

Physical Inactivity and Health-Related Quality of Life among U.S. Adult Men and Women

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Abstract

Objectives: Physical inactivity (PIA) and health-related quality of life (HRQOL) are both major public health concepts of growing interest. This study had two purposes: (1) To evaluate the relationship between PIA and HRQOL among adult men and women, and (2) To examine the extent to which gender differences exist in the PIA and HRQOL relationship.

Methods: Data from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) were used for the study. Four self-reported items and one constructed index for a total of five measures were used to assess HRQOL. PIA status was assessed by answers to two questions regarding recreational physical activity. Multiple logistic regression was used to obtain odds ratios and 95% confidence intervals adjusted for demographic and health-related variables.

Results: There were significantly greater odds of poor HRQOL for those who were physically inactive, while controlling for age, race, gender, income, BMI, smoking status, and sedentary time. PIA was significantly related to all 5 measures of HRQOL with the greatest odds seen for poor general health (OR = 2.49, 95% CI: 2.11 – 2.95). Gender differences were evident in most of the models, with odds of poor HRQOL ranging from 1.38 to 1.92 and 2.37 to 3.40 for women and men, respectively.

Conclusions: Results from this study show that PIA is a strong predictor of poor HRQOL and remains so after controlling for potential confounding variables. Overall, more women report poor levels of HRQOL compared to men, however, men are more likely than women to report poor levels of HRQOL if they are physically inactive.

Keywords: Health-related quality of life; Physical inactivity; Epidemiology; Measurement

Introduction

Physical Inactivity (PIA) is a health behavior at the low-end of the physical activity continuum and, as in many studies, is considered a primary risk factor for some of the major health problems among adults, such as coronary heart disease, stroke, hypertension, and type II diabetes [1]. PIA, as its own concept, has been shown to be directly related to the risk of both all-cause and cause-specific mortality [2,3]. PIA has also been shown to be directly linked to many specific types of illnesses leading to the nation's principal causes of premature death and disability [4,5]. As such, current physical activity guidelines for Americans state that adults should accumulate 150 minutes of weekly moderate-intensity physical activity or 75 minutes of weekly vigorous-intensity activity or an equivalent weekly combination of both [6].

Health-related quality of life (HRQOL) is a growing construct of interest that includes the specific aspects of quality of life that affect either physical health, mental health, or both [7]. HRQOL has become as an important outcome measure in public health research as that of more objective clinical measures and is now a standard in both intervention and observational studies [8].

Physical activity, as with many health-related outcome measures, has been shown to be related to HRQOL. Specifically, meeting recommended levels of physical activity has shown to be related to superior levels of HRQOL [9-11]. However, there is limited information pertaining to the specific relationship between PIA and HRQOL. Therefore, the purpose of this study was to examine the association between PIA and HRQOL among a representative sample of U.S adults. Additionally, the extent to which gender differences exist in the PIA and HRQOL relationship was investigated.

Methods

Sample

Data from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) were used for this study. NHANES is a continuous survey and uses a multistage, stratified sampling design to represent the non-institutionalized U.S. citizen population [12]. Three components of the survey (demographic, questionnaire and examination) were used for this study. The majority of the data came from the demographic and questionnaire components of the survey. The examination component was used to obtain body measurement data.

Physical inactivity

PIA was assessed by answers to two questions asking respondents if they participated in moderate or vigorous activities during leisure-time. The vigorous activity question asked respondents if they participated in any vigorous-intensity sports, fitness, or recreational activities that cause large increases in breathing or heart rate like running or basketball

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for at least 10 minutes continuously. The moderate activities question asked respondents if they participated in any moderate-intensity sports, fitness, or recreational activities that cause a small increase in breathing or heart rate such as brisk walking, bicycling, swimming, or golf for at least 10 minutes continuously. Those respondents answering "no" to both questions were considered to be physically inactive.

Health-related quality of life

Respondents were asked 4 questions which were used to assess HRQOL. The first question was the broadest and asked the respondents to rate their perceived *general health*.

Response options included "excellent", "very good", "good", "fair", and "poor". Those reporting either "fair" or "poor" were considered to have poor perceived general health. The second and third questions were specifically geared toward *physical health* (physical illness and injury) and *mental health* (stress, depression, and emotional problems), respectively. These questions asked respondents to report the number of days (out of the previous 30 days) that their physical (or mental) health was not good. Those reporting 14 days or more were considered to exhibit poor physical (or mental) health [13]. The last question specifically addressed the amounts of *usual activity* (self-care, work, or recreation) influenced by physical and/or mental health. Respondents were asked to report the number of days (out of the previous 30 days) that poor physical or mental health kept them from their usual activities. Those reporting 14 days or more were considered to be inactive due to health. A final HRQOL variable was constructed from the physical and mental health questions and used to assess the overall number of *unhealthy days* due to physical and/or mental health, not to exceed 30 days [7]. This variable was also dichotomized according to the <14 and ≥ 14 days.

Covariates

Body Mass Index (BMI) was calculated using examination measurements of height (in centimeters) and weight (in kilograms). BMI was categorized as either underweight (<18.8), normal (18.5-24.9), overweight (25-29.9), or obese (≥ 30) [14]. A dichotomous variable was created for current smoking status where respondents were considered current smokers if they reported smoking cigarettes "everyday" or "some days". Sedentary time was assessed by a single question asking respondents how much time they usually spend sitting or reclining (including time spent sitting at a desk, sitting with friends, traveling in a car, bus, or train, reading, playing cards, watching television, or using a computer) on a typical day. Age (in years), race (Non-Hispanic white, Non-Hispanic black, Hispanic, Other), and monthly income (in dollars) were used for descriptive purposes and as demographic control variables.

Statistical analysis

Prevalence estimates and standard errors (SEs) of PIA were computed by demographic characteristic, health characteristic, and the 5 measures of HRQOL. Logistic regression was used to calculate the unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) of PIA for each demographic, health, and HRQOL variable. Multiple logistic regression was used to first fit a series of models (model 1) using PIA to predict each of the 5 HRQOL variables separately, while controlling for demographic variables (age, gender, race, and income). Next, a second series of models (model 2) were fit adding additional health-related variables (BMI, smoking status, and sedentary time). For both series of models (models 1 & 2), PIA-by-gender interactions were tested, to examine the extent to which gender differences exist in the

PIA and HRQOL association. All analyses were performed using the complex samples module of SPSS version 16. All *p*-values are reported as 2-sided and statistical significance level was set at 0.05.

Results

Overall, 51.7% of the samples were women. For age, 48.9% were between 18 and 44 years, 34.9% between 45 to 64 years, and 16.2% 65 years or older. For race, 69.2% were Non-Hispanic White, 11.4% were Non-Hispanic Black, 13.4% were Hispanic, and 6.0% were considered another race or multiracial. Of the sample, 34.2% reported monthly household income less than \$2100, 29.0% reporting between \$2100 and \$4599, 14.0% reporting between \$4600 and \$6249, and 22.8% reporting \$6250 or greater. Using BMI classification, 1.8% of the sample was considered underweight, 31.3% considered normal weight, 33.9% considered overweight, and 33.0% considered obese. Approximately 22.8% of the samples were current smokers of cigarettes. For HRQOL measures, 16.5%, 10.4%, 11.9%, 5.4%, and 20.2% were considered to have poor levels when considering physical health, mental health, usual activity, and unhealthy days, respectively.

The overall prevalence of PIA was greatest for older (65+ years) adults, those of Hispanic race, those reporting lower (< \$2100 per month) household income, those classified as obese (BMI > 30), and current smokers (Table 1). Similar prevalence claims of PIA were observed for males and females, except PIA prevalence was greatest for underweight males. Prevalence of PIA was greater for all measures of poor HRQOL, with the largest prevalence seen for poor general health (overall and females) and poor usual activity (males) (Table 2).

The first series (model 1) of multiple logistic regression models all showed significantly greater odds of poor HRQOL for those who were physically inactive, while controlling for age, race, gender, and income (Table 3). The greatest odds of poor HRQOL was seen for poor general health (OR=2.86, 95% CI: 2.47 - 3.31). The second series (model 2) of multiple logistic regression models as well all showed significantly greater odds of poor HRQOL for those who were physically inactive, while additionally controlling BMI, smoking status, and sedentary time. The greatest odds of poor HRQOL remained for poor general health (OR=2.49, 95% CI: 2.11 - 2.95).

To test for the moderating effect that gender may have on the PIA and HRQOL relationship, PIA-by-gender interactions were subsequently placed in both series of multiple logistic regression models (Table 3). The majority of the models saw either a significant ($p < 0.05$) interaction effect or an effect that approached ($p < .10$) significance. Therefore, separate models (models 1 & 2) were ran for males and females. For females, all odds of poor HRQOL were significantly greater (ORs range: 1.57 to 2.42) for those who were physically inactive, while controlling for age, race, and income. All female ORs remained significant (ORs range: 1.38 to 1.92) after controlling for BMI, smoking status, and sedentary time. Among males, all odds of poor HRQOL were significantly greater (ORs=2.54 to 3.44) for those who were physically inactive, while controlling for age, race, and income. Male ORs remained significant (ORs = 2.37 to 3.40) after controlling for BMI, smoking status, and sedentary time.

To further describe the gender differences on the PIA and HRQOL relationship, prevalence of poor physical and/or mental health was examined (Figure 1). The prevalence of poor physical and/or mental health for those physically inactive was 28.5% for females and 24.5% for males ($p = .015$ for difference). The prevalence of poor physical and/or mental health for those not physically inactive was 18.7% for females and 10.1% for males ($p < .001$ for difference). The difference between

Characteristic	Overall			Males			Females		
	PIA ^a	OR ^b	95% CI	PIA ^a	OR ^b	95% CI	PIA ^a	OR ^b	95% CI
Overall	48.6 (2.6)			44.7 (3.1)			52.3 (2.5)		
Age (y)									
18-44	39.2 (2.1)	1.00	---	35.6 (2.7)	1.00	---	42.7 (2.1)	1.00	---
45-64	54.5 (4.0)	1.86	1.44 - 2.40	52.0 (4.7)	1.96	1.46 - 2.62	56.8 (3.8)	1.77	1.34 - 2.33
65+	64.3 (3.1)	2.80	2.12 - 3.70	58.4 (2.6)	2.54	2.02 - 3.20	68.7 (4.2)	2.94	1.89 - 4.57
Race									
Non-Hispanic white	45.2 (4.1)	1.00	---	42.7 (4.5)	1.00	---	47.4 (4.0)	1.00	---
Non-Hispanic black	55.9 (1.6)	1.54	1.06 - 2.25	48.7 (2.1)	1.28	.83 - 1.96	61.7 (1.5)	1.79	1.24 - 2.59
Hispanic	59.8 (1.6)	1.81	1.24 - 2.64	53.0 (1.5)	1.52	1.01 - 2.28	67.0 (2.5)	2.25	1.50 - 3.39
Other	49.3 (4.4)	1.18	.70 - 2.00	40.8 (5.9)	0.93	.52 - 1.65	57.9 (5.4)	1.53	.80 - 2.93
Monthly Income (\$)									
6250+	33.7 (3.2)	1.00	---	32.3 (4.0)	1.00	---	35.3 (3.6)	1.00	---
4600-6249	42.3 (4.3)	1.44	1.07 - 1.93	38.8 (5.8)	1.33	.88 - 2.02	46.0 (4.6)	1.56	1.08 - 2.25
2100-4599	49.2 (3.0)	1.90	1.43 - 2.54	45.6 (3.9)	1.76	1.21 - 2.56	52.7 (3.1)	2.04	1.50 - 2.76
<2100	59.1 (2.7)	2.84	2.25 - 3.58	56.1 (3.1)	2.68	1.88 - 3.82	61.5 (3.2)	2.92	2.01 - 4.25
Weight Status ^c									
Normal Weight	43.2 (3.1)	1.00	---	41.6 (4.6)	1.00	---	44.4 (2.7)	1.00	---
Underweight	50.3 (6.9)	1.33	.80 - 2.23	57.8 (12.5)	1.92	.70 - 5.28	46.9 (8.2)	1.11	.58 - 2.10
Overweight	43.9 (2.9)	1.03	.90 - 1.18	39.2 (3.0)	0.91	.71 - 1.15	50.1 (3.3)	1.26	1.02 - 1.55
Obese	55.9 (2.0)	1.67	1.38 - 2.02	51.3 (2.5)	1.48	1.09 - 1.99	59.9 (2.2)	1.87	1.55 - 2.26
Current Smoker									
No	46.3 (2.5)	1.00	---	41.8 (2.7)	1.00	---	50.1 (2.6)	1.00	---
Yes	59.3 (3.4)	1.69	1.39 - 2.04	55.8 (4.9)	1.76	1.34 - 2.30	63.7 (2.0)	1.75	1.42 - 2.14

^cDetermined by body mass index (BMI).

Table 1: Prevalence and Odds of PIA by Demographic and Health Characteristics among U.S. Adults 18 Years of Age and Older, 2007-08.

Characteristic	Overall			Males			Females		
	PIA	OR	95% CI	PIA	OR	95% CI	PIA	OR	95% CI
General Health ^c									
Good	42.6 (2.7)	1.00	---	38.4 (3.1)	1.00	---	46.6 (2.6)	1.00	---
Poor	74.0 (1.5)	3.85	3.11 - 4.75	73.4 (1.9)	4.42	3.22 - 6.05	74.6 (2.0)	3.36	2.60 - 4.35
Physical Health ^d									
Good	45.4 (2.5)	1.00	---	40.9 (2.8)	1.00	---	49.6 (2.6)	1.00	---
Poor	68.7 (3.6)	2.64	1.97 - 3.54	71.6 (5.5)	3.63	2.21 - 5.99	66.5 (2.9)	2.02	1.58 - 2.60
Mental Health ^e									
Good	45.8 (2.5)	1.00	---	41.7 (2.8)	1.00	---	49.8 (2.4)	1.00	---
Poor	62.1 (3.6)	1.94	1.61 - 2.35	64.4 (4.7)	2.53	1.91 - 3.36	60.8 (3.5)	1.60	1.28 - 1.90
Usual Activity ^f									
Good	46.2 (2.5)	1.00	---	42.1 (2.9)	1.00	---	50.1 (2.4)	1.00	---
Poor	73.9 (4.7)	3.31	2.15 - 5.10	75.1 (4.3)	4.15	2.71 - 6.35	73.1 (6.0)	2.70	1.54 - 4.74
Unhealthy Days ^g									
Good	43.8 (2.4)	1.00	---	39.4 (2.7)	1.00	---	48.3 (2.5)	1.00	---
Poor	63.2 (3.0)	2.20	1.89 - 2.58	65.4 (4.3)	2.90	2.17 - 3.86	61.8 (2.8)	1.73	1.45 - 2.06

^aPrevalence estimates with standard errors in parentheses.

^bUnadjusted odds ratios (OR).

^cPoor HRQOL defined as self-reporting general health as "fair" or "poor".

^dPoor HRQOL defined as self-reporting 14+ unhealthy days due to physical health. ^ePoor HRQOL defined as self-reporting 14+ unhealthy days due to mental health.

^fPoor HRQOL defined as self-reporting 14+ days unable to do usual activities due to physical/mental health. ^gPoor HRQOL defined as self-reporting 14+ unhealthy days due to physical and/or mental health.

Table 2: Prevalence and Odds of PIA by HRQOL among U.S. Adults 18 Years of Age and Older, 2007-08.

the two activity groups seen in poor physical and/or mental health was 9.8% for females and 14.4 for males ($p = .006$ for difference).

Discussion

The primary purpose of this study was to examine the association between PIA and HRQOL among adult men and women. It was clear

from our findings that PIA is associated with HRQOL. The prevalence of PIA was greater among those reporting poor HRQOL, on all 5 measures, as compared to those reporting good HRQOL. Furthermore, the odds of being physically inactive were much greater for those reporting poor as compared to good HRQOL, with all 5 measures. In addition, after controlling for possible confounding variables, we found

	n	OR	Model 1 ^a		Int ^c	n	Model 2 ^b		Int ^c
			95% CI				OR	95% CI	
Overall									
General Health ^d	4864	2.86	2.47 - 3.31		0.096	4562	2.49	2.11 - 2.95	.030
Physical Health ^e	4847	2.20	1.62 - 3.00		0.082	4545	1.95	1.41 - 2.69	0.075
Mental Health ^f	4851	1.89	1.47 - 2.44		0.005	4549	1.82	1.58 - 2.09	0.019
Usual Activity ^g	4851	2.56	1.72 - 3.81		0.130	4549	2.26	1.53 - 3.34	0.212
Unhealthy Days ^h	4842	2.04	1.66 - 2.50		0.011	4540	1.83	1.50 - 2.23	0.015
Males									
General Health ^d	2437	3.44	2.61 - 4.55			2270	3.40	2.65 - 4.36	
Physical Health ^e	2431	3.00	1.76 - 5.10			2264	2.68	1.56 - 4.60	
Mental Health ^f	2432	2.54	1.80 - 3.59			2265	2.37	1.58 - 3.56	
Usual Activity ^g	2432	3.16	2.01 - 4.96			2265	2.87	1.85 - 4.46	
Unhealthy Days ^h	2430	2.71	1.96 - 3.74			2263	2.46	1.70 - 3.56	
Females									
General Health ^d	2427	2.42	1.90 - 3.07			2292	1.92	1.45 - 2.54	
Physical Health ^e	2416	1.72	1.21 - 2.44			2281	1.50	1.03 - 2.19	
Mental Health ^f	2419	1.57	1.20 - 2.05			2284	1.38	1.07 - 1.78	
Usual Activity ^g	2419	2.12	1.27 - 3.56			2284	1.87	1.14 - 3.06	
Unhealthy Days ^h	2412	1.64	1.31 - 2.06			2277	1.46	1.17 - 1.82	

^aAdjusted for demographic variables (age, race, income, and gender).

^bAdjusted for demographic and health-related variables (smoking status, BMI, and sedentary time).

^cTest of PIA*Gender Interaction.

^dPoor HRQOL defined as self-reporting general health as "fair" or "poor".

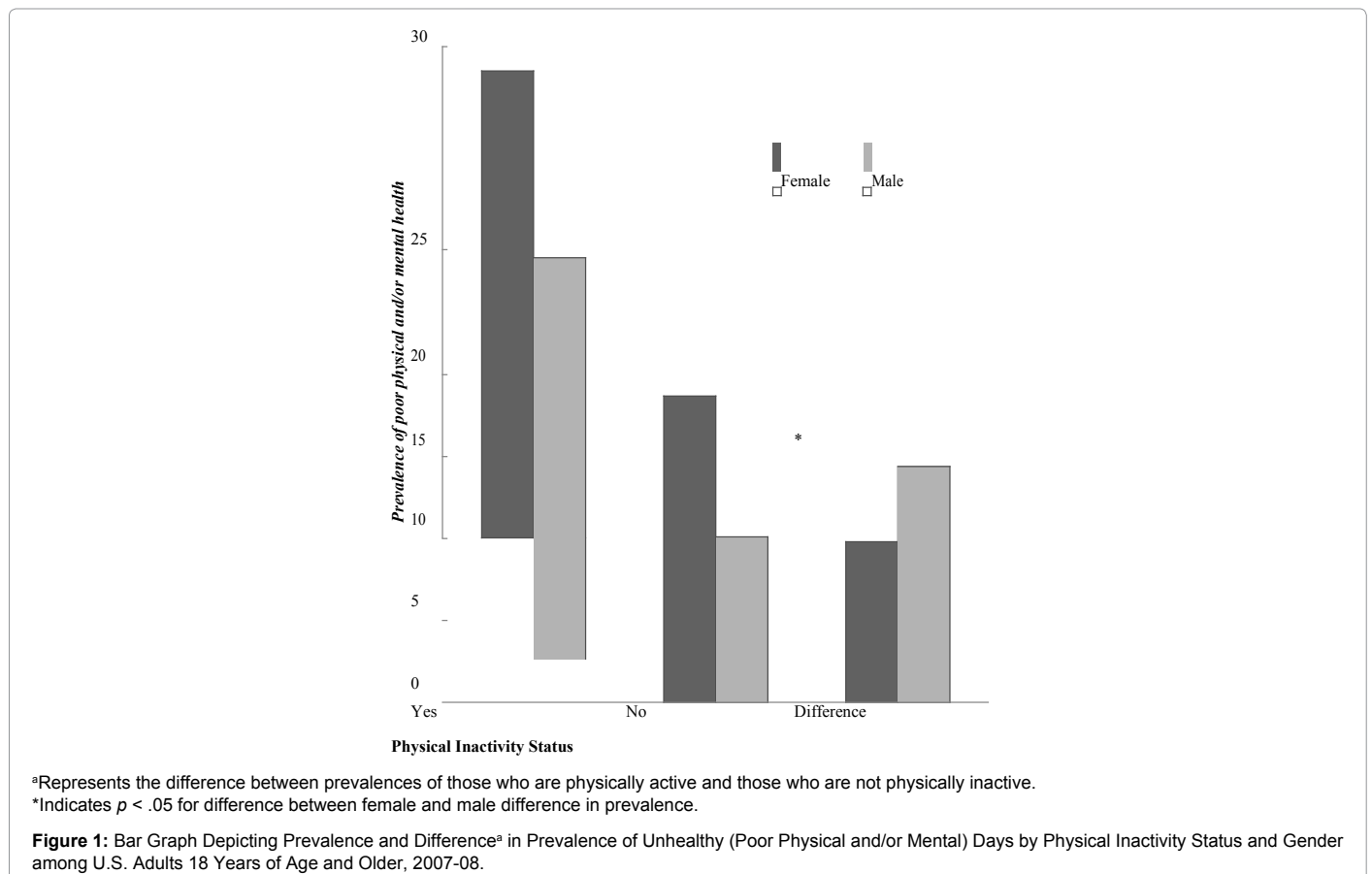
^ePoor HRQOL defined as self-reporting 14+ unhealthy days due to physical health.

^fPoor HRQOL defined as self-reporting 14+ unhealthy days due to mental health.

^gPoor HRQOL defined as self-reporting 14+ days unable to do usual activities due to physical/mental health.

^hPoor HRQOL defined as self-reporting 14+ unhealthy days due to physical and/or mental health.

Table 3: Odds of Poor HRQOL for Physically Inactive U.S. Adults 18 Years of Age and Older, 2007-08.



that those who are physically inactive have close to twice the odds of reporting poor HRQOL, as compared to those who are not physically inactive, on all 5 measures used in the study. Although no studies have specifically examined PIA in relation to HRQOL, similar studies have investigated physical activity and HRQOL. One such study found indirect relationships between physical activity and poor HRQOL [11]. Another study found an indirect dose-response relationship between physical activity and poor HRQOL [10]. Findings from these studies support the current study in that if physical activity is indirectly related to HRQOL, then the lack of physical activity should be directly related to HRQOL.

The secondary purpose of this study was to examine the extent to which gender differences exist in the PIA and HRQOL relationship. Results from the fully adjusted series of models showed that gender differences indeed exist in the PIA and HRQOL relationship on 3 of the 5 models. Gender differences were statistically seen for general health, mental health, and unhealthy days. Additionally, a gender difference approached significance for physical health. When analyzing gender-specific models, greater odds of poor HRQOL remained for those who were physically inactive, for both men and women. However, the odds were even greater for men than for women. The largest gender difference was seen in the unhealthy days measure of HRQOL. That is, men were close to 2.5 times more likely to report poor HRQOL if they were physically inactive, whereas, women were only about 1.5 times more likely.

A limitation of this study is its cross-sectional nature which limits the generalizations to those of correlations as opposed to causations. Longitudinal data would be needed to determine whether PIA in fact causes a person to acquire poor HRQOL. Another limitation of this study was the use of self-report PIA as the main exposure variable. While self-report of no moderate and no vigorous intensity recreational physical activity may be more accurate than measuring amounts and intensities of recreational physical activity, its use may still provide an amount of error un-accounted for in this study.

This study has much strength worth mentioning. This analysis is the first of its kind to examine PIA and HRQOL in a nationally representative sample of U.S. adult men and women. Although a few studies have investigated certain physical activity levels and HRQOL [9,10] none have specifically emphasized PIA. Another strength in this study is its use of 5 different measures of HRQOL. Including more than one measure of HRQOL, with significant findings, adds robustness to the PIA and HRQOL relationship. In fact, in all 5 of our HRQOL measures, we found a greater odds of poor health associated with PIA. A final strength of our study is the gender-specific analysis of PIA and HRQOL. Directly testing PIA-by-gender interaction terms in our models provided appropriate statistical evidence for gender differences in the PIA and HRQOL relationship and in turn justification for gender-specific models.

Conclusions

In conclusion, this study shows that PIA, a growing health behavior of interest, is substantially linked to lower levels of HRQOL in both

men and women. As well, the results show that the PIA and HRQOL relationship remains after controlling for potential confounding variables. Despite the fact that more women report poor levels of HRQOL compared to men, men are more likely than women to report poor levels of HRQOL if they are physically inactive.

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