# Physical activity and health-related quality of life among men with prostate cancer living in remote areas of Quebec: A cross-sectional, observational study

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## ABSTRACT

**Introduction:** The majority (97.5%) of men with prostate cancer (PCa) live for at least five years after diagnosis. The health-related quality of life (HRQoL) of such men is affected by the adverse effects of treatment. Men living in remote areas of Canada have difficulty accessing specialized medical resources and psychological support. This constitutes an additional burden that weighs heavily on their HRQoL. Regular physical activity (PA) has a direct benefit, or an effect mediated by emotional distress, on the HRQoL of such individuals. In Canada, and elsewhere in the world, there is a poor uptake of PA-related recommendations.
**Method:** We conducted a cross-sectional, observational study among 85 participants between May 2023 and September 2023. We then explored, through mediation analyses, the association between PA and HRQoL, taking into account the potential mediating effect of emotional distress.
**Results:** Most participants (61.2%) engaged in a high level of PA; however, their physical and mental HRQoL scores were low (mean scores of 41.99±6.09 and 52.40±4.86, respectively). Participants self-reported low levels of stress (mean score of 3.18±2.62). Very few participants (5.9%) displayed symptoms consistent with depression. In contrast, the majority of participants (92.9%) displayed symptoms of anxiety. No significant statistical association was observed between the level of PA and HRQoL.

**Conclusions:** This lack of association may be explained by the short-term, seasonal nature of certain types of PA, which prevents such PA from having a positive effect on the HRQoL.

## INTRODUCTION

In Canada, prostate cancer (PC) is the most frequently diagnosed cancer among men.[1] In 2022, the number of new cases of PC was estimated at 25 560 and the age-specific standardized incidence rate (SIR) of PC was 60.1 cases per 100 000 people.[1] In Quebec, in 2020, the SIR of PC was 125.74 cases per 100 000 people.[2] In remote areas of Quebec, namely in the region of Abitibi-Témiscamingue, the SIR of this type of cancer in 2020 was 102.69 cases per 100 000 people.[2] A high percentage of men with PC (97.5 %) live at least five years after receiving diagnosis.[3] Although they survive for a long time, these men live with a health-related quality of life (HRQoL) altered by the disease, its treatments and their adverse effects.[4, 5, 6, 7] The HRQoL of men with PC thus constitutes a major health issue and an important indicator in the assessment of the impact of this cancer and the effects of its treatments.[4, 8, 9] In this light, the interest in assessing the HRQoL of men with PC has grown significantly.[9] On a global scale, Smith-Palmer et al. (2019) found that the HRQoL of men with PC is lower than that of the general population.[10] Still on a global scale, Ralph et al. (2020) demonstrated that the deterioration of the HRQoL of men with PC continues over time, up until 10 years post treatment in 35 to 40 % of cases.[11] When it comes to Canada, Ilie et al. (2023) showed that 90 % of men with PC experience decreased physical and mental HRQoL in the first six months following diagnosis.[12] Also, previous studies have shown that the HRQoL of men with PC is affected by emotional distress, including stress,[13, 14] anxiety,[4, 5] and depression,[15, 16] suffered during and after treatment. To our knowledge, no study had yet been conducted on the HRQoL of men with PC living in remote areas of Canada, including those of Quebec. It is worth noting that men with PC who live in remote areas of Canada, including the region of Abitibi-Témiscamingue, experience specific disadvantages, namely centralized specialized healthcare services, large travelling distances to reach healthcare facilities—entailing additional healthcare costs—and limited treatment options.[17] The limited and hindered access to specialized medical resources and psychological support leads to a greater vulnerability to the challenges introduced by the disease and an additional burden impacting HRQoL.[18] Considering the lack of information on the HRQoL of men with PC living in remote areas of Quebec and given the specific contexts of such regions, it was necessary to produce data on this crucial aspect of the health of these men.

Over the last two decades, there has been growing interest in PC healthcare strategies focused on adopting a healthy lifestyle, including PA.[19] PA is in fact a safe approach that offers men with PC several benefits, including the reduction of overall and disease-specific mortality, and the improvement of HRQoL.[19] Indeed, several studies have shown a positive association between PA and HRQoL.[19, 22] Some of these have demonstrated an indirect association, mediated by a decrease in the emotional distress experienced by such patients.[23, 24] Based on the latest guidelines, PA should be considered as a complementary treatment in prostate cancer.[25] The

*American Cancer Society* (2022) recommends that patients with PC engage in 150 - 300 minutes of moderate PA or 75 - 150 minutes of high PA, including muscle strengthening exercises, at least two days per week.[26] While the benefits of PA for this population are proven, and despite the related recommendations, several canadian studies have shown that this population remains underactive.[27, 28, 29] To our knowledge, prior to our study, no data pertaining to PA among men with PC living in remote areas of Canada, including those of Quebec, were available. However, we know that PA programs for people with cancer are very scarce—if not non-existent—in these areas.[30] Given the low level of PA among men with PC and the lack of data pertaining specifically to such men in remote areas, and considering the specific contexts of these regions, it was appropriate to produce data on these practices. Furthermore, in light of the evidence revealed in literature regarding the association between PA and enhanced HRQoL and the potential mediating effect of emotional distress on this association, and considering that no such study existed for remote areas of Quebec, we deemed it wise to produce the first data set on this association and to identify if said association was direct or mediated by emotional distress.

The goal of this study was threefold: 1) describe the HRQoL of men with PC living in Abitibi-Témiscamingue, a remote region of Quebec; 2) describe the level of PA of these men; and 3) describe the association between the level of PA and the HRQoL, considering the potential mediating effect of emotional distress on the association.

## METHODS

### Study workflow and sample

To meet the goal of the present study, a cross-sectional observational study was conducted in Abitibi-Témiscamingue, a remote region of Quebec. According to their order of arrival at the urology outpatient clinic at the Rouyn-Noranda hospital (Centre intégré de santé et de services sociaux de l'Abitibi-Témiscamingue), patients with PC (no matter the stage, grade or prostate-specific antigen [PSA] level) who spoke and understood French were informed of this study by their urologist. Patients with cognitive problems preventing them from completing the questionnaire or providing free and informed consent were not informed of the study. Patients interested in learning more about the study were referred to a member of the research team (M-PG) who was working in an office across from the clinic. Of the 121 patients who left the clinic with the study envelope containing the information and consent form, the questionnaire, and a postage-paid envelope, 85 returned the questionnaire fully completed (response rate: 70 %) (Figure 1). Recruitment activities took place between May and September 2023. Considering the exploratory nature of this study and the known challenges in clinical recruitment, we included patients who visited the clinic during the recruitment period, met the selection criteria, and agreed to participate in the study. Access to medical files was granted by 64 % of participants (n = 54). It should be mentioned that the present study received proper ethical approval from the Comité central d'éthique de la recherche of the ministère de la Santé et des Services sociaux du Québec and the Comité d'éthique de la recherche de l'UQAT.

### Variables and measuring instruments

We used a questionnaire composed of valid and reliable scales to measure the various variables targeted by the present study. HRQoL was measured using the *12-Item Short Form Health Survey version 2.0*, which is based on two basic components: physical and mental health.[31] The score of each component ranges from 0 to 100. The higher the score, the better the HRQoL.[31] We assessed PA using the short form of the *International Physical Activity Questionnaire* (IPAQ), which measures overall PA and sedentary behaviour. [32] Two periods were covered: before receiving diagnosis and after receiving diagnosis. We assessed emotional distress by measuring perceived stress, anxiety and depression.[33] The level of perceived stress was assessed using the *Perceived Stress Scale 4* (PSS-4), a four-point scale, whose overall scores range from 0 to 16, which measures the frequency of seemingly threatening situations. The higher the score, the higher the level of perceived stress.[34] We assessed anxiety using the *Generalized Anxiety Disorder-2* (GAD-2), a very brief screening tool whose overall scores range from 0 to 6, and where a score of 3 or more suggests the presence of anxiety symptoms.[35] To perform the assessment of depression, we used the *Patient Health Questionnaire-2* (PHQ-2), another brief screening tool whose scores range from 0 to 6, and where a score of 3 or more shows the presence of symptoms of depression.[35]

We also measured the sociodemographic variables (age, country of birth, ethnic origin, highest level of education completed, etc.) and the clinical variables (treatment, stage of the cancer, Gleason score and PSA level). To achieve greater clarity within the questionnaire, we completed pretesting among ten individuals. Such pretesting did not lead to any adjustments.

### Statistical analyses

Data entry and analyses were performed using *IMB SPSS Statistics*, version 28. We calculated descriptive statistics to describe the HRQoL, level of PA, perceived stress, presence of anxiety symptoms, presence of depression symptoms, and clinical sociodemographic characteristics of participants. We conducted correlation analyses to verify any possible collinearity between the three dummy variables for emotional distress: stress, anxiety, and depression. As multicollinearity was found between these variables (Table 4), we grouped them to form one single variable (the “emotional distress” variable) to enable mediation analyses. We then used mediation analyses (simple linear regression) to measure the association between PA and mental/physical HRQoL, and the potential mediating effect of emotional distress on said association. The sample size was established according to Cohen (1988)[36] and the chosen p-value was  0.05.

## RESULTS

### Sociodemographic and clinical characteristics

The mean age of participants was 73.42 ± 7.01. Most participants were Caucasian (98.8 %), in a relationship (76.5 %) and retired (72.9 %) (Table 1).

Most (92.7 %) had localized PC (stage ≤ T2c). Nearly half of participants (42.5 %) had a Gleason score of 6 or less. Also, the majority of participants (82.4 %) had commenced treatment upon diagnosis. External radiation therapy was the most common treatment (35.3 %) (Table 2).

**Level of PA**
Most participants (81.2 %) considered themselves as active prior to diagnosis. Also, most participants (61.2 %) engaged in intense PA after diagnosis. Only 20 % were inactive. Furthermore, only 16.5 % of participants spent over eight hours per day in a sitting position (Table 3).

**HRQoL**
The mean score of the physical component of the participants' HRQoL (41.99 ± 6.09) was below the threshold (50), while that of the mental component was above the threshold (52.40 ± 4.86). These results expose the low physical HRQoL and the borderline mental HRQoL of study participants.

**Emotional distress**
The participants' mean score on the PSS-4 was 3.18 ± 2.62 (scale ranging from 0 to 16), which reflects a low level of stress. Additionally, only 5.9 % of participants posted a score of 3 or more on the PHQ-2, which shows the presence of symptoms of depression. In contrast, a large majority of participants (92.9 %) scored 3 or more on the GAD-2 scale, thus indicating the presence of anxiety symptoms.

**Association between PA and HRQoL**
The results of the present study have not demonstrated a significant statistical association between PA and HRQoL. As a result, there is no mediating effect of emotional distress on the association.

In terms of the mental component of HRQoL, the results of the present study show the following: 1) lack of a significant statistical association between PA and mental HRQoL ($\beta = 0.007$; $p = 0.744$; 95 % CI [-0.033 – 0.046]); 2) lack of a significant statistical association between PA and emotional distress ($\beta = -0.007$; $p = 0.852$; 95 % CI [-0.083 – 0.069]); 3) presence of a significant statistical association between emotional distress and HRQoL, where emotional distress has a negative impact on mental HRQoL, thus indicating that a high level of emotional distress is associated to low mental HRQoL ($\beta = - 1.012$; $p < 0.001$; 95% CI [-0.362 – - 0.152]) (Figure 2).

In terms of physical HRQoL, the results of the present study show the following: 1) lack of a significant statistical association between PA and physical HRQoL ($\beta = 0.016$; $p = 0.319$; 95% CI [-0.016 – 0.047]); 2) lack of a significant statistical association between PA and emotional distress ($\beta = -0.063$; $p = 0.852$; 95% CI [-0.083 -0.069]); 3) presence of a significant statistical association between emotional distress and physical HRQoL, where emotional distress has a negative impact on physical HRQoL, thus indicating that a high level of emotional distress is associated to low physical HRQoL ($\beta = - 1.012$; $p < 0.001$; 95% CI [- 0.205 – - 0.021]) (Figure 3).

## DISCUSSION

To our knowledge, the present study is the first to focus on the association between PA and HRQoL while considering the potential mediating effect of emotional distress on said association among men with PC living in remote area of Quebec. Our study shows that while men with PC are physically active, their physical and mental HRQoL is low. However, it has failed to demonstrate a significant statistical association between PA and HRQoL.

First, the results regarding PA before and after diagnosis reveal that participants are more physically active than what is described in literature.[19, 28, 37, 38] This finding is both unexpected and reassuring. Indeed, it is encouraging to learn that many participants engage in high levels of PA. Perhaps such high levels of PA are due to a certain knowledge and awareness among the population of the benefits of PA.[39] That said, although the majority of participants reported a high level of PA, some participants (20 %) were inactive. This finding supports those of other studies,[27, 28, 29] including a study by Stone et al. (2019), according to which 44.6% of Canadians with PC reported levels of PA below the recommended threshold.[40] To help men with PC better follow recommendations, PA should be medically prescribed by a physician or a nurse practitioner (NP).[37] Also, to promote regular PA, it is critical to consider the personal preferences of patients in terms of PA[37] and to encourage patients to engage in PA within organizations or facilities that provide follow-up services by PA professionals and peer support.[43]

Second, the results show that men with PC have lower physical and mental HRQoL, with their physical HRQoL being lower than their mental HRQoL. The low HRQoL found in the present study supports the findings of other studies.[10, 11] The same is true for the lower physical versus mental HRQoL.[44, 45] The adverse effects of treatment options could account for these findings.[4] In fact, the present study shows that few patients were treated through active surveillance, whereas most received curative treatment such as prostatectomy or radiotherapy, both of which are known for their adverse effects impact on HRQoL.[46] It should be noted that the results regarding the most commonly received treatments align with those observed by El-Haouly et al. in their study conducted in a remote area of Quebec.[47] According to El-Haouly et al. (2021), the choice of patients to opt for active treatment would be based on the concern of being affected by the disease and the fear that cancer may spread.[47]

Third, the present study did not demonstrate a significant statistical association between PA and HRQoL. Such results differ from those of most studies published in the field according to which PA increases the HRQoL of men with PC.[25] As the high level of PA self-reported by the participants of the present study may have been limited to a short period of time corresponding to local summer months, it is logical to argue that the short period was not sufficient to positively impact HRQoL scores. In fact, literature shows that PA must span at least 12 weeks to have a positive impact on HRQoL.[38] This further supports the importance of engaging in regular PA.

While the present study failed to show a direct or indirect association between PA and HRQOL, one should keep in mind that it did reveal a significant statistical association between

emotional distress and physical and mental HRQoL. This result supports the finding of Awick et al. (2017) showing an association between high emotional distress and impaired HRQoL.[23] It can be explained by the physical, psychological and social decline that arises out of emotional distress among patients with a chronic disease, such as cancer, which in turn affects their HRQoL.[48]

**Strengths and limitations**

The present study is innovative in that, to our knowledge, it is the first to examine the association between PA and HRQoL among men with PC living in remote areas of Quebec. Furthermore, to our knowledge, it is the first to address the potential mediating effect of emotional distress on said association in this specific setting. The other strengths of the present study include: 1) a high level of participation (70%) compared to other studies (45.2%[28] and 59.3%[49]); 2) the use of validated scales such as the SF-12v2 and the IPAQ, thus upholding the validity of the measures; and 3) the pretesting of the questionnaire to ensure its clarity. Despite the use of a non-probability sampling scheme, we consider that the recruitment of participants through the hospital's regional urology centre minimized the possibility of selection bias. In terms of limitations, the present study's small sample size may have lowered its statistical power. A larger sample size could have enabled the identification of an association between PA and HRQoL, which could have been observed in a real-life setting. Furthermore, our sample did not include individuals from indigenous peoples, which represents a potential bias in representativeness. Finally, having converted the "anxiety" and "depression" variables into continuous variables and having created the "emotional distress" variable from the "anxiety", "depression" and "stress" variables corresponds to a limitation of the study due to a potential abnormal distribution of these variables.

## CONCLUSIONS

The results of the present study provide current data on two important aspects of a subject of growing interest: PA and HRQoL among men with PC living in remote areas of Quebec. Such data collection and findings constitute the first step in promoting regular PA, managing emotional distress, and improving the HRQoL of men with PC living in remote areas. We recommend that further studies be carried out in the future to measure physical activity over a longer period, in order to minimize any potential bias related to seasonality.

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## FIGURES AND TABLES

**Figure 1.** Recruitment flowchart.

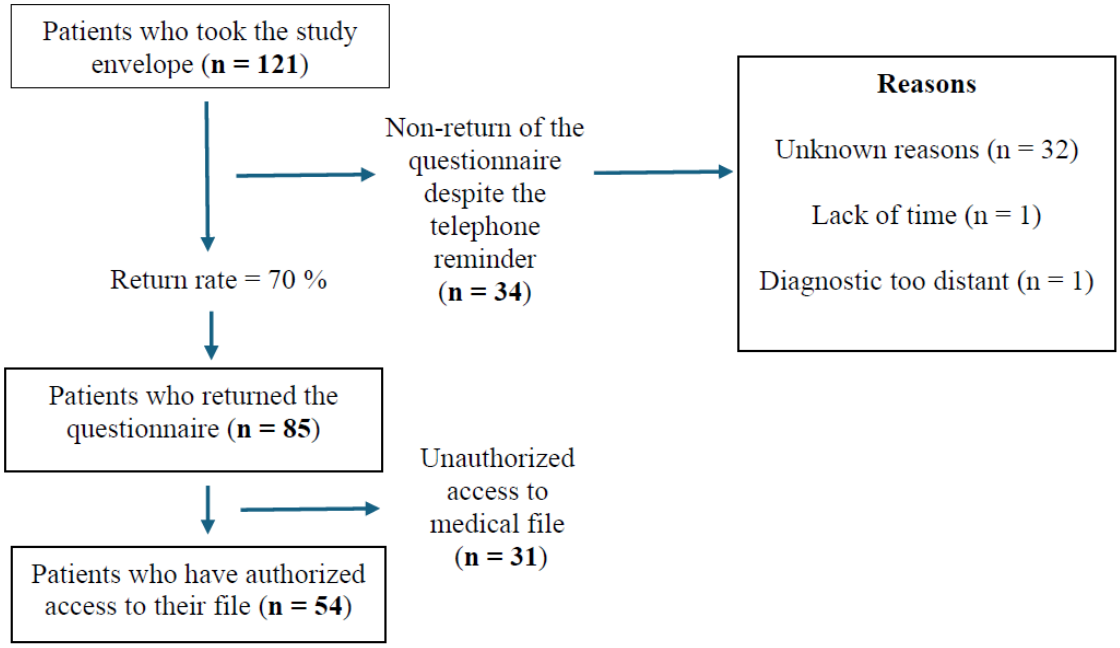

**Figure 2.** Association between physical activity and mental health-related quality of life considering the mediating effect of emotional distress.

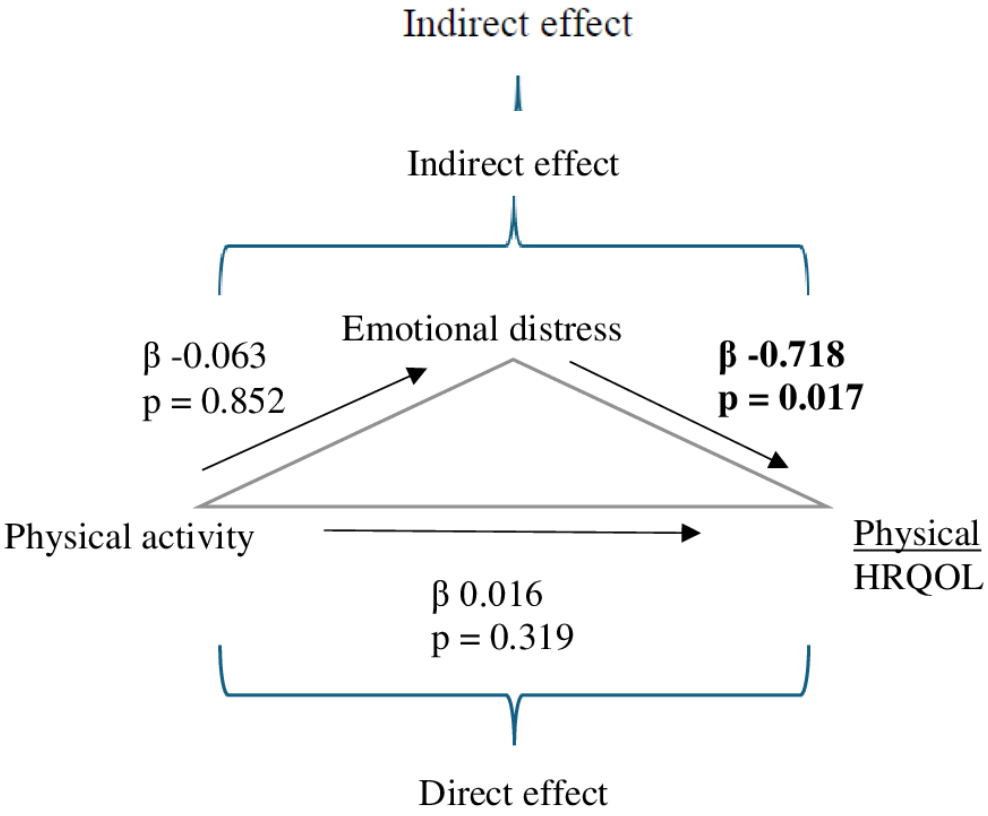


**Figure 3.** Association between physical activity and mental health-related quality of life considering the mediating effect of emotional distress

| **Table 1. Sociodemographic characteristics of participants** | |
|---|---|
| **Characteristics** | **N=85** |
| Age (in years), mean ± SD | 73.42±7.01 |
| Minimum | 56 |
| Maximum | 93 |
| Country of birth, n (%) | |
| Canada | 84 (98.8) |
| Other | 1 (1.2) |
| Ethnic origin, n (%) | 84 (98.8) |
| Caucasian | |
| Education, n (%) | |
| Elementary school | 13 (15.3) |
| High school | 31 (36.5) |
| Vocational training | 22 (25.9) |
| College | 7 (8.2) |

| | |
|---|---|
| University | 11(12.9) |
| Home situation, n (%) | |
| Alone (with or without children) | 24 (28.2) |
| With partner (with or without children) | 59 (69.4) |
| With roommate(s) (e.g., friend[s]) | 1 (1.2) |
| Other | 1 (1.2**)** |
| Work status, n (%) | |
| Working full-time | 10 (11.8) |
| Working part-time | 12 (14.1) |
| Retired | 62 (72.9) |
| Other | 1 (1.2) |
| Household income, n (%) | |
| <$20 000 | 8 (9.4) |
| $20 000–39 000 | 24 (28.2) |
| $40 000–59 000 | 25 (29.4) |
| $60 000–79 000 | 11 (12.9) |
| $80 000–99 999 | 8 (9.4) |
| ≥$100 000 | 6 (7.1) |
| Area of residence, n (%) | |
| Rural* | 37 (43.5) |
| Urban** | 48 (56.5) |

Missing data of variables shown range from 1.2–3.5%. *Community with a population of <10 000 people. **Community with a population of ≥10 000 people.

| **Table 2. Clinical characteristics of participants** | |
|---|---|
| **Characteristics** | **N=85** |
| Stage of cancer as per information provided by physician, n (%) | |
| Localized | 84 (97.6) |
| Locally advanced prostate cancer | 1 (1.2) |
| Treatment started, n (%) | |
| Yes | 70 (82.4) |
| No | 15 (17.6) |
| Treatment received*, n (%) | |
| External radiation therapy | 30 (35.3) |
| Internal radiation therapy | 24 (28.2) |
| Hormone therapy | 14 (16.5) |
| Surgery | 14 (16.5) |

| | |
|---|---|
| Active surveillance | 4 (4.7) |
| Chemotherapy | 1 (1.2) |
| Unknown | 4 (4.7) |
| **Characteristics** | **n=54** |
| Stage**, n (%) | |
| ≤T1b | 4 (9.7) |
| T1c–T2c | 34 (83) |
| ≥T3 | 3 (7.3) |
| Gleason score, n (%) | 23 (42.5) |
| ≤6 | 17 (31.5) |
| 7 | 14 (26.0) |
| ≥7 | |
| PSA level (ng/mL), mean ± SD | 25.93 ± 91.76 |
| Minimum | 0.52 |
| Maximum | 649 |

Missing data of variables shown=1.2%. *Some participants received more than one type of treatment. **13 medical files did not contain any information on the stage of the cancer.

| **Table 3. Level of PA among participants** | |
|---|---|
| **Physical activity** | **N=85** |
| Physically active before the illness*, n (%) | |
| Yes | 9 (81.2) |
| No | 14 (16.5) |
| Unknown | 1 (1.2) |
| Level of PA in the last 7 days**, n (%) | |
| Low | 18 (21.2) |
| Moderate | 15 (17.6) |
| High | 52 (61.2) |
| Time spent sitting down (hours/day), n (%) | |
| ≤8 hours | 59 (69.4) |
| >8 hours | 14 (16.5) |
| Unknown | 12 (14.1) |

* Physical activity prior to diagnosis was measured using the following question: Considering that an active person had 150 minutes of moderate physical activity or 75 minutes of total vigorous activity per week, prior to your prostate cancer diagnosis, would you say you were an active person? **As the original variables are continuous (MET min.), each one (sedentary behavior, walking, low level of PA, moderate level of PA, high level of PA) was transformed into a total score expressed in MET min/week and then converted into an ordinal variable: low (MET min/week <1500), moderate (MET min/week >1500), and high (MET min/week >3000).

| **Table 4. Correlations between emotional distress indicators (n = 85)** | | | |
|---|---|---|---|
| **Variables[a]** | **1** | **2** | **3** |
| 1. Stress | 1 | | |
| 2. Anxiety | 0.547* | 1 | |
| 3. Depression | 0.639* | 0.646* | 1 |

[a]Correlation analyses: Initial variables were grouped to form one single variable (the emotional distress variable) to enable mediation analyses. *Threshold for correlation significance=0.01 (bilateral).