Neighborhood environment, physical activity, and quality of life in adults: Intermediary effects of personal and psychosocial factors

Eleni Theodoropoulou *, Nektarios A.M. Stavrou, Konstantinos Karteroliotis

School of Physical Education and Sport Science, National and Kapodistrian University of Athens, Athens 17237, Greece

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Abstract

Background: Studies have indicated that there is a positive and indirect relationship between physical activity (PA) and quality of life (QoL). The current study examined this relationship through a social cognitive model with consideration to the intermediary effects of exercise self-efficacy, and physical (PCS) and psychological (MCS) health. Additionally, this model was widened to include concepts from the ecological theory, and any causal associations among neighborhood environment, PA, and QoL.

Methods: Six hundred and eighty-four physically active adults (39.16 ± 13.52 years, mean ± SD), living in Athens, Greece, completed a series of questionnaires measuring PA, QoL, exercise self-efficacy, PCS, MCS, neighborhood environment, and family and friend support for PA. The examined models were analyzed using structural equation modeling.

Results: The social cognitive and ecological models proved to be of appropriate fit. Within the social cognitive model, PA positively affected QoL through the mediating effects of exercise self-efficacy, PCS, and MCS. With regards to the ecological model, neighborhood environment positively influenced QoL through the intermediary effects of family support for PA, exercise self-efficacy, PA, PCS, and MCS.

Conclusion: Results indicated that the most important mediators in the examined models were exercise self-efficacy and health. Further, findings demonstrated the role of neighborhood environment in enhancing PA and QoL. Future studies should be carried out applying longitudinal data for a better understanding of these associations over time.

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Keywords: Cognitive; Ecological; Health; Self-efficacy; Structural equation modeling

1. Introduction

During the last 20 years there has been an increasing research interest on the prediction of quality of life (QoL). QoL consists a multidimensional concept incorporating factors such as personal health, social relationships, perceived happiness, family life, occupational satisfaction, and environmental connection. In particular, social researchers have defined QoL as a cognitive judgment of satisfaction with one’s life. Lately, various scientists have replaced the term QoL with health-related QoL, focusing on the effects of illnesses or other variables on one’s perceived health status. Despite the different definitions of QoL, it is common that QoL has been associated with various factors, such as physical and psychological health, social function, well-being, and satisfaction with life. Further, several studies have demonstrated that participation in physical activity (PA) is an effective intervention for increasing and maintaining QoL. Specifically, Sorensen et al. indicated that participation in a 4-month exercise program increased QoL. In line with this, Wolin et al. have longitudinally examined 63.152 women aged 40–67 years old, and observed that increases in PA were associated with an improvement in QoL.

The well-established positive relationship between PA and QoL has led to an examination of possible mediators that may explain this association. Specifically, PA has been positively associated with QoL, which was defined as satisfaction with one’s life, through the intermediary effects of exercise self-efficacy, physical (PCS) and psychological (MCS) health, and positive affect. In particular, Elavsky et al. observed that PA positively influenced QoL through the mediating effects of exercise self-efficacy, and positive affect. However, this causal
model accounted for only 12% of the variance in QoL. Higher percentages of the variance in QoL have been found in other studies including health status as a mediator.\textsuperscript{12–14} More specifically, McAuley et al.\textsuperscript{12,13} have examined a social cognitive model, and demonstrated that PA positively affected exercise self-efficacy, which positively influenced PCS and MCS. In turn, PCS and MCS had positive effects on QoL.\textsuperscript{12,13} For the development of these models both the social cognitive theory and the value that individuals place on PA were considered, as they play an important role in QoL outcomes.\textsuperscript{2,5,12–15}

Apart from the aforementioned models, recently the associations among neighborhood environment, PA, PCS, and MCS have been examined.\textsuperscript{16} Results have shown that neighborhood environment, which serves as an important concept in the ecological theory, was positively related to the PA, PCS, and MCS. Additionally, PA was supported to be a possible mediator in the relationship between neighborhood environment, PCS, and MCS.\textsuperscript{16} This hypothesis could be supported by data that proved the positive associations between neighborhood environment and PA,\textsuperscript{17} and also among PA, health status, and QoL.\textsuperscript{12,13} In particular, Ishii et al.\textsuperscript{17} have examined a model of the relationship between neighborhood environment and PA, in which they found: (a) direct positive effects of neighborhood environment on PA, (b) indirect positive effects of neighborhood environment on PA through the intermediary roles of social support for PA and exercise self-efficacy, and (c) direct positive effect of exercise self-efficacy on PA. In addition, positive associations among neighborhood environment, PCS, and MCS have been observed.\textsuperscript{9,16} As far as the effects among PA, exercise self-efficacy, PCS, MCS, and QoL were concerned, these associations were well established.\textsuperscript{12–13} Therefore, it could be hypothesized that neighborhood environment on the one hand is positively associated with PA through the intermediary roles of social support for PA and exercise self-efficacy, and on the other hand is positively related to PCS and MCS. PA seems to enhance PCS and MCS, which in turn increase QoL.

The aforementioned concepts have not been examined within the context of the same theoretical model so far. Similarly, neighborhood environment, social support, and ecological theory have not been used in tandem regarding an examination of the PA and QoL relationship. In particular, an ecological model of the association between neighborhood environment, PA, and QoL including the mediating effects of social factors, such as family and friend support for PA has not been examined so far in the literature. Therefore, the purpose of the current study is twofold. First, it aims to examine further the social cognitive model of PA and QoL proposed by McAuley et al.\textsuperscript{13} testing its adequacy to fit in a different sample. The second purpose is to evaluate the usefulness of an ecological model of neighborhood environment, PA, and QoL. Specifically, the model proposed by McAuley et al.\textsuperscript{13} was widened including concepts from the ecological theory\textsuperscript{17} with the aim to examine a model including associations between neighborhood environment and QoL. In the ecological model, the intermediary effects of family and friend support for PA, exercise self-efficacy, PA, PCS, and MCS were assessed. An original aspect of this study was the investigation of the model with the best fit of the collected data.

2. Materials and methods

2.1. Participants’ recruitment and sample size calculation

The sample’s selection met the following criteria: (a) participation in PA because the importance that individuals place on PA is a moderator of PA and QoL relationship,\textsuperscript{5} and (b) 18–65 years old to exclude older adults and adolescents. In particular, the sample that was not randomly selected consisted of 752 participants who agreed to complete the questionnaires. They participated in various exercise programs in the sport facilities of the Municipality of Athens. Due to listwise deletion both of missing values and outliers, 684 participants consisting of 206 men (30.12%) and 478 women (69.88%) aged 39.16 ± 13.52 years (mean ± SD) were used for the analyses.

The sample size was calculated using the criterion of 10 participants per item (10:1 ratio).\textsuperscript{19} Further, a statistical algorithm calculating sample size in structural equation modeling was used (www.danielsoper.com).\textsuperscript{17} The sample size definition was calculated based on the following criteria: (a) a power of 0.8, (b) an effect size of 0.1, and (c) a significant level of 0.5.\textsuperscript{19}

2.2. Assessments

2.2.1. PA

PA was measured using the International Physical Activity Questionnaire (IPAQ) short form.\textsuperscript{20} The IPAQ-short form, having 7 days recall period, consists of 6 items assessing exercise frequency and duration and one item measuring sedentary behavior. The 6 items evaluated the following PA indexes: walking PA, moderate PA, vigorous PA, and total PA. The PA indexes are expressed in MET – minutes per week and are calculated as duration × frequency per week × MET intensity. The total PA index was calculated by adding the walking PA, the moderate PA, and the vigorous PA indexes.\textsuperscript{20} Validity and reliability of the IPAQ were well established, and verified for its Greek version.\textsuperscript{20–22}

2.2.2. QoL

The Satisfaction with Life Scale (SWLS) was used to assess QoL.\textsuperscript{4} The SWLS consists of the following five items: “in most ways my life is close to my ideal”, “the conditions of my life are excellent”, “I am satisfied with my life”, “so far I have gotten the important things I want in my life”, and “if I could live my life over, I would change almost nothing”. Each item was rated on a 7-point scale with higher values representing better life satisfaction. All items constituted one factor. Pavot and Diener\textsuperscript{5} have reported satisfactory factorial and construct validity as well as acceptable internal consistency ($\alpha = 0.80–0.89$), and test–retest reliability ($r = 0.64–0.84$) of the SWLS.\textsuperscript{5} In line with this, the psychometric properties examination of the Greek SWLS version indicated acceptable factorial validity, internal consistency ($\alpha = 0.90–0.93$), and test–retest reliability (ICC = 0.77).\textsuperscript{23}

2.2.3. Exercise self-efficacy

Exercise self-efficacy was estimated using a 5-item Self-Efficacy Scale.\textsuperscript{24} This scale was designed to estimate one’s belief in his/her ability to persist in exercising under the following adverse situations: tired, bad mood, not having time, on...
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vacation, and raining or snowing. The validity as well as the internal consistency (\(\alpha = 0.76\)), and test–retest reliability (\(r = 0.90\)) of the scale are well established.24 Recent research findings demonstrated that the Greek version of the Self-Efficacy Scale had sufficient factorial validity and reliability (\(\alpha = 0.83–0.87, \text{ICC} = 0.96\)).25

2.2.4. PCS and MCS

The Short Form 36 (SF-36) Health Survey26,27 is a questionnaire consisting of 36 items that evaluate eight first-order factors: physical functioning, role disability due to physical problems (physical role), bodily pain, general health perceptions (general health), vitality, social functioning, role disability due to emotional problems (emotional role), and mental health. These first-order factors can be grouped under two second-order factors that were used in the current statistical analyses: PCS and MCS. In the current study, the eight first-order factors’ scores were transformed into eight factors’ scores using the equations proposed by Ware et al.25 PCS and MCS second-order factors were calculated through confirmatory factor analytic procedure using the first-order factors’ scores.27,28 Finally, recent studies proposed the existence of a valid and reliable Greek version of the SF-36 Health Survey.29,30

2.2.5. Neighborhood environment

Regarding Ishii et al.’s17 theoretical work, the neighborhood environment was evaluated based on five items: “I possess home fitness equipment”, “my neighborhood provides facilities (e.g., walking trail, park, fitness club) for PA”, “my neighborhood provides a safe and well-maintained environment (e.g., adequate lighting and sidewalks) for PA”, “I have access to enjoyable scenery when engaging in PA”, and “I frequently observe other people exercising”. A recent study demonstrated that the Greek version of the Neighbourhood Environment Scale was valid and reliable (\(\alpha = 0.84–0.86, \text{ICC} = 0.87\)).31

2.2.6. Family support for PA

The Family Support for Exercise Behaviour Scale (FaSEBS) was administered for the assessment of family support for PA.32 The FaSEBS consisted of 15 items (e.g., “my family exercised with me”, “gave me encouragement to stick with my exercise program”, “changed their schedule so we could exercise together”). Satisfactory construct validity, internal consistency (\(\alpha = 0.91\)), and test–retest reliability (\(r = 0.77\)) were established for FaSEBS.32 In line with this, a recent study indicated acceptable construct validity, internal consistency (\(\alpha = 0.85–0.91\)), and test–retest reliability (\(\text{ICC} = 0.89–0.93\)) for the FaSEBS Greek version.33 Particularly, the Greek version contained 12 items that constituted two factors named the “family support for exercise” and “family participation in exercise”.33

2.2.7. Friend support for PA

Friend support for PA was estimated using the Friend Support for Exercise Behaviour Scale (FrSEBS).33 The FrSEBS consists of five items, asking participants if their friends exercised with them, offered to exercise with them, gave them helpful reminders to exercise, gave them encouragement to stick with their exercise program, and changed their schedule so they could exercise together. The FrSEBS construct validity, internal consistency (\(\alpha = 0.84\)), and test–retest reliability (\(r = 0.79\)) were satisfactory.33 Recent study demonstrated acceptable validity, internal consistency (\(\alpha = 0.86–0.91\)), and test–retest reliability (\(\text{ICC} = 0.90\)) for the Greek version of FrSEBS.13

2.3. Ethical approval, study design, and procedure

This cross-sectional study was approved by the National and Kapodistrian University of Athens’ Ethical Committee, and was carried out from February to May in 2012. An experienced research group visited the sport facilities and informed individuals about the purpose and the procedure of the study. Participants who agreed to participate in the study signed the consent form and filled in the questionnaires.

2.4. Statistical analyses

Means, medians, standard deviations, frequencies, sums, skew, kurtosis, and normality tests were conducted using the SPSS 17.0 statistical software (SPSS Inc., Chicago, IL, USA).

2.4.1. Model testing

The hypothesized models were examined following two steps: (a) confirmatory factor analysis (CFA) for assessing the fit of the measurement models, and (b) structural equation modeling (SEM) for testing the fit of the structural models.13,34 Analyses were performed using the AMOS 16.0 statistical software (AMOS Development Corporation, Chicago, IL, USA).

2.4.2. CFA

Separate CFA employing maximum likelihood estimation were conducted in order to examine the factorial validity of the SWLS, Exercise Self-Efficacy Scale, SF-36 Health Survey, Neighbourhood Environment Scale, and Family and Friend Support for PA Scales. Appropriateness of the items was based on the criteria of skewness (±2), kurtosis (±2.5), Mardia’s coefficient (<p (p + 2), p = number of instrument items), factor loadings (>0.40), and correlation matrix (<0.90).13,35 In addition, internal consistency was estimated using the Cronbach’s \(\alpha\) coefficient.13

2.4.3. SEM

SEM utilizing maximum likelihood estimation and bootstrapping procedures was conducted to assess the fit of the two structural models.13,34 In particular, the social cognitive model (Fig. 1) proposed by McAuley et al.13 specified a direct effect of PA on exercise self-efficacy, which directly affected PCS and MCS. In turn, PCS and MCS had direct paths on QoL (SWLS).

Further, as Fig. 2 proposes, the ecological model specified direct paths of neighborhood environment on family and friend support, PA, PCS, and MCS. Family and friend support for PA directly affected exercise self-efficacy, which had direct paths on PA, PCS, and MCS. PA directly influenced exercise self-efficacy, PCS, and MCS. Therefore, the relationship between exercise self-efficacy and PA was bidirectional, based on studies showing that both PA affected exercise self-efficacy,13 and the latter influenced PA.17 In turn, direct paths of PCS and MCS on QoL (SWLS) were specified. Regarding the development of this model, neighborhood environment as well as
family and friend support for PA constituting concepts of the ecological theory were added in the model proposed by McAuley et al., in accordance with recent studies. Therefore, the aforementioned structural models were considered as hierarchical.

2.4.4. Model fit

Assessment of models fit was based on the chi-square test ($\chi^2$), the Satorra–Bentler $\chi^2/df$ ratio, and the root mean square error of approximation (RMSEA). Non-significant values of $\chi^2$ and values of $\chi^2/df$ ratio smaller than 3.0 indicate acceptable fit. RMSEA values lower than 0.05 represent close fit, between 0.05 and 0.08 indicate acceptable fit, whereas RMSEA values greater than 0.08 represent poor fit. Further, assessment of models fit was based on the following indexes: (a) Comparative Fit Index (CFI), (b) Goodness-of-Fit Index (GFI), (c) Incremental Fit Index (IFI), and (d) Tucker and Lewis Index (TLI). CFI, GFI, IFI, and TLI values approximating 1.0 indicate perfect fit, whereas values above 0.90 represent acceptable fit. Finally, differences ($\Delta$) between the structural models in the $\chi^2/df$ ratio ($\chi^2/df_0$) and in CFI ($CFI_0$) were examined to find the model with the best fit. Significant differences between them in the $\chi^2/df$ ratio, and differences higher than the value of $-0.01$ between the models in CFI indicated significant differences. For finding the differences between the models in the $\chi^2/df$ ratio, the statistical software SBDIFF.EXE (University of Aberdeen, Aberdeen, UK) was used.

3. Results

3.1. Descriptive statistics and sample size calculation

In total, 2.20% of sample participated in light intensity PA, 72.95% participated in moderate PA, while 24.85% participated in vigorous PA. The mean value of sedentary life was 5.57 ± 3.02 h/day (mean ± SD). Additionally, initial analysis indicated non-normal distributions for the total PA index and the scores of the 8 first-order factors of the SF-36 Health Survey. Therefore, the values were transformed using square root and logarithmic functions to solve the problem of non-normal distributions.

Regarding the sample size, the ratio of participants’ number to observed variables was higher than the 10:1 ratio, as it was 42.75:1 for the social cognitive model, and 20.73:1 for the ecological model. In line with the above, the number of participants was higher than the recommended sample size for both models’ structure ($N_{soc/cognitive} = 100$, $N_{ecological} = 90$), and significant effects’ identification ($N_{soc/cognitive} = 387$, $N_{ecological} = 579$).

3.2. CFA results

3.2.1. SWLS (QoL)

The SWLS Mardia’s coefficient (2.65) supported the multivariate normality. The measurement model provided a good fit ($\chi^2 = 43.282$, $df = 5$, $p = 0.000$, $\chi^2/df = 8.656$, $CFI = 0.978$, $GFI = 0.974$, $IFI = 0.978$, $TLI = 0.956$) apart from RMSEA value (0.106). Therefore, an alternative model was examined setting a pair of correlated errors between items 2 and 3 based on their conceptual similarity. The alternative model represented a better fit to the data ($\chi^2 = 21.320$, $df = 4$, $p = 0.000$, $\chi^2/df = 5.330$, $CFI = 0.990$, $GFI = 0.987$, $IFI = 0.990$, $TLI = 0.975$, $RMSEA = 0.070$). Further, the better fit of the alternative model was confirmed by the differences between the models in CFI ($CFI_0 = -0.01$), and $\chi^2/df$ ratio ($\chi^2/df_0 = 4.14$, $df_0 = 1$, $p < 0.05$). The Cronbach’s $\alpha$ of the SWLS was 0.88.

3.2.2. Exercise self-efficacy scale

The Mardia’s coefficient (2.87) of the scale indicated multivariate normality. The measurement model demonstrated an
adequate factorial validity ($\chi^2 = 16.668$, $df = 5$, $p = 0.005$, $\chi^2/df = 3.334$, $CFI = 0.993$, $GFI = 0.990$, $IFI = 0.993$, $TLI = 0.987$, $RMSEA = 0.058$). The Cronbach’s $\alpha$ of this scale was 0.88.

### 3.2.3. SF-36 Health Survey

The Mardia’s coefficient of the SF-36 Health Survey showed multivariate non normality, and CFA was conducted applying bootstrapping with the Bollen–Stine approach. Three hypothesized hierarchical models were examined. In the first model, physical functioning, physical role, bodily pain, and general health subscales constitute the PCS factor, whereas vitality, social functioning, emotional role, and mental health subscales comprised the MCS factor. This model provided a poor fit ($\chi^2 = 46.517$, $df = 19$, $p = 0.005$, $\chi^2/df = 2.448$, $CFI = 0.847$, $GFI = 0.913$, $IFI = 0.884$, $TLI = 0.775$, $RMSEA = 0.132$). In the second model, the PCS factor consisted of the physical functioning, physical role, and bodily pain subscales, the MCS factor was composed of the social functioning, emotional role, and mental health subscales, whereas the well-being factor consisted of the general health and vitality subscales. This model also represented a poor fit ($\chi^2 = 33.516$, $df = 17$, $p = 0.005$, $\chi^2/df = 1.972$, $CFI = 0.871$, $GFI = 0.924$, $IFI = 0.872$, $TLI = 0.788$, $RMSEA = 0.128$). Finally, a 2-factor model was tested, in which the physical functioning, physical role, and bodily pain subscales constitute the PCS factor, whereas the emotional role, and mental health subscales constitute the MCS factor. This model demonstrated the best fit ($\chi^2 = 2.521$, $df = 2$, $p = 0.075$, $\chi^2/df = 1.261$, $CFI = 0.991$, $GFI = 0.996$, $IFI = 0.991$, $TLI = 0.955$, $RMSEA = 0.063$). In line with this, the differences between the latter and the first two models in CFI ($CFI_D \geq -0.02$) indicated significant differences.

### 3.4. Neighborhood environment scale

The Mardia’s coefficient (3.04) of the scale demonstrated multivariate normality. The measurement model provided a good fit ($\chi^2 = 13.948$, $df = 4$, $p = 0.007$, $\chi^2/df = 3.487$, $CFI = 0.988$, $GFI = 0.992$, $IFI = 0.988$, $TLI = 0.970$, $RMSEA = 0.060$). The Cronbach’s $\alpha$ was 0.76.

### 3.5. Family and friend support for PA scales

The Mardia’s coefficient (29.75) of the family support for PA scale indicated multivariate non normality, and CFA was conducted performing bootstrapping with the Bollen–Stine approach. Results showed that the measurement model represented a good fit ($\chi^2 = 67.434$, $df = 53$, $p = 0.005$, $\chi^2/df = 1.272$, $CFI = 0.970$, $GFI = 0.949$, $IFI = 0.970$, $TLI = 0.963$, $RMSEA = 0.065$). The Cronbach’s $\alpha$ was 0.92 for the “family support for exercise” factor, and 0.91 for the “family participation in exercise” factor. In the current study, only the “family support for exercise” factor was used in the structural model, due to the ecological theory’s focus on social support for PA.

With regard to the friend support for PA scale, the Mardia’s coefficient (1.29) indicated multivariate normality. Results supported the factorial validity of the scale ($\chi^2 = 84.837$, $df = 5$, $p = 0.000$, $\chi^2/df = 16.967$, $CFI = 0.964$, $GFI = 0.949$, $IFI = 0.964$, $TLI = 0.929$). However, the RMSEA value (0.153) was high. An alternative model was examined setting a pair of correlated errors between items 3 and 4, based on their conceptual similarity. The alternative model provided a better fit ($\chi^2 = 12.738$, $df = 4$, $p = 0.013$, $\chi^2/df = 3.185$, $CFI = 0.996$, $GFI = 0.992$, $IFI = 0.996$, $TLI = 0.990$, $RMSEA = 0.057$). This finding was confirmed by the differences between the models in CFI ($CFI_D = -0.03$), and $\chi^2/df$ ratio ($\chi^2_D = 8.01$, $df_D = 1$, $p < 0.05$). The Cronbach’s $\alpha$ was 0.88.

### 3.3. Structural models’ fit

The Mardia’s coefficients for both the social cognitive and the ecological models indicated multivariate non normality. Therefore, SEM was conducted utilizing bootstrapping with the Bollen–Stine approach to assess model fit under non normal conditions.

In particular, the social cognitive model provided an appropriate fit ($\chi^2 = 103.029$, $df = 96$, $p = 0.001$, $\chi^2/df = 1.073$, $CFI = 0.965$, $GFI = 0.957$, $IFI = 0.965$, $TLI = 0.956$, $RMSEA = 0.048$). The model accounted for 14% of the QoL variance. As Fig. 1 shows, PA positively affected exercise self-efficacy (0.35, $p < 0.01$), which had positive paths on PCS (0.17, $p < 0.01$) and MCS (0.22, $p < 0.01$). In turn, PCS (0.18, $p < 0.01$) and MCS (0.48, $p < 0.01$) positively affected QoL. The total standardized effect of PA on QoL was 0.03, indicating that an increase of 1 SD on PA predicts an increase of 0.03 SD on QoL.

Further, the ecological model represented an adequate fit ($\chi^2 = 517.029$, $df = 479$, $p = 0.001$, $\chi^2/df = 1.079$, $CFI = 0.958$, $GFI = 0.924$, $IFI = 0.958$, $TLI = 0.953$, $RMSEA = 0.037$). The model accounted for 16% of the variance in QoL. As Fig. 2 shows, neighborhood environment had positive effects on family (0.12, $p < 0.05$) and friend (0.16, $p < 0.01$) support for PA, PA (0.11, $p < 0.05$), and MCS (0.11, $p < 0.05$), but did not significantly affect PCS ($p = 0.30$). Family support for PA positively influenced exercise self-efficacy (0.08, $p < 0.05$). However, friend support for PA did not significantly affect exercise self-efficacy ($p = 0.29$). The relationship between exercise self-efficacy and PA was reciprocal (0.34, $p < 0.01$). In addition, exercise self-efficacy had positive paths on PCS (0.13, $p < 0.05$) and MCS (0.19, $p < 0.01$). In turn, PA positively influenced PCS (0.12, $p < 0.05$), but not MCS ($p = 0.19$). Finally, positive paths from PCS (0.23, $p < 0.01$) and MCS (0.52, $p < 0.01$) to QoL were found. The total standardized effects of neighborhood environment on exercise self-efficacy was 0.02 and on QoL was 0.07, indicating that when neighborhood environment increases by 1 SD exercise self-efficacy increases by 0.02 SD, whereas QoL increases by 0.07 SD.

Regarding comparisons between the aforementioned models in fit, analyses demonstrated that there were no significant differences between them, based on both CFI ($CFI_D = -0.007$), and $\chi^2/df$ ratio ($\chi^2_D = 0.05$).

### 4. Discussion

This study examined the causal relationships between PA and QoL as well as among neighborhood environment, PA, and QoL within the context of theoretical frameworks. Particularly, the selection of the models’ variables was based on the social cognitive and ecological theories strengthening the research.
purpose for identifying effects and interactions among them. In addition, an original aspect of the current study was the investigation of the ecological model regarding the relationship between neighborhood environment and QoL through the intermediary effects of family and friend support for PA, exercise self-efficacy, PA, PCS, and MCS. Such associations have not been reported so far in the literature, because concepts from the ecological approach have not been used until now to enlighten the relationship between PA and QoL.

The current study demonstrated that adults who participate in PA feel confident enough with regard to their ability to persist in exercising under adverse situations, providing also better PCS, MCS, and QoL. Therefore, the important mediating effects of exercise self-efficacy, as a basic social cognitive theory concept, and perceived health status for the PA and QoL relationship were supported. These findings indicated that to improve health status and QoL, specialists should focus on increasing exercise self-efficacy. One of the ways to enhance self-efficacy is to create successful experiences and positive feelings during PA. The aforementioned results are in accordance with previous research findings. However, PA accounted for a small amount of variance in QoL. A possible explanation is that QoL was assessed as satisfaction with one’s life, which represents a multidimensional concept that is not indispensably associated with either PA or perceived health. In other words, the relationship between PA and QoL may be moderated by personal value systems not including PA or health perceptions in cognitive judgment of QoL. Further, satisfaction with one’s life may serve as a more salient factor of QoL. Finally, it was found that MCS had a higher positive effect on satisfaction with one’s life than PCS. This could be explained by the fact that satisfaction with one’s life reflects subjective well-being which is highly associated with psychological health status.

Regarding the ecological model, the current findings suggest that environmental factors, such as access to facilities for PA, may improve MCS and family’s efforts to increase PA. In turn, social support from family could enhance self-efficacy beliefs for PA and participation in PA. The direct effect of neighborhood environment on PA was low. Therefore, social ecological models should be used in promoting PA as it seems that social ecological variables modulate PA. The above findings are in line with previous research findings, in which environmental factors positively affected PA through the intermediary effects of social support for PA, and exercise self-efficacy. In addition, the current study indicated that both high PA levels were associated with greater beliefs in one’s ability to persist in exercising, and the latter was related to high PA levels, indicating that self-efficacy is closely linked to PA. Finally, the present results demonstrated that greater levels of exercise self-efficacy were associated with better PCS, MCS, and QoL, confirming the findings of previous research in the area. The aforementioned findings provided further support to the importance of the ecological and social cognitive theories, PA levels, and perceived health status for explaining the relationship between neighborhood environment and QoL. However, the ecological model accounted for a small amount of variance in QoL. A possible explanation is that satisfaction with one’s life is related to a diverse variety of concepts, such as self-confidence, emotional affect, and enjoyment. Future research needs to examine these factors. In line with this, the small amount of variance could be partly explained from the fact that only five items’ scales were used for both the satisfaction with one’s life and neighborhood environment assessment.

Finally, this study has several limitations that need to be reported. First, due to the cross-sectional nature of the study, such data are not optimal for assuming causality over time, and testing intermediary effects. In particular, single source-bias may account for some of the associations, and the proportion of the total effect mediated by mediators is often misleading. However, the hypothesized models were based on a sufficient theoretical background, and they could be examined within a cross-sectional framework for identifying relationships among the examined factors. Second, measures were self-reported and problems associated with common method variance should be considered. Third, multidimensional measures of QoL and objective measures of environment through geographical information systems technology were not used. Despite the apparent limitations, this study had some advantages that should be considered. In particular, a key feature of this study was the ecological theoretical model of the associations among neighborhood environment, PA, and QoL that has not been examined until now. Further, no such study has been carried out in physically active adults, aged 18–65 years old.

5. Conclusion

In this study, associations between PA and QoL as well as between neighborhood environment and QoL were examined. The most important mediators in these relationships appeared to be exercise self-efficacy and health status indicating the role of beliefs in one’s ability to persist in exercising and perceptions of one’s health. In addition, the current study proposed that an effective neighborhood environment for PA promotion could be used for enhancing both PA and QoL. Considering the limitations of the study, future studies should be carried out to examine the structural models using longitudinal data for better understanding the interactions and relations over time. Finally, similar studies using multidimensional measures of QoL, and objective assessments of neighborhood environment and PA would be of considerable value.

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Authors’ contributions

All authors were involved in formulating the paper. ET conceived, designed and carried out the study, analyzed the models, drafted and revised the manuscript. NS contributed to the study’s design and statistical analyses, and helped to draft and revise the
manuscript. KK participated in designing and carrying out the study, and contributed to the manuscript’s statistical analyses and revision. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

None of the authors declare competing financial interests.

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