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Physical Activity Dimensions Differentially Predict Physical and Mental Components of Health-Related Quality of Life: Evidence from a Sport for All Study

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Abstract: The present cross-sectional study aimed to investigate the relationship between different dimensions of physical activity (PA) (i.e., work, sport, leisure) and health-related quality of life (HRQoL) (i.e., overall, physical component, mental component) in an adult lifespan sample of 381 active individuals (age range: 18–88 years; 38.8% men), while controlling for important covariates in terms of sex, age, education, and health profile regarding medical history. HRQoL was assessed using the 12-item Short-Form Health Survey (SF-12). Usual (i.e., previous 12 months) PA was assessed during face-to-face interviews using the Baecke questionnaire. Hierarchical regression analyses showed in Step 1 that the three PA dimensions work, sport, and leisure (entered simultaneously) together predicted 8%, 10%, and 4% of the variance in SF-12 total score, SF-12 physical component, and SF-12 mental component, respectively. In the final model, adjusting for sex, age, education, and health profile regarding medical history, sport emerged as the only PA dimension predicting SF-12 total score and the SF-12 physical component. In conclusion, health-policy targets at the community level should include the promotion of lifelong engagement in PA, especially sport, to allow the sustainability of HRQoL across the lifespan of our society.

Keywords: health-related quality of life; well-being; mental health; physical health; physical activity; sport for all; exercise

Citation: Ihle, A.; Gouveia, B.R.; Gouveia, É.R.; Cheval, B.; Nascimento, M.d.M.; Conceição, L.; Marconcin, P.; Peralta, M.; Ferrari, G.; Oliveira, D.; et al. Physical Activity Dimensions Differentially Predict Physical and Mental Components of Health-Related Quality of Life: Evidence from a Sport for All Study. *Sustainability* **2021**, *13*, 13370. https://doi.org/10.3390/su132313370

Academic Editor: José Carmelo Adsuar Sala

Received: 8 November 2021
Accepted: 29 November 2021
Published: 2 December 2021

1. Introduction

Promoting sustained quality of life as a result of preserved functional abilities across the lifespan constitutes one of the biggest challenges for public health in this century [1,2]. Focusing on this health perspective, previous studies have investigated health-related quality of life (HRQoL) as a global indicator [3,4]. In this regard, HRQoL can be distinguished into two main components: a physical component and a mental component [5]. The physical component comprises physical functioning, physical role functioning, bodily pain, and general health. The mental component covers vitality, social role functioning, emotional role functioning, and mental health. The combination of these two components represents the individual's perception of global HRQoL [5].

In daily life, many factors can affect HRQoL. For instance, physical activity (PA) and physical fitness have been found to be among the strongest beneficial predictors of HRQoL across the adult lifespan [6–19]. In contrast, physical (e.g., arthritis, diabetes, hypertension) and mental medical conditions (e.g., depression) are associated with poorer HRQoL [20–22]. HRQoL has further been found to be higher in men, in younger ages, and in individuals with higher education [6,7,23].

Importantly, with regard to PA, three specific PA dimensions can be distinguished: PA at work/housework, sport, and PA during leisure time [24]. Notably, it remains unclear so far whether there are differential PA-HRQoL relationship patterns that depend on the respective HRQoL component (physical or mental) and on the specific PA dimensions (work, sport, or leisure) in relatively active individuals that frequently perform PA. Therefore, to close this knowledge gap, the present study aimed to investigate the relationship between different PA dimensions (work, sport, leisure) and overall HRQoL and the specific (i.e., physical and mental) HRQoL components in an adult lifespan sample of active individuals, while controlling for important covariates in terms of sex, age, education, and health profile regarding medical history.

2. Materials and Methods

2.1. Sample and Study Design

This cross-sectional study included 381 participants from the project entitled "Movement and Health: A Study on Practitioners of Sport for All in the Autonomous Region of Madeira" (MOVeS), Funchal, Portugal. Participants were volunteers recruited between January and August 2017 through direct contacts in gyms, cultural and sports clubs, and associations that offer sport for all activities. Participants were from different districts of the Autonomous region of Madeira, where the Madeira Association of Sport for All has associations or clubs affiliated. Inclusion criteria were: (1) being affiliated in a sports association, club, or another organization that promotes PA; and (2) practicing any PA regularly. Exclusion criteria were: (1) any medical contraindications to sub-maximum exercise according to the guidelines of the American College of Sports Medicine [25]; (2) inability to understand and follow the assessment protocol of the study; and (3) not having individual medical insurance from the sports association/organization/club to practice PA (due to legal conditions). The study sample size was determined following an a priori power analysis, which indicated that to detect a small effect size of r = 0.06, with a two-tailed alpha probability of 0.05, a power of 0.95, and a total of eight predictors, the sample size would need to comprise 387 participants.

The study was scientifically and ethically approved by the Scientific Commission of the Department of Physical Education and Sports of the University of Madeira (reference: ACTA n.º 84; 17 January 2017) and the Regional Secretary of Education and Culture. Informed consent was provided by all participants before the assessments, and this study included adherence to the declaration of Helsinki.

2.2. Instruments

2.2.1. Health-Related Quality of Life

HRQoL was assessed using the Portuguese version [26] of the 12-item Short-Form Health Survey (SF-12 [5]). The SF-12 includes eight dimensions: physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). Two major components can be obtained by sum scores: (1) physical component (PF + RP + BP + GH) and (2) mental component (VT + SF + RE + MH), with both components' scores ranging from 0 to 100 each. In this study, Cronbach's alpha was 0.772 and 0.754 for the physical and the mental component, respectively. The total SF-12 score can be obtained by a sum score: physical component + mental component, with scores ranging from 0 to 200.

2.2.2. Physical Activity

Usual PA was assessed during face-to-face interviews using the Baecke questionnaire [24], with a reference period of the previous 12 months. This questionnaire included a total of 16 questions classified into three specific dimensions: (1) PA at work/housework, (2) sport, and (3) PA during leisure time (the latter excluding sports during leisure). If the subjects were unemployed or retired, their occupation was coded as a homemaker. Numerical coding for response categories varied from 1 to 5 (Likert scale), ranging from never to always or very often. Questions 1 (main occupation) and 9 (types of sports played) required a written response. The work index included information about sitting, standing, walking, lifting, and if sweating at work was elicited, and information about fatigue after work or household activities (HS). Additionally, each subject was asked how they perceived their activity at work or during HS compared to others their age. A sports score (one or two main sports) was also calculated from the intensity, amount of time per week and proportion of the year in which the sport was practiced. Sports were subdivided into three levels of PA: the low level (average energy expenditure of 0.76 MJ/h), the middle level (average energy expenditure of 1.26 MJ/h) and the high level (average energy expenditure of 1.76 MJ/h). The leisure-time activity index was based on the frequency of walking and cycling either for leisure and/or to work or shopping. This index included the amount of time spent watching television. PA indices were calculated according to specific formulas for work (questions 1–8), sport (questions 9–12), and leisure time (questions 13–16). For a detailed description of the scoring procedures see [24].

2.2.3. Demographics and Health Profile

Demographic information was collected by questionnaire. Participants were asked to indicate their highest educational level attained, which was coded into eight levels: (1) no education; (2) 1st cycle; (3) 2nd cycle; (4) 3rd cycle; (5) secondary school level; (6) Bachelor Degree; (7) Master Degree; or (8) PhD. Health profile was assessed using the Physical Activity Readiness Questionnaire (PAR-Q [27]). This questionnaire is a preparticipation health screening concerning relevant medical history and symptomatology. Participants were asked to answer "yes" or "no" to the following seven questions: (1) Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?; (2) Do you feel pain in your chest when you do physical activity?; (3) In the past month, have you had chest pain when you were not doing physical activity?; (4) Do you lose your balance because of dizziness or do you ever lose consciousness?; (5) Do you have a bone or joint problem (for example, back, knee, or hip) that could be made worse by a change in your physical activity?; (6) Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?; (7) Do you know of any other reason why you should not do physical activity? The sum of the "yes" questions was considered in the analyses. The history of depression was collected by asking participants whether they suffered from depression (yes/no).

2.3. Statistical Analyses

First, descriptive characteristics of participants were reported as means and SDs. An independent-samples t-test or Chi-square test was calculated to compare the mean score or percentages between males and females. Second, hierarchical multiple regression analyses were conducted to investigate the amount of variance in HRQoL (SF-12 total score, physical and mental components) that was simultaneously predicted by the three PA dimensions (work, sport, and leisure time indices), while controlling for the influences of health profile (PAR-Q and depression), education, sex, and age. Specifically, the three PA dimensions were simultaneously entered in Step 1, consecutively controlling for health profile (PAR-Q Score and depression status) in Step 2, education in Step 3, and sex and age in Step 4. For these analyses, standardized coefficients β were calculated. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. The level of significance was set at $p < 0.05$. Data analysis was performed using IBM SPSS Statistics version 26 (SPSS Inc., an IBM Company, Chicago, IL, USA).

3. Results

This study included 148 males (mean age = 39.1 years, *SD* = 13.8; range: 18–83) and 233 females (mean age = 49.3 years, *SD* = 15.0; range: 18–88). Descriptive statistics for analyzed variables, for the overall sample as well as separately for men and women, are presented in Table 1.

Table 1. Descriptive statistics for health-related quality of life components, physical activity dimensions, education, and health variables, for the overall sample as well as separately for men and women.

	Overall		**Men (*n* = 148)**		**Women (*n* = 233)**		
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	***p***
Sample proportion			38.8%		61.2%		
Age	45.3	15.4	39.1	13.8	49.3	15.0	<0.001
SF12 Physical Component	71.6	22.1	76.0	19.4	68.9	23.3	0.003
SF12 Mental Component	74.8	19.3	78.5	16.6	72.5	20.6	0.004
SF12 Total Score	146.4	36.7	154.5	31.7	141.4	38.7	<0.001
Work Index PA	2.9	0.7	2.9	0.7	2.9	0.7	0.801
Sport index PA	3.1	0.7	3.2	0.7	2.9	0.6	<0.001
Leisure Time Index PA	2.7	0.6	2.8	0.6	2.6	0.6	0.003
Education	3.6	1.6	3.9	0.12	3.4	0.11	0.004
PAR-Q score	1.1	1.4	1.0	1.4	1.2	1.3	0.226
Depression	6.8%		2.7%		9.4%		<0.001

SF-12: 12-item Short-Form Health Survey; PA: physical activity; PAR-Q: Physical Activity Readiness Questionnaire.

Results of the hierarchical multiple regression analyses for SF-12 total score are displayed in Table 2, for SF-12 physical component in Table 3, and for SF-12 mental component in Table 4. In these analyses, in Step 1, work index PA, sport index PA, and leisure time index PA together predicted 8%, 10%, and 4% of the variance in SF-12 total score, SF-12 physical component, and SF-12 mental component, respectively.

In Step 2, PAR-Q score and depression status significantly increased explained variance by 25% (SF-12 total score), 28% (SF-12 physical component), and 13% (SF-12 mental component). Education entered in Step 3 significantly increased explained variance in SF-12 total score (3%) and SF-12 physical component (7%). Sex and age entered in Step 4 did not significantly contribute to the variance on any of the three SF-12 variables. Finally, the total variance explained by the model (as a whole) was 36%, 45%, and 17% in the SF-12 total score, SF-12 physical component, and SF-12 mental component, respectively.

Table 2. Hierarchical regression analyses with physical activity dimensions, health profile, education, sex, and age predicting SF-12 total score.

	1	2	3	4
	β	β	β	β
Work Index PA	−0.035	−0.028	0.017	0.012
Sport index PA	0.278 ***	0.139 ***	0.107 **	0.103 *
Leisure Time Index PA	0.020	0.030	0.048	0.042
PAR-Q Score		−0.382 ***	−0.335 ***	−0.330 ***
Depression (0/1)		−0.269 ***	−0.259 ***	−0.250 ***
Education			0.184 ***	0.167 ***
Sex (1/2)				−0.037
Age				−0.026
R^2	0.081	0.326	0.354	0.356
F for change in R^2	10.70 ***	66.04 ***	15.50 ***	0.56

Step 1: work index PA, sport index PA, leisure time index PA; Step 2: work index PA, sport index PA, leisure time Index PA, PAR-Q, depression; Step 3: work index PA, sport index PA, leisure time index PA, PAR-Q, depression, education; Step 4: work index PA, sport index PA, leisure time index PA, PAR-Q, depression, education, sex, age. PA: physical activity; PAR-Q: Physical Activity Readiness Questionnaire; Depression: 0 = no, 1 = yes; Sex: 2 = female, 1 = male. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3. Hierarchical regression analyses with physical activity dimensions, health profile, education, sex, and age predicting SF-12 physical component.

	1	2	3	4
	β	β	β	β
Work Index PA	−0.052	−0.047	0.022	0.010
Sport index PA	0.327 ***	0.172 ***	0.122 ***	0.123 **
Leisure Time Index PA	−0.035	−0.014	0.013	0.007
PAR-Q Score		−0.459 ***	−0.387 ***	−0.367 ***
Depression (0/1)		−0.213 ***	−0.197 ***	−0.186 ***
Education			0.283 ***	0.242 ***
Sex (1/2)				−0.001
Age				−0.089
R^2	0.100	0.377	0.442	0.447
F for change in R^2	13.51 ***	80.52 ***	42.21 ***	1.66

Step 1: work index PA, sport index PA, leisure time index PA; Step 2: work index PA, sport index PA, leisure time index PA, PAR-Q, depression; Step 3: work index PA, sport index PA, leisure time index PA, PAR-Q, depression, education; Step 4: work index PA, sport index PA, leisure time Index PA, PAR-Q, depression, education, sex, age. PA: physical activity; PAR-Q: Physical Activity Readiness Questionnaire; Depression: 0 = no, 1 = yes; Sex: 2 = female, 1 = male. ** $p < 0.01$; *** $p < 0.001$.

Concerning the HRQoL total score, in the final model four variables were statistically significant: Sport index PA (β = 0.10, $p = 0.033$), PAR-Q Score (β = −0.33, $p < 0.001$), depression (β = −0.25, $p < 0.001$), and education (β = 0.17, $p < 0.001$).

Similar results were found for the physical HRQoL component in the final model, with four variables being statistically significant: Sport index PA (β = 0.12, $p = 0.006$), PAR-Q Score (β = −0.37, $p < 0.001$), depression (β = −0.19, $p < 0.001$), and education (β = 0.24, $p < 0.001$).

Regarding the mental HRQoL component, in the final model two variables were statistically significant: PAR-Q Score (β = −0.21, $p < 0.001$) and depression (β = −0.27, $p < 0.001$).

Table 4. Hierarchical regression analyses with physical activity dimensions, health profile, education, sex, and age predicting SF-12 mental component.

	1	2	3	4
	β	β	β	β
Work Index PA	−0.006	−0.001	0.007	0.012
Sport index PA	0.154 ***	0.068	0.063	0.056
Leisure Time Index PA	0.078	0.074	0.076	0.073
PAR-Q Score		−0.201 ***	−0.194 ***	−0.207 ***
Depression (0/1)		−0.268 ***	−0.267 ***	−0.267 ***
Education			0.027	0.040
Sex (1/2)				−0.070
Age				0.051
R^2	0.038	0.166	0.167	0.172
F for change in R^2	4.96 **	40.12 ***	0.78	2.97

Step 1: work index PA, sport index PA, leisure time index PA; Step 2: work index PA, sport index PA, leisure time index PA, PAR-Q, depression; Step 3: work index PA, sport index PA, leisure time index PA, PAR-Q, depression, education; Step 4: work index PA, sport index PA, leisure time index PA, PAR-Q, depression, education, sex, age. PA: physical activity; PAR-Q: Physical Activity Readiness Questionnaire; Depression: 0 = no, 1 = yes; Sex: 2 = female, 1 = male. ** $p < 0.01$; *** $p < 0.001$.

4. Discussion

The present study aimed to examine the relationship between the different PA dimensions and specific HRQoL components. Hierarchical regression analyses showed that (in the initial model without control variables) the three PA dimensions work, sport, and leisure together predicted a substantial part of the variance in overall HRQoL and the physical and mental HRQoL components. This supports the idea that PA is a beneficial predictor of HRQoL across the adult lifespan [6–9,12,13,16–19].

Most importantly, in the final model controlling for sex, age, education, and health profile regarding medical history as covariates, sport emerged as the only PA dimension predicting overall HRQoL and the physical HRQoL component. One reason could be that for those regularly doing sport it may be easier to meet the public health recommendations regarding moderate and vigorous PA and profit from their benefits [28–30]. This engagement then helps to improve functional and physical fitness that is a further key predictor of HRQoL since it allows pursuing an active and independent life [2,6,8,10–15,17,18]. Another reason could be that engagement in sports, particularly in team settings, can provide additional benefits, such as offering a social support network [31–33], which helps to promote quality of life and well-being [34]. In addition, it seems that sport merely helps to improve the physical, but less the mental HRQoL component. One explanation could be that the physical aspects of HRQoL and well-being (in contrast to the mental aspects) are much more susceptible to alterations regarding engagement in regular PA and other activities [35]. This could be explained by the proximity between the behavior (i.e., a physically active behavior) and the outcome (i.e., physical HRQoL component). In this regard, low engagement in sports is associated with vulnerability to reduced physical fitness, frailty, chronic diseases, and worse cognitive outcomes [36–39], and, as we showed in the present study, also to lower HRQoL, especially in the physical component.

Moreover, confirming preliminary evidence [20–23], an inspection of the covariates in our final model suggests that physical and mental health issues in the individuals' medical history, as well as lower education, constitute substantial risk factors for overall HRQoL, and also for both the physical and the mental HRQoL component. Therefore, these circumstances await further attention when targeting the promotion of HRQoL.

As limitations of the present study, we acknowledge the cross-sectional nature of the data that did not allow drawing causal conclusions regarding the direction of effects. However, most importantly, PA assessments referred to a period of the previous 12 months. Nevertheless, we acknowledge that to further scrutinize the consistency of our findings

over longer time frames and to better understand the causal pathways underlying the association between the different PA dimensions and HRQoL components across the lifespan further research including longitudinal studies and comparative-control group designs is required. Moreover, our data were based on self-reports and retrospective evaluations. We conducted face-to-face interviews to minimize bias. We acknowledge that nutrition was not the focus of the present study. Future research might investigate the relationship between nutrition, nutritional status, and HRQoL in more detail. The study may also stimulate future replications at the national level (overcoming a possible bias related to the regional allocation of the sample) and even international research efforts.

Further strengths of the present study are the detailed investigation of the different PA dimensions and the specific HRQoL components in a large adult lifespan sample (with a broad age range of 18–88 years) of active individuals that perform PA frequently and controlling for important confounders in terms of sex, age, education, and health profile regarding medical history.

In conclusion, health-policy targets at the community level should (besides addressing physical and mental health issues per se) include the promotion of lifelong engagement in PA, especially sport, to allow the sustainability of HRQoL across the lifespan of our society.

Author Contributions: Conceptualization, A.I., B.R.G. and É.R.G.; methodology, É.R.G. and L.C.; software, É.R.G.; validation, É.R.G. and L.C.; formal analysis, É.R.G.; investigation, A.I., B.R.G., É.R.G. and L.C.; resources, B.R.G., É.R.G. and D.O.; data curation, É.R.G.; writing—original draft preparation, A.I. and É.R.G.; writing—review and editing, B.R.G., B.C., M.d.M.N., L.C., P.M., M.P., G.F., D.O. and M.K.; visualization, É.R.G.; supervision, A.I., B.R.G., É.R.G. and M.K.; project administration, A.I., B.R.G., É.R.G., L.C. and D.O.; funding acquisition, B.R.G., É.R.G., D.O. and M.K. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the Madeira Regional Government and Regional Secretary of Education, Science and Technology via the Madeira Association of Sport for All. B.R.G. and E.R.G. acknowledge support from LARSyS—Portuguese national funding agency for science, research and technology (FCT) pluriannual funding 2020–2023 (Reference: UIDB/50009/2020). A.I. and M.K. acknowledge support from the Swiss National Centre of Competence in Research LIVES—Overcoming vulnerability: life course perspectives, funded by the Swiss National Science Foundation (grant number: 51NF40-185901).

Institutional Review Board Statement: This study was scientifically and ethically approved (Ethics Committee Name: Scientific Commission of the Department of Physical Education and Sports of the University of Madeira; Approval Code: ACTA n.º 84; Approval Date: 17 January 2017). This study included adherence to the declaration of Helsinki.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available upon request from the corresponding author.

Acknowledgments: The authors are grateful to Carina Basílio and Marta Ascenção for technical assistance in the data collection and management. We are especially thankful to the participants and the sports associations, organizations, and clubs that allowed the data collection.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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