA type. All analyses were conducted using SPSS Version 19 on the cases with complete data for the particular analysis.

Results

Seven hundred and ninety three respondents took part in the study. Demographic characteristics of the respondents are provided in Table 1, together with summary statistics for level of PA, life satisfaction (measured by LSS), physical health (measured by PCS) and mental health (measured by MCS). No outliers were detected during data screening, but incomplete answers to questions resulted in reduced sample sizes for the analyses involving level of PA (Table 2; n=710), LSS (Table 3; n=708), and PCS and MCS (Table 3; n=683).

Table 1 shows that respondents predominantly undertook moderate to high levels of PA. With regard to the normed PCS and MCS measures, on average respondents scored 1–3 points higher on PCS and 1–3 points lower on MCS than the reference population averages of 50 points. There was also a tendency for less variation within each group than the reference population standard deviation of 10 points.

The tertiles of PA in the previous seven days were: 1) 0–150 min; 2) 150–350 min; and 3) >350 min. The boundary between the first and second tertile corresponds approximately to current recommendations for sufficient PA to incur a health benefit [5]. Counts and percentages within each PA type for each tertile are shown in Table 2. We note that, while in principle, tertiles by definition have equal frequencies, in practice, because of the discrete nature of reported durations (typically to the nearest hour or half hour), the PA measure was discretely quantized, and there were many ties (equal values). Hence the division of cases into three equally-sized subsets could only be approximate. Table 2 also shows that PA type moderated the exposure to PA, with sports club participants being

under-represented and walkers being over-represented in the 1st tertile of exposure, and the converse occurring in the 3rd tertile of exposure.

Correlations between the three outcome measures—PCS, MCS and LSS—were as follows: PCS-MCS, -0.14; PCS-LSS, 0.07; MCS-LSS, 0.51.

Table 3 shows a summary of the results of ANOVA and ANCOVA significance tests for the response of the three outcome measures to level of PA and type of PA. Examination of residuals from ANOVAs and ANCOVAs showed that for all three outcome measures, there was for some analyses some evidence of negative skew and heterogeneity of variance, with variance tending to be larger at the lower end of the range of scores in each case. However, considering the large sample size, these effects were not considered to be so pronounced as to constitute a serious threat to the validity of the analyses.

For physical health (PCS), there was a significant dose-response to PA exposure (one-factor unadjusted p=0.005 and adjusted p=0.003; two-factor unadjusted p=0.002 and adjusted p=0.001). Whilst there was no significant main effect of PA type on physical health, there was a significant interaction between level of PA and PA type (unadjusted p=0.015; adjusted p=0.037).

Table 2 shows that the sample sizes for the walking type of PA were much smaller than for the other two PA types, and hence the standard errors were larger and so less confidence can be placed in the pattern of mean scores for this group (Figure 1a). Because the profile of means for the walking type was closer to that of the gymnasium type than that of the sports club type, the walking and gymnasium types were coalesced into a "non-sports club" type. Figure 1b shows the results of the two-type analysis. Table 3 shows that the results of the significance tests from the two-type ANOVA and ANCOVA analyses are similar to those of the three-type analyses. Figure 1b shows that participants in sports club PA reported better physical health (mean PCS scores) than participants in non-sports club PA for the 1st and 2nd tertiles of exposure, and there is a similar dose-response effect in both types. For the 3rd tertile, the mean score for sports club participants plateaued whilst the

positive dose-response relationship was maintained in the non-sports club participants, resulting in the highest of the six mean PCS scores. Effect sizes (partial eta^2) for significant effects ranged from 0.015 to 0.020.

For mental health (MCS), there was no significant dose-response to PA exposure, in either one- or two-factor analyses. In the two-factor analyses, PA type displayed a significant effect on mental health (unadjusted p=0.031; adjusted p=0.005), but there was no significant interaction between PA exposure and PA type. The only strong and consistent indication was the effect of PA type on mental health, with no evidence of dose-response effects. Effect sizes (partial eta^2) for significant effects ranged from 0.010 to 0.016.

For life satisfaction (LSS), the unadjusted one-factor analysis (i.e. with all PA types combined) showed a significant dose-response to PA exposure (p=0.025), with near-significance (p=0.060) after adjustment for confounders. The two-factor analyses showed a significant main effect for PA type (unadjusted p=0.001; adjusted p<0.001), but there was no evidence of a main effect of PA exposure. The interaction between PA type and PA exposure was significant in the unadjusted analysis (p=0.042) but not after adjustment for confounders (p=0.089). Therefore, the only strong and consistent was the effect of PA type on life satisfaction, with only weak evidence of a dose-response to PA exposure. Effect sizes (partial eta^2) for significant effects ranged from 0.010 to 0.024.

Discussion

This study investigated the dose-response relationship between HRQoL (physical and mental aspects) and life satisfaction, and level of PA. In addition it investigated whether any dose-response relationships depended on the type of PA participation.

The findings indicated a positive dose-response relationship between HQRoL in terms of physical health and level of PA. The shape of the positive dose-response relationship depended on the types of PA undertaken. Sports club participants reported higher levels of physical health than participants in other types of PA at low to moderate PA levels, while the opposite occurred at high PA levels. No dose-response relationship was

observed between HQRoL, in terms of mental health, or life satisfaction, and level of PA; however there were associations between both mental health and life satisfaction, and the type of PA undertaken.

Although PCS is a general measure of physical health, these results support the findings of seminal reports such as the US Department of Health and Human Services *Physical activity guidelines advisory committee report, 2008*, which demonstrated the existence of a positive relationship between level of PA exposure and the magnitude of reduction in a number of specific chronic diseases [5]. This study furthers the understanding of this dose-response relationship by revealing that the PA–physical health dose-response relationship differed according to the types of PA undertaken. This was particularly apparent when the PA participants were classified as sport and non-sport. The relationship between physical health and tertile of PA was generally positive, but differed in detail according to type of PA participation. The relationship between physical health and non-sport participation was positive and linear, which is consistent with the results of Brown et al. (2004) who reported improvements in an integrated measure of physical and mental HRQoL for individuals who participated in moderate PA up to 6 days·wk^{-1} or up to 90 min·day^{-1} [9]. In comparison, in this study, the sports club participants displayed a positive relationship between physical health and PA for the first two tertiles. However, this positive relationship plateaued between the second and third tertiles. This pattern of results is consistent with evidence from a number of studies that where a dose-response is observed in preventing chronic disease or reducing all-cause mortality the relationship is curvilinear; the health benefits become less and less for any given increase in PA levels [23]. Although the reasons for this were not investigated, it may be that the increased volume of sport being played by respondents in this group increased both their risk and actual incidence of injury [24], thereby negatively affecting their physical health.

Another way of looking at these results is to compare the physical health for the sport-club and non-sport club participants within each tertile of PA. For the first two tertiles, physical health was better for sports club participants, but for the third tertile participants this was reversed, with the physical health of non-sport club participants being better than for the sports club participants. This indicates that at low to moderate levels of PA, sports club participation provides the greatest benefit to physical health, but at the highest levels, greater benefits accrue from participation in non-sports club PA. It is also noted that the physical health of gymnasium participants in the first tertile of PA fell below the normative population mean of 50 points. Mean scores for the eight other PA type × PA level categories were all above 50, indicating that participants in PA in general report better physical health than the population as a whole.

When investigating the results for mental health—which, when using the SF-36 is most heavily weighted for vitality, social functioning, role-emotional and mental health—we found that mental health depended on types of PA undertaken (specifically, MCS was higher in sports club participants than in women who engaged in other types of PA), but not on the level of PA. These results support the conclusion of an international evidence-based symposium on dose-response issues concerning PA and health [1]. In particular, Kesaniemi et al. (2001) concluded that while there was evidence from observational studies that individuals with higher levels of PA were less likely to develop depressive illness, the Panel could find "no dose-response relationship between PA and depression and anxiety". In addition, a review of published data by Spirduso and Cronin (2001) failed to identify evidence of a dose-response relationship between PA-induced changes in wellbeing and exercise intensity in older adults [8]. More recently, Asztalos et al. (2009) [10] reported positive associations between mental health and the achievement of recommended levels of moderate PA or walking, but not between mental health and vigorous PA, in women. In each case, the significant differentiation occurred between the upper two tertiles of the mental health measure [10]. These results suggest that there are mental health benefits associated

with participation in lower intensity PA (moderate or walking) for women who have at least a moderate level of mental health. However, the analysis was framed in terms of tertiles of mental health (rather than tertiles of PA as in this study), which makes direct comparison with the present study difficult.

The findings of the current study are not consistent with those of several studies in which positive dose-response relationships between PA level and general measures of mental health have been reported [7,14,25]. Galper et al. (2006) and Mummery et al. (2004) both reported that the dose-response relationship between PA level and mental health plateaued above the recommended levels of PA required for health benefits [7,14]. Further evidence of the existence of a dose-response relationship between PA exposure and HRQoL was published by Brown et al. (2004) who reported a curvilinear relationship between level of PA (walking, jogging and running) and an integrated measure of physical and mental HRQoL [9]. The lack of a dose-response observed in our study may be due to a combination of: differences in the conceptualisation of PA and/or mental health and the tools used to measure them; differences in the types of PA studied; and differences in the ranges of dose and response observed.

In the current study, life satisfaction (as measured by LSS) was dependent on the PA type; specifically, life satisfaction was higher in sports club participants than in women who engaged in other types of PA. However, life satisfaction did not display a dose-response relationship with the level of PA. These results suggest that the improved life satisfaction reported by sports club participants is likely to be related to the increased level of social involvement provided by club-sport participation and not to increased participation in PA per se. These findings are different to those of previous studies, such as that of Schnohr et al. (2005), who reported an inverse dose-response relationship between PA and life dissatisfaction [26]. However, the most pronounced impact of PA on life dissatisfaction in that study was between the low active and the moderately active levels. The fact that the focus of the current study was on women who were already at least moderately active may explain

the lack of a dose-response relationship between PA and life satisfaction observed in this study.

Study limitations

Although this study has extended our understanding of the relationships between measures of HRQoL and life satisfaction and levels of PA, the cross-sectional design means that better health outcomes cannot necessarily be attributed directly to participation in PA. While we have characterised exposure to PA as the "dose" and measures of HRQoL and life satisfaction as the "response", the converse could also apply—those with better HRQoL and life satisfaction may be likely to participate more in PA. Participation in the survey was voluntary so it is also possible that there could be a bias due to respondents having higher HRQoL and life satisfaction than non-respondents.

In this non-experimental survey-based study many respondents participated in more than one of the three types of PA included, and so a decision had to be made as to how to allocate respondents into the three mutually exclusive PA types. We used a hierarchy based on level of organisation, which resulted in the sport club type including many who were also gymnasium participants and/or walkers. It is possible that categorizing respondents differently might have led to different results.

A further limitation is that the measure of PA was based on self-reported recall of frequency and duration over a 7-day period. Also, the measure of PA used in the current study was tailored to the particular focus of the study on different types of PA. Direct comparisons could not be made with studies which used different self-report tools for measuring PA or direct measures such as those derived from pedometers and accelerometers, which do not capture information about types of PA.

So as not to exacerbate the increased respondent burden associated with reporting the different types of PA undertaken over a 7-day period, with the consequent risk of poor compliance and degraded data quality, we did not ask respondents to report the intensity of

the PA undertaken. If intensity of PA is related to the type of PA undertaken, this could result in some confounding between type of PA and level of PA.

Finally, the effect sizes (partial eta^2) of the significant effects ranged from 0.010 to 0.024, which range upwards from a "small" effect size (equivalent to partial eta^2 = 0.01) as characterized by Cohen (1992) [27]As outlined by Eime et al. (2010)[18], the study was powered to detect differences of two points in PCS or MCS (a clinically significant magnitude) between adjacent group means in a three group ANOVA, which is equivalent to partial eta^2=0.027, close to the largest significant effect size observed. The fact that smaller effect sizes were statistically significant is a consequence of an increase in power attributable to two things. First, the sample size was increased to compensate for the effects of imbalance in the sample sizes for the three types of PA; and second, the within-group variability in our sample (see Table 1) was generally less than the normative 10 points used in the power calculations.

Conclusion

Positive dose-response relationships were found between level of PA and physical health. This study also demonstrated different health benefits according to different types of PA. Specifically we have provided evidence of differences in the response of physical health to level of PA between participants in sports clubs and participants in non-club settings, with club sport being associated with additional physical health benefits at low to medium durations of recreational PA.

Whilst the current population recommendations regarding minimal exposures to PA for health refer to mental health benefits of PA as well as physical health outcomes, it is acknowledged that there is a need for more quantitative evidence about the effects of PA on mental health outcomes. More information is also required about the relative physical, mental and social benefits of participation in different types of PA and the settings in which they occur. This paper has advanced the understanding of these issues.

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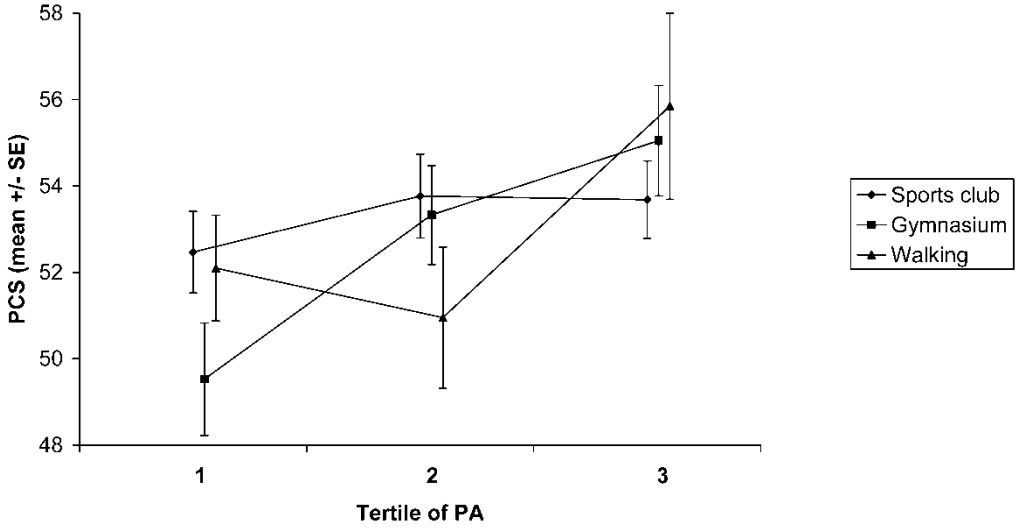
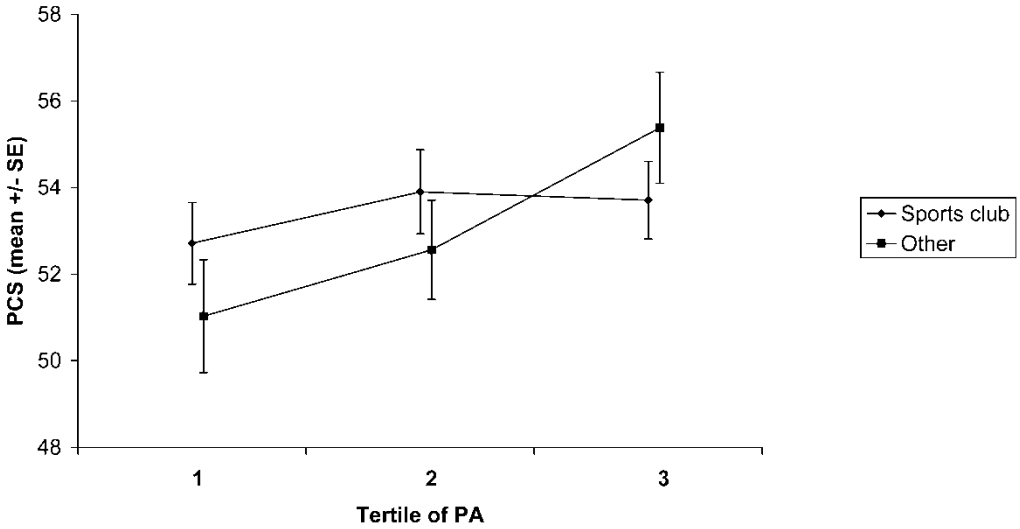
Figure 1a. Three PA types: *Mean Physical Component Score (PCS) (adjusted for five confounders) by tertile of weekly duration of PA and PA type*



(Error bars represent one standard error)

Figure 1b: Two PA types: *Mean Physical Component Score (PCS) (adjusted for five confounders) by tertile of weekly duration of PA and PA type*



(Error bars represent one standard error)

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Table 1. Summary of respondent characteristics

	Type of physical activity[1]		
	Sports Club	Gymnasium	Walk
Sample size (n)[2]	499	185	109
Age (years) Mean ± SD	33.9 ± 13.7	38.5 ± 12.9	44.5 ± 13.2
Married/de facto (%)	54	57	73
Children under 16 years (%)	39	32	45
Ability to manage on income			
It is impossible (%)	2	1	3
It is difficult all the time (%)	10	7	10
It is difficult some of the time (%)	24	26	20
It is not too bad (%)	47	46	42
It is easy (%)	17	20	25
Highest educational level attained			
Secondary school not completed (%)	14	12	18
Completed secondary school (%)	33	20	15
Trade/apprenticeship/ certificate/diploma (%)	21	21	23
University degree (%)	23	25	25
University higher degree (%)	10	21	20
Total duration of recreational PA in sporting club, gymnasium and walking settings in the week prior to the survey (minutes) Mean ± SD	334 ± 314	300 ± 359	148 ± 154
Physical Component Summary (PCS) Mean ± SD	52.8 ± 6.4	52.4 ± 7.80	51.1 ± 7.9
Mental component Summary (MCS) Mean ± SD	49.9 ± 8.8	47.3 ± 10.1	49.0 ± 10.4
Life Satisfaction Score (LSS) Mean ± SD	3.30 ± 0.44	3.14 ± 0.49	3.24 ± 0.51

[1] Sports Club: all sports club participants, including those who also participate in gymnasium and/or walking. Gymnasium: includes gymnasium participants who also walk. Walking: consists of those who walk only.

[2] Sample sizes shown are for all survey respondents (N=793). Missing data due to incomplete responses resulted in reductions of up to 14% in the sample sizes for particular variables and particular analyses.

Table 2. Cross-tabulation of tertiles of level of recreational physical activity by type of physical activity

		Physical activity level: tertile of exposure to recreational physical activity			
Physical activity type		**1**	**2**	**3**	**Total**
Sports club	Count	126	142	192	460
	% within tertile	56.5%	60.9%	75.6%	64.8%
Gymnasium but not sports club	Count	42	67	50	159
	% within tertile	18.8%	28.8%	19.7%	22.4%
Walking but neither sports club or gymnasium	Count	55	24	12	91
	% within tertile	24.7%	10.3%	4.7%	12.8%
Total	Count	223	233	254	710
	% within tertile	100.0 %	100.0 %	100.0 %	100.0 %

"Dose-Response of Women's Health-Related Quality of Life (HRQoL) and Life Satisfaction to Physical Activity"
by Eime R, Harvey J, Payne W
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Table 3. Results of significance tests of responses to level and type of recreational physical activity

				Unadjusted		Adjusted for confounders	
Response	N	Analysis[2]	Factor	F test p-values[1]	Effect size (Partial eta[2])	F test p-values[1]	Effect size (Partial eta[2])
PCS	683						
		1-factor	PA level	0.005	0.015	0.003	0.017
		2-factor	PA level	0.002 (0.001)[3]	0.018 (0.020)	0.001 (0.001)[3]	0.020 (0.020)
			PA type	0.344 (0.264)[3]	0.003 (0.002)	0.613 (0.449)[3]	0.001 (0.001)
			PA level × PA type	0.015 (0.034)[3]	0.018 (0.010)	0.037 (0.040)[3]	0.015 (0.010)
MCS	683						
		1-factor	PA level	<u>0.051</u>	0.009	0.120	0.006
		2-factor	PA level	0.278	0.004	0.255	0.004
			PA type	0.031	0.010	0.005	0.016
			PA level × PA type	0.127	0.006	<u>0.058</u>	<u>0.014</u>
LSS	708						
		1-factor	PA level	0.025	0.010	<u>0.060</u>	<u>0.008</u>
		2-factor	PA level	0.900	0.000	0.977	0.000
			PA type	0.001	0.019	<0.001	0.024
			PA level × PA type	0.042	<u>0.014</u>	<u>0.089</u>	<u>0.012</u>

[1] Boldface indicates $p<0.05$ Underline indicates $0.05<p<0.10$

[2] ANOVA for unadjusted analyses; ANCOVA for adjusted analyses

[3] Values in parentheses are for the analysis based on two activity categories: sports club and non-sports club.