

# Knowing is Half the Battle: the Association Between Leisure-Time Physical Activity and Quality of Life Among Four Groups with Different Self-Perceived Health Status in Taiwan

Huang-tz Ou<sup>1</sup> · Chia-Ting Su<sup>2</sup> · Wei-Ming Luh<sup>3</sup> ·  
Chung-Ying Lin<sup>4</sup> 

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**Abstract** Physical activity (PA) is a contributing factor toward an important global issue: quality of life (QoL). The aim of this study was to investigate the association between PA and QoL regarding different self-perceived healthy/unhealthy male and female adults to determine whether self-perception of health status plays an important role for appreciating PA. Data were obtained from the Taiwan Social Change Survey comprising 1643 participants (828 men, 815 women). The mean age was 43.98 years (SD = 14.44). Four hierarchical linear regressions were constructed to explore the unique contribution of PA to QoL in each group. As expected, PA was significantly positively related to QoL; however, the explained variations in terms of  $R^2$  are quite different: 8.8 % self-perceived unhealthy men and 1.2 % healthy men, 4.1 % unhealthy women and 0.6 % healthy women. Among the four groups, self-perceived healthy females had a lower level of PA and may not have appreciated the effects of PA on QoL. Our results suggest that people who perceive themselves as unhealthy engage in more PA than self-perceived healthy people. Therefore, encouraging self-perceived healthy people to stay alert to maintain their physical health is crucial to QoL.

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✉ Chung-Ying Lin  
cylin36933@gmail.com

<sup>1</sup> Institute of Clinical Pharmacy and Pharmaceutical Sciences, National Cheng Kung University College of Medicine, Tainan, Taiwan

<sup>2</sup> Department of Occupational Therapy, Medical College, Fu Jen Catholic University, New Taipei City, Taiwan

<sup>3</sup> Institute of Education, College of Social Sciences, National Cheng Kung University, Tainan, Taiwan

<sup>4</sup> Department of Rehabilitation Sciences, Faculty of Health and Social Sciences, The Hong Kong Polytechnic University, Hung Hom, Hong Kong

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## Introduction

Quality of life (QoL) has become an important global issue because it is a meaningful indicator for the understanding of both mental and physical well-being through each individual's subjective evaluation embedded in the cultural and social context (Chang and Lin 2015). Physical activity (PA)—any bodily movements produced by skeletal muscles that result in energy expenditure (Caspersen et al. 1985)—can broadly include occupational PA, housework, leisure-time PA (e.g., exercise), and transport-related PA. PA is considered one of beneficial factors contributing to QoL (Dishman 2003; Guthold et al. 2010; Morimoto et al. 2006; Wendel-Vos et al. 2004). An adequate level of PA is important for both physical and mental well-being (Jiang et al. 2004; Shimada et al. 2007) and provides a protective effect for the risks of mental conditions such as depression and dementia (Bracegirdle 2002; Fox et al. 2007) as well as physical problems such as obesity or cardiovascular diseases (Kostka and Bogus 2007; Rothberg et al. 2014). Lack of PA has been linked to poor QoL in young boys (Lin et al. 2012; Piko 2007) and increases mortality rates among female populations (Carlsson et al. 2006). Some research has discussed the influence of PA on QoL in healthy and unhealthy participants (Chen and Chao 2002; Milani et al. 1996; Panagiotakos et al. 2008; Ruhland and Shields 1997; Su et al. 2013); however, not all studies confirm beneficial effects of PA on health status (Berlin and Colditz 1990; Dishman and Buckworth 1996). The effect of the type and intensity/level of PA on health status has been emphasized. The majority of evidence indicates that leisure-time PA (e.g., exercise) is the type of activity that provides positive influences on health (Berlin and Colditz 1990; Dishman and Buckworth 1996; Kaleta et al. 2006). In addition, self-perceived health could be involved in the relationship between leisure-time PA and QoL.

To the best of our knowledge, no study has compared the difference of the associations between leisure-time PA and QoL between self-perceived healthy and unhealthy populations. That is, we do not know whether leisure-time PA is associated with QoL more in self-perceived healthy or unhealthy people. Self-perceived health—an individual's evaluation of general health status—predicts various chronic diseases and their prognosis, functional limitations, and mortality (Lee 2000; Sundquist and Johansson 1997). Studies have shown that leisure-time PA (i.e., not housework, transportation, or occupational PA) was significantly correlated with self-perceived health (Kaleta et al. 2006; Okano et al. 2003). Significant leisure-time PA in the creation of self-perceived health has been indicated. Enhanced self-perceived health through frequent leisure-time PA may improve people's well-being and reduce risks for developing cardiovascular diseases. Spending more time in leisure-time PA or doing leisure-time PA at a moderate to vigorous level is correlated with self-perceived health status. Hence, people with different health perceptions (i.e., perceived health or perceived unhealthy) are likely to be different in terms of their leisure-time PA, which might consequently affect their QoL. However, to date no study has assessed whether the association of leisure-time PA on QoL varies by people's health perceptions (i.e., perceived health or perceived unhealthy) or has determined the role of self-perceived

health. If self-perception is a key factor in the relationships between PA and QoL to PA, the present study can shed light on health promotion of leisure-time PA.

Furthermore, gender plays an important role in participating in PA. Taiwanese women are less likely than men to engage in PA (Azevedo et al. 2007; Dagmar et al. 2011; Morimoto et al. 2006; Panagiotakos et al. 2008). In addition, in traditional Asian society, married women are expected to dedicate their lives to conventional virtues and housework, which may constrain their time for undertaking activities for themselves (Gates 1989; Hershatter 2004). This kind of pressure may affect their time for doing PA, especially leisure-time activities. On the other hand, young Asian girls like the body image of being thin and white-skinned, therefore outdoor activities are strictly avoided. Thus, the relationship between PA and QoL could differ between men and women, especially in Asian society. So far, no nationwide data have demonstrated this issue to consider the cultural differences.

The purpose of this study was to explore the relationship between PA and QoL in people with different perceptions of health status as well as in different genders by using the national data of the Taiwan Social Change Survey. We hypothesized that QoL can be positively associated with PA but that the degree of association would vary by self-perceived health status and gender.

## Materials and Methods

Secondary data analysis was performed based on data obtained from the Taiwan Social Change Survey, a research project conducted in 2000 by the Institute of Sociology, Academia Sinica, Taiwan. The survey was carefully designed to control reliability and was administered nationwide.

Random stratified sampling was used in this survey. Trained investigators interviewed participants  $\geq 20$  years of age. After excluding those with missing values, 1643 participants (828 men, 815 women) were included and analyzed in our study. The mean age of participants was 43.94 years (SD = 14.41, range 20.58–91.50). The demography is presented in Table 1. We classified the participants into four groups: self-perceived unhealthy men ( $n = 81$ ), self-perceived healthy men ( $n = 747$ ), self-perceived unhealthy women ( $n = 145$ ), and self-perceived healthy women ( $n = 670$ ) based on their answers to one question in the survey: “How was your physical status in the past 2 weeks?”

The dependent variables in this study were the standardized scores of QoL, including items on mental health, physical health, and happiness. The independent variable was the Metabolic Equivalent of Task (MET), which is a PA indicator. The confounding factors in this study were age, income, smoking status, drinking status, and betel nut-eating status.

For measuring leisure-time PA, the answers to the following questions were used: “What kind of activities do you usually do when you are not at work?” Six items were tested by a four-point Likert scale (*usually, sometimes, seldom, never*): “Reading, photography, painting, writing (METs is 1.5),” “Listening to radio or music (METs is 1.5),” “Exercising, hill climbing, camping, fishing (METs is 3.5),” “Chess playing, card playing, small talking (METs is 1.5),” “Planting or animal raising (METs is 1.5),” “Aerobic exercise, hot bathing, gym exercising (METs is 6)” We first transformed these items into METs according to the average MET (Lin et al. 2004) in each item. Then, the METs in each item were multiplied by the frequencies (1–4 Likert Scale). Finally, we

**Table 1** Demographic characteristics of all the participants

	1. Unhealthy men ( <i>n</i> = 81)	2. Healthy men ( <i>n</i> = 747)	3. Unhealthy women ( <i>n</i> = 145)	4. Healthy women ( <i>n</i> = 670)	Scheffé post hoc, <i>p</i> < 0.05	Total ( <i>N</i> = 1643)
Age, mean years (SD) range	51.01 (14.57) 24.42–83.75	44.19 (14.82) 20.58–91.50	45.92 (15.59) 20.67–88.25	42.38 (13.34) 20.58–89.83	1 > 2, 4	43.94 (14.41) 20.58–91.50
Income, mean <sup>a</sup> (SD)	67,118 (52,245)	75,806 (48,335)	54,410 (40,046)	70,580 (43,683)	2, 4 > 3	71,357 (46,360)
Drinking status, %						
No	55.7	41.0	76.8	76.4		59.3
Yes	44.3	59.0	23.2	23.6		40.7
Smoking status, %						
No	51.7	47.2	94.7	96.0		71.5
Yes	48.3	52.8	5.3	4.0		28.5
Betel nut eater, %						
No	85.1	81.1	97.8	98.7		89.9
Yes	14.9	18.9	2.2	1.3		10.1
MET <sup>b</sup> , mean (SD) range	29.94 (8.64) 15.50–50.80	32.88 (8.45) 15.50–62.00	30.31 (8.55) 15.50–53.20	31.91 (8.94) 15.50–62.00	2 > 1, 3	32.11 (8.71) 15.50–62.00
Z-QoL <sup>c</sup> (SD) range	-2.84 (2.24) -7.91–1.71	0.64 (1.72) -5.35–3.94	-3.36 (2.39) -11.83–1.91	0.37 (1.82) -5.67–3.94	2 > 1, 3, 4; 4 > 3	0.00 (2.26) -11.83–3.94

<sup>a</sup>Total income of family (in new Taiwanese dollar)<sup>b</sup>Physical activity (METs, metabolic equivalents)<sup>c</sup>Standardized quality of life (QoL)

summed up the products of multiplication in the six items to represent a PA score during the participant's daily life. A higher score represented a greater amount of PA during the day.

For measuring QoL, we considered three dimensions: mental health, physical health, and happiness. Fifteen items on these three dimensions were used. In mental health, "Have you felt any of the following in the past 2 weeks?" were used, and the following 12 items were tested by four-point Likert scale (*never, as usual, more than usual, much more than usual*): "Headaches," "Palpitations or heart beating faster, and worried about having heart disease," "Chest discomfort," "Trembling or numbing over extremities," "Cannot sleep well," "Many things are burden to you," "Lacking confidence in yourself," "Hopelessness," "Nervous and uneasy, can't relax," "Worry caused by family and friends," "Can get along with family and friends," "Future seems very hopeful."

In physical health, two questions were used: "How was your physical status in the past 2 weeks? (four-point Likert scale: *good, not bad, a little bad, very bad*)" and "Do you feel (find) your daily activities, such as studying, working, or housework have been affected by physical discomfort or injury in the past 2 weeks? (four-point Likert scale: *never, a little affect, affect, affect a lot.*)" Finally, one question was used in happiness: "In one word, are you happy with life?" (three-point Likert scale: *very happy, happy, not happy.*) Because the number of items was not the same in the three dimensions, we standardized these scores for each dimension, and then summed up the standardized scores in the three dimensions to represent QoL. A higher standardized score represented a higher QoL.

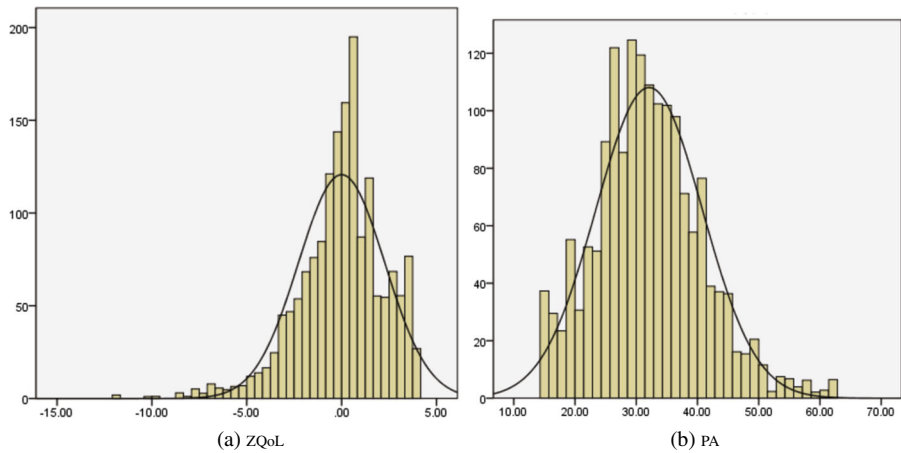
Hierarchical regression analysis was applied for investigating the relationship between QoL and other explanatory variables for the four groups: self-perceived unhealthy men, healthy men, self-perceived unhealthy women, and healthy women. The values of  $R^2$  were reported. PA was entered first, resulting in Models 1, 3, 5, and 7. Then, age, family income, current smoking status, current drinking status, and current betel nut-eating status were considered as confounding variables and were entered last, resulting in Models 2, 4, 6, and 8 to control for their effects. We also used Chow's law (Chow 1960) to compare different groups:

$$\frac{(S_c - (S_1 + S_2)) / (k)}{(S_1 + S_2) / (N_1 + N_2 - 2k)}$$

where  $S_c$  represents the overall residuals when combining two models;  $S_1$  and  $S_2$  represent the residual of one group and another;  $N_1$  and  $N_2$  represent the number of observations of one group and another, respectively;  $k$  represents the number of the parameters in the models compared. An F test with degree of freedom ( $df1 = 2k - 1$ ,  $df2 = N_1 + N_2 - df1$ ) was also used to test the statistical significance. All the data were analyzed by SPSS 13.0 and the significance level was set to be 0.05.

## Results

The means (SD) of QoL, PA, and demographic data are presented in Table 1. The skewness and kurtosis were  $-0.853$  and  $1.785$  in QoL,  $0.478$  and  $0.427$  in PA. Thus, the distributions of these variables were assumed as normal (Fig. 1).



**Fig. 1** Distributions of (a) the standardized quality of life (ZQoL) score and (b) physical activity (PA)

The correlations among PA, QoL, gender, age, and family income are presented in Table 2. As expected, PA and family income were all significantly positively correlated to QoL except for the group of self-perceived healthy women. Conversely, age was negatively significantly correlated to QoL in the group of self-perceived unhealthy men.

Hierarchical regression results are presented for men and women in Tables 3 and 4, respectively. It can be shown that before entering the confounding variables, PA was a significant contributor to QoL in all of the groups except for the self-perceived healthy women (Model 7). The regression coefficients of PA were positive, showing that

**Table 2** Correlations among quality of life (QoL), physical activity (PA), Age, and Family Income within four groups

	QoL	PA	Age
Unhealthy men ( <i>n</i> = 81)			
PA	0.296**		
Age	-0.210	-0.495**	
Family income	0.326**	0.427**	-0.465**
Healthy men ( <i>n</i> = 747)			
PA	0.109**		
Age	0.033	-0.187**	
Family income	0.110**	0.283**	-0.243**
Unhealthy women ( <i>n</i> = 145)			
PA	0.201*		
Age	-0.053	-0.410**	
Family income	0.231**	0.426**	-0.351**
Healthy women ( <i>n</i> = 670)			
PA	0.074		
Age	-0.044	-0.205**	
Family income	0.011	0.278**	-0.245**

\**p* < 0.05

\*\**p* < 0.01

**Table 3** Regression of quality of life (QoL) in men by physical activity (PA) and confounding variables

	Unhealthy men ( <i>n</i> = 81)		Healthy men ( <i>n</i> = 747)	
	Model 1	Model 2	Model 3	Model 4
	B(se) $\beta$	B(se) $\beta$	B(se) $\beta$	B(se) $\beta$
Intercept	-5.140(0.864)	-5.592(1.773)	-0.087(0.254)	-0.597(0.435)
PA	0.077(0.028) 0.296**	0.040(0.033) 0.155	0.022(0.007) 0.109**	0.014(0.008) 0.071*
Age		-0.005(0.019) -0.030		0.011(0.005) 0.090*
Family income		0.128(0.050) 0.276*		0.036(0.014) 0.102**
Drinking status <sup>a</sup>		0.110(0.361) 0.034		0.102(0.101) 0.040
Smoking status <sup>b</sup>		0.242(0.145) 0.191		-0.025(0.039) -0.026
Betel nut eating status <sup>c</sup>		0.229(0.569) 0.047		-0.063(0.141) -0.019
Model R <sup>2</sup>	0.088**	0.213**	0.012**	0.025**
Adjusted R <sup>2</sup>	0.076	0.150	0.011	0.017

\* $p < 0.05$ \*\* $p < 0.01$ <sup>a</sup> reference group: no drinking<sup>b</sup> reference group: no smoking<sup>c</sup> reference group: no betel nut eating

greater PA was associated with higher QoL. After controlling for the confounding variables, PA remained significant to QoL in the group of self-perceived healthy men and women (Models 4, 8) but non-significant in the unhealthy groups.

Investigating the difference between healthy and unhealthy groups, we found that PA explained 7 times more variation of QoL in Model 1 (unhealthy men) than Model 3 (healthy men) ( $F_{(3,822)} = 136.9690$ ,  $p < 0.01$ ); nearly 7 times more in Model 5 (unhealthy women) than Model 7 (healthy women) ( $F_{(3,809)} = 221.176$ ,  $p < 0.01$ ). These results show that although PA is a significant contributor to QoL, the degree of association is quite different between self-perceived healthy and unhealthy participants.

Furthermore, because family income significantly explains the variance of QoL in Models 2 and 6, we consider that an interaction effect may exist between PA and family income in self-perceived unhealthy people. Thus, we split the self-perceived unhealthy people into two groups: lower income group (less than 40,000 new Taiwanese dollars [NTD] a month) ( $n = 103$ ) and higher income group ( $n = 123$ ). The regression analyses showed that PA explains 1 % ( $p = 0.237$ ) variation of QoL in the lower income group and 13 % ( $p < 0.01$ ) in the higher income group. The explained variations are significantly different between the two groups ( $F_{(3,220)} = 10.763$ ,  $p < 0.01$ ).

**Table 4** Regression of quality of life (QoL) in women by physical activity (PA) and confounding variables

	Unhealthy women ( <i>n</i> = 145)		Healthy women ( <i>n</i> = 670)	
	Model 5	Model 6	Model 7	Model 8
	B(se) $\beta$	B(se) $\beta$	B(se) $\beta$	B(se) $\beta$
Intercept	-5.065(0.722)	-4.715(1.645)	-0.117(0.260)	0.634(0.689)
PA	0.056(0.023) 0.201*	0.034(0.025) 0.130	0.015(0.008) 0.074 <sup>#</sup>	0.018(0.008) 0.088*
Age		0.012(0.014) 0.086		-0.008(0.005) -0.061
Family income		0.116(0.052) 0.206*		-0.004(0.017) -0.010
Drinking status <sup>a</sup>		0.235(0.399) 0.058		-0.507(0.162) -0.126**
Smoking status <sup>b</sup>		0.084(0.323) 0.027		0.068(0.144) 0.019
Betel nut eating status <sup>c</sup>		-1.214(1.023) -0.111		0.088(0.561) 0.006
Model R <sup>2</sup>	0.041*	0.090*	0.006	0.021*
Adjusted R <sup>2</sup>	0.034	0.050	0.004	0.012

<sup>#</sup>  $p = 0.054$

\* $p < 0.05$

\*\* $p < 0.01$

<sup>a</sup> reference group: no drinking

<sup>b</sup> reference group: no smoking

<sup>c</sup> reference group: no betel nut eating

## Discussion

The results of our study suggest that leisure-time PA can positively explain QoL in the groups of self-perceived unhealthy men, healthy men, and unhealthy women. This finding is consistent with other studies that suggest that PA is a contributing factor to QoL (Jiang et al. 2004; Lan et al. 2006; Shimada et al. 2007; Wendel-Vos et al. 2004; Wolin et al. 2007). Our findings also show that leisure-time PA plays a much more important role in QoL for self-perceived unhealthy participants than healthy participants in both genders. The ratio of explained variance in leisure-time PA on QoL is 7 to 1 between the groups of self-perceived unhealthy and healthy men and women, respectively, suggesting that the relationship between leisure-time PA and QoL depends on the physical condition. If an individual is self-perceived as unhealthy, leisure-time PA seems to be a more important factor toward QoL in daily life than in the condition of self-perception as healthy. Therefore, self-awareness of the health condition is crucial. In the self-perceived unhealthy group, leisure-time PA explains much more of QoL than in the self-perceived healthy group. One reason may be that studies already show that PA is good for QoL among populations with chronic diseases (Milani et al. 1996; Rejeski and



Mihalko 2001; Ruhland and Shields 1997). Since physical ability is considered one of the dimensions of QoL, improvement of QoL in proportion to strengthened physicality after PA is quite natural (Morimoto et al. 2006).

Conversely, we found that if people think they are healthy, leisure-time PA may not be a priority. Instead, attending school, working, or other factors would be more important than leisure-time PA toward QoL (Ku et al. 2006). We suggest that there are two possible reasons: (a) self-perceived healthy people may have had less opportunity to feel the benefits from leisure-time PA than self-perceived unhealthy people, and (b) self-perceived healthy people may not have fully recognized the value of leisure-time PA. Studies have shown that self-perceived healthy people put more energy into their work rather than into PA just as youth and middle age people do (Ku et al. 2006; Lin et al. 2007), whereas self-perceived unhealthy people concentrate on their physical condition and develop the habit of an adequate level of PA just as people with chronic diseases (Lin et al. 2007). Thus, we consider that people without exercising habits may ignore the benefits from leisure-time PA or appreciate PA less. Hence, we are concerned that self-perceived healthy people will quit leisure-time PA easily when they think they are too busy. To prevent the consequences mentioned above, we suggest that helping self-perceived healthy people develop and strengthen their belief in leisure-time PA is necessary.

The present findings also suggest that leisure-time PA has a weak connection to QoL in self-perceived unhealthy people with lower family income. These people probably worry about their lives and thus limit their leisure-time PA due to financial problems. Therefore, we also recommend a policy of helping self-perceived unhealthy people engage in leisure-time PA without worrying about financial problems.

Finally, gender differences were found and, as expected, the results suggest that PA is not related to QoL in self-perceived healthy women (Model 7). Although women in Taiwan who may be physically active with traditional activities, such as housework and raising children, may not consider these kinds of PA as contributing to QoL (Dunn et al. 2004), thus causing a lower relationship between leisure-time PA and QoL than in men. Different genders are expected to have different expectations toward leisure-time PA (Fredricks and Eccles 2005; Lin et al. 2007). For example, parents perceive that sports or exercise is more important for their sons than for their daughters (Fredricks and Eccles 2005). In addition, boys gain higher levels of achievement and competence from exercise and sports than girls (Fredricks and Eccles 2005; Lin et al. 2007). Thus, different genders will have different feelings toward PA, resulting in different levels of association of leisure-time PA with QoL. In addition, different attitudes toward leisure-time PA may cause the different meanings of leisure-time PA toward QoL. One study showed that men practice leisure-time PA because of enjoyment, whereas women practice leisure-time PA because of the recommendation of physicians (Azevedo et al. 2007). Thus, we suggest that men would get more benefits from PA in their QoL than women. Furthermore, we suggest that in traditional Chinese culture, women are expected to obey standard conventions, which restrict them from doing any form of leisure-time PA in which they are interested (Gates 1989; Hershatter 2004); however, studies have suggested that PA is good for women (Carlsson et al. 2006; Lin et al. 2007). Thus, we suggest that encouraging women to engage in PA based only on the reason of maintaining physical health is not the best policy; because women may not enjoy leisure-time PA and reduce the benefits (Azevedo et al. 2007). Moreover, women

**Table 5** Regression of quality of life (QoL) in men by physical activity (PA) and confounding variables

	Unhealthy men ( <i>n</i> = 81)		Healthy men ( <i>n</i> = 747)	
	Model 1	Model 2	Model 3	Model 4
	B(se) $\beta$	B(se) $\beta$	B(se) $\beta$	B(se) $\beta$
Intercept	-5.281(1.002)	-6.538(2.211)	0.041(0.245)	-0.650(0.483)
PA	0.105(0.032) 0.344**	0.048(0.038) 0.156	0.015(0.007) 0.075*	0.010(0.008) 0.053
Age		-0.008(0.021) -0.047		0.012(0.004) 0.104**
Family income		0.154(0.058) 0.306**		0.037(0.014) 0.106**
Drinking status <sup>a</sup>		0.564(0.584) 0.107		0.245(0.133) 0.072
Smoking status <sup>b</sup>		0.794(0.573) 0.151		-0.094(0.133) -0.028
Betel nut eating status <sup>c</sup>		0.338(0.835) 0.046		-0.175(0.171) -0.041
Model R <sup>2</sup>	0.118**	0.247**	0.006*	0.030**
Adjusted R <sup>2</sup>	0.107	0.186	0.004	0.022

\**p* < 0.05\*\**p* < 0.01

QoL was calculated without using item "How was your physical status in the past 2 weeks?"

<sup>a</sup> reference group: no drinking<sup>b</sup> reference group: no smoking<sup>c</sup> reference group: no betel nut eating

in Taiwan may resist doing exercise because of the muscular effects after exercise. Since a muscular body may conflict with the beauty of slim and slender in the East (Shih and Kubo 2005), women in Taiwan may consequently lose interests in engaging in leisure-time PA. Thus, helping women in Taiwan find the fun aspect of leisure-time PA and supporting them to feel pleasure, playfulness, and achievement when they are doing PA can let women gain more advantages from PA. Exercise programs with fun are warranted, especially fitness programs that will not make them muscular.

There were some limitations in our study. First, our QoL was not measured by standardized instruments and our measure of QoL may not encompass all aspects of QoL. Second, in our study, QoL was easily influenced by some daily life events, such as car accidents or cancer, and we could not control for these negative events as the research project was not designed for these types of research questions. Third, PA was measured by a subjective questionnaire and could be biased or subject to mistaken memory (Lin et al. 2013). We suggest a program designed to be conducted which contains a standardized QoL questionnaire, objective measures of PA, and that includes daily life events. Furthermore, a longitudinal study could be better than a cross-sectional study. This will help us understand better how PA contributes to QoL.

**Table 6** Regression of quality of life (QoL)<sup>a</sup> in women by physical activity (PA) and confounding variables

	Unhealthy women ( <i>n</i> = 145)		Healthy women ( <i>n</i> = 670)	
	Model 5	Model 6	Model 7	Model 8
	B(se) β	B(se) β	B(se) β	B(se) β
Intercept	-4.774(0.771)	-2.346 (2.120)	-0.202(0.255)	0.319(0.779)
PA	0.065(0.024) 0.217**	0.034(0.028) 0.112	0.016(0.008) 0.078*	0.018(0.008) 0.088*
Age		0.002(0.016) 0.015		-0.009(0.005) -0.066
Family income		0.131(0.059) 0.204*		0.002(0.017) 0.005
Drinking status <sup>b</sup>		0.365(0.581) 0.060		-0.505(0.171) -0.120**
Smoking status <sup>c</sup>		-0.063(1.133) -0.006		0.015(0.367) 0.002
Betel nut eating status <sup>d</sup>		-2.622(1.603) -0.150		0.380(0.635) 0.024
Model R <sup>2</sup>	0.047**	0.108*	0.006*	0.021*
Adjusted R <sup>2</sup>	0.040	0.069	0.005	0.012

\**p* < 0.05\*\**p* < 0.01<sup>a</sup> QoL was calculated without using item “How was your physical status in the past 2 weeks?”<sup>b</sup> reference group: no drinking<sup>c</sup> reference group: no smoking<sup>d</sup> reference group: no betel nut eating

Fourth, although we controlled for important confounders such as age and healthy behaviors, some factors such as education and marital status were not adjusted in analysis due to lack of such information in our derived dataset. This may somewhat explain our low values of R<sup>2</sup> in the regression models. Therefore, future studies are needed to adjust for these potential confounders. Fifth, our dataset was relatively old (launched in 2000), and our results may be biased because the lifestyles and PA may have been changed over time. However, our results may not be seriously biased because we investigated the relationship between PA and QoL, instead of the performances of PA and QoL (e.g., the intensity and pattern of the PA, the QoL level). We justified that if the relationships between QoL and PA exist in the dataset, the relationships might not be changed just as the relationship between PA and weight status is consistent across different eras. Especially, Taiwan has been become a developed country in 1998 based on the gross domestic product (GDP), and the government has made policies for engaging in leisure-time PA for Taiwanese. Despite our justifications, we suggest that future studies with a contemporary dataset are warranted to corroborate our findings. Lastly, some may argue that using a sub-variable of our dependent variable (i.e., QoL) to stratify our sample is not adequate; hence, we re-analyzed our regression models using QoL measured without the item for

stratification (i.e., “How was your physical status in the past 2 weeks?”). The results were similar to those from our primary analyses (Tables 5 and 6).

The findings of the present study can be used by policymakers to develop strategies supporting self-perceived unhealthy people to engage in leisure-time PA. Since our findings indicate that finances could be a factor influencing the association between PA and QoL in self-perceived unhealthy people, we suggest that the government’s building up a system of leisure-time PA for public use can resolve some of the financial problems. Also, policymakers can use the present study as evidence to encourage adults in Taiwan—especially self-perceived healthy individuals—to change their lifestyles, to stay alert to their health condition, to keep doing exercise to prevent negative consequences of declining physical health. The reason we should encourage the self-perceived healthy population to value leisure-time PA is to prevent them from taking their healthy condition for granted. If they do not value the importance of PA, they may easily give up doing leisure-time PA with a moderate to vigorous level of intensity, resulting in the consequence of their physical condition declining. Policymakers may also want to use our study results to encourage women to design their own leisure-time PA that benefits them.

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## References

- Azevedo, M. R., Araújo, C. L. P., Reichert, F. F., Siqueira, F. V., da Silva, M. C., & Hallal, P. C. (2007). Gender differences in leisure-time physical activity. *International Journal of Public Health, 5*, 8–15.
- Berlin, J. A., & Colditz, G. A. (1990). A meta-analysis of physical activity in the prevention of coronary heart disease. *American Journal of Epidemiology, 132*(4), 612–629.
- Bracegirdle, H. (2002). Developing physical fitness to promote mental health. In J. Creek & L. Lougher (Eds.), *Occupational Therapy and Mental Health* (pp. 209–225). Philadelphia: Churchill, Livingstone.
- Carlsson, S., Andersson, T., Wolk, A., & Ahobom, A. (2006). Low physical activity and mortality in women: baseline lifestyle and health as alternative explanations. *Scandinavian Journal of Public Health, 34*(5), 480–487.
- Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports, 100*(2), 126–131.
- Chang, K.-C., & Lin, C.-Y. (2015). Effects of publicly funded and quality of life on attendance rate among methadone maintenance treatment patients in Taiwan: an 18-month follow-up study. *Harm Reduction Journal, 12*, 40.
- Chen, H.-M., & Chao, Y.-F. (2002). Change in quality of life in patients with permanent cardiac pacemakers: a six-month follow-up study. *Journal of Nursing Research, 10*(2), 143–150.
- Chow, G. (1960). Tests of equality between sets of coefficients in two linear regression. *Econometrica, 28*(3), 591–605.
- Dagmar, S., Erik, S., Karel, F., & Aleš, S. (2011). Gender differences in physical activity, sedentary behavior and BMI in the Liberec region: the IPAQ Study in 2002–2009. *Journal of Human Kinetics, 28*, 123–131.
- Dishman, R. K. (2003). The impact of behavior on quality of life. *Quality of Life Research, 12*(S1), 43–49.

- Dishman, R. K., & Buckworth, J. (1996). Increasing physical activity: a quantitative synthesis. *Medicine and Science in Sports and Exercise*, 28(6), 706–719.
- Dunn, J. R., Walker, J. D., Graham, J., & Weiss, C. B. (2004). Gender differences in the relationship between housing, socioeconomic status, and self-reported health status. *Reviews on Environmental Health*, 19(3–4), 177–195.
- Fox, K. R., Stathi, A., McKenna, J., & Davis, M. G. (2007). Physical activity and mental well-being in older people participating in the Better Ageing Project. *European Journal of Applied Physiology*, 100(5), 591–602.
- Fredricks, J. A., & Eccles, J. S. (2005). Family socialization, gender, and sport motivation and involvement. *Journal of Sports and Exercise Psychology*, 27, 3–31.
- Gates, H. (1989). The commoditization of Chinese women. *Signs*, 14(4), 799–832.
- Guthold, R., Cowan, M. J., Autenrieth, C. S., Kann, L., & Riley, L. M. (2010). Physical activity and sedentary behavior among schoolchildren: a 34-country comparison. *Journal of Pediatrics*, 157(1), 43–49.
- Hershatter, G. (2004). State of the field: women in China's long twentieth century. *The Journal of Asian Studies*, 63(4), 991–1065.
- Jiang, J., Tang, Z., Futatsuka, M., & Zhang, K. (2004). Exploring the influence of depressive symptoms on physical disability: a cohort study of elderly in Beijing, China. *Quality of Life Research*, 13(7), 1337–1346.
- Kaletka, D., Makowiec-Dabrowska, T., Dzionkowska-Zaborszczyk, E., & Jegier, A. (2006). Physical activity and self-perceived health status. *International Journal of Occupational Medicine and Environmental Health*, 19(1), 61–69.
- Kostka, T., & Bogus, K. (2007). Independent contribution of overweight/obesity and physical inactivity to lower health-related quality of life in community-dwelling older subjects. *Zeitschrift für Gerontologie und Geriatrie*, 40(1), 43–51.
- Ku, P.-W., Fox, K. R., McKenna, J., & Peng, T. L. (2006). Prevalence of leisure-time physical activity in Taiwanese adults: results of four national surveys, 2000–2004. *Preventive Medicine*, 43(6), 454–457.
- Lan, T.-Y., Chang, H.-Y., & Tai, T.-Y. (2006). Relationship between components of leisure physical activity and mortality in Taiwanese older adults. *Preventive Medicine*, 43(1), 36–41.
- Lee, Y. (2000). The predictive value of self assessed general, physical, and mental health on functional decline and mortality in older adults. *Journal of Epidemiology and Community Health*, 54, 123–129.
- Lin, J.-C., Wang, S. C., & Wu, C. F. (2004). *The referenced study of daily physical activity levels and energy expenditure* (p. 28). Taipei, Taiwan: Department of Health, Bureau of Health Promotion. [In Chinese].
- Lin, Y.-C., Wen, C.-P., & Wai, J. P.-M. (2007). Leisure-time physical activity and its association with health behaviors, health status and health-related quality of life among Taiwanese adults. *Taiwan Journal of Public Health*, 26(3), 218–228  
[In Chinese].
- Lin, C.-Y., Su, C.-T., & Ma, H.-I. (2012). Physical activity patterns and quality of life of overweight boys: a preliminary study. *Hong Kong Journal of Occupational Therapy*, 22, 31–37.
- Lin, C.-Y., Yang, A.-L., & Su, C.-T. (2013). Objective measurement of weekly physical activity and sensory modulation problems in children with attention deficit hyperactivity disorder. *Research in Developmental Disabilities*, 34, 3477–3486.
- Milani, R. V., Lavie, C. J., & Cassidy, M. M. (1996). Effects of cardiac rehabilitation and exercise training programs on depression in patients after major coronary events. *American Heart Journal*, 132(4), 726–732.
- Morimoto, T., Oguma, Y., Yamazaki, S., Sokejima, S., Nakayama, T., & Fukuhara, S. (2006). Gender differences in effects of physical activity on quality of life and resource utilization. *Quality of Life Research*, 15(3), 537–546.
- Okano, G., Miyake, H., & Mori, M. (2003). Leisure time physical activity as a determinant of self-perceived health and fitness in middle-aged male employees. *Journal of Occupational Health*, 45(5), 286–292.
- Panagiotakos, D. B., Pitsavos, C., Lentzas, Y., Skoumas, Y., Papadimitriou, L., Zeimbekis, A., et al. (2008). Determinants of physical inactivity among men and women from Greece: a 5-year follow-up of the ATTICA study. *Annals of Epidemiology*, 18(5), 387–394.
- Piko, B. F. (2007). Self-perceived health among adolescents: the role of gender and psychosocial factors. *European Journal of Pediatrics*, 166(7), 701–708.
- Rejeski, W. J., & Mihalko, S. L. (2001). Physical activity and quality of life in older adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 56(2), 23–35.
- Rothberg, A. E., McEwen, L. N., Kraftson, A. T., Neshewat, G. M., Fowler, C. E., Burant, C. F., et al. (2014). The impact of weight loss on health-related quality-of-life: implications for cost-effectiveness analyses. *Quality of Life Research*, 23(4), 1371–1376.

- Ruhland, J. L., & Shields, R. K. (1997). The effects of a home exercise program on impairment and health-related quality of life in persons with chronic peripheral neuropathies. *Physical Therapy, 77*(10), 1026–1039.
- Shih, M.-Y., & Kubo, C. (2005). Body shape preference and body satisfaction of Taiwanese and Japanese female college students. *Psychiatry Research, 133*(2–3), 263–271.
- Shimada, H., Lord, S. R., Yoshida, H., Kim, H., & Suzuki, T. (2007). Predictors of cessation of regular leisure-time physical activity in community-dwelling elderly people. *Gerontology, 53*(5), 293–297.
- Su, C.-T., Wang, J.-D., & Lin, C.-Y. (2013). Child-rated versus parent-rated quality of life of community-based obese children across gender and grade. *Health and Quality of Life Outcomes, 11*, 206.
- Sundquist, J., & Johannson, S. E. (1997). Self reported poor health and low educational level predictors for mortality: a population based follow up of 39,156 people in Sweden. *Journal of Epidemiology and Community Health, 51*, 35–40.
- Wendel-Vos, G. C. W., Schuit, A. J., Tijhuni, M. A., & Kromhout, D. (2004). Leisure time physical activity and health-related quality of life: cross-sectional and longitudinal associations. *Quality of Life Research, 13*(3), 667–677.
- Wolin, K. Y., Glynn, R. J., Colditz, G. A., Lee, I.-M., & Kawachi, I. (2007). Long-term physical activity patterns and health-related quality of life in U.S. women. *American Journal of Preventive Medicine, 32*(6), 490–499.