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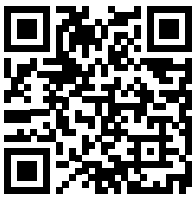

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Do Physical Activity and Quality of Life Influence Health Behavior and Psychological Health under the Moderating Role of Cancer Risk Perception? A Cross-Sectional Study on Cancer Patients

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Abstract

This study aimed to examine the influence of physical activity, and quality of life on psychological health through health behavior. The moderating role of cancer risk perception also tested. To address the research objective, a quantitative approach was employed, incorporating a cross-sectional design and statistical analysis using SPSS and AMOS. A sample of 250 cancer patients was selected using purposive sampling for data collection. The findings revealed that both physical activity and quality of life have a significant and positive impact on the psychological health of cancer patients. Moreover, health behavior plays a significant mediating role in the relationships between physical activity and psychological health, as well as between quality of life and psychological health. In addition, cancer risk perception significantly and positively moderates among physical activity, quality of life and health behavior. The study with these findings emphasizes the significance of promoting physical activities and a better quality of life to improve the psychological health of cancer patients. Promoting healthy behaviors and addressing cancer-related risk perceptions through physical activity and quality of life interventions can significantly enhance psychological well-being, informing the development of comprehensive cancer care approaches.

Keywords:

Physical Activity, Health Behavior, Quality of Life, Cancer Patients, Cancer-related Risk Perception, Psychological health

Introduction

The psychological health (PH) of cancer patients is crucial to their overall well-being [1]. Various emotional and psychological challenges are associated with the diagnosis of cancer, which include stress and anxiety that could intensify the physical symptoms that could negatively affect the recovery and treatment [2]. Correspondingly, cancer patients also struggle with their mental health because of treatment side effects and uncertainty about their condition [3]. This is the reason, a better PH of the cancer patients is necessary not only to improve their life quality during their treatment, but it is also important for facilitating better coping strategies, which helps to increase their ability in managing their both of psychological and physical cancer aspects [4]. Similarly, research has demonstrated that patients with strong PH have better treatment outcomes, including improved immune function and reduced recurrence rates [5]. In the meantime, developing successful interventions that can enhance overall results requires understanding the variables influencing cancer patients' PH.

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Various factors improve PH, but among those, health behavior (HB) is an important factor that improves PH, particularly among cancer patients [6]. In practice, in cancer patients, promoting HB through regular exercise, stress management, and adequate sleep significantly improves mental health [7]. Correspondingly, adoption of HB among the patients is not only important for the improvement of physical health, but it also helps to increase the psychological resilience [8]. Sabiston and Brunet [9] also supported the view that engagement of cancer patients in health-promoting behavior improves their mood, reduces their overall psychological state. Positive HB promotes to helps individuals to increase their control to improve their health through reducing stress and improving their self-esteem [10]. Other researchers also highlighted that HB is a particularly important factor for cancer patients because it can reduce the negative psychological effects, which significantly improve the patient's well-being [1]. Furthermore, cancer patients are encouraged to adopt healthy behaviors to improve their mental health and PH outcomes. Therefore, the impact of health behaviors on cancer patients' PH is the focus of the study.

Engaging in physical activity (PA) is crucial for enhancing people's health behaviors, which in turn promotes better PH [11]. Concerning cancer patients, regular PA increases various physical benefits like improved cardiovascular health, reduced fatigue, and enhanced mobility, which are all crucial for cancer patients undergoing treatment [12]. At the same time, by enhancing positive health behaviors, cancer patients' psychological well-being is also directly associated with their quality of life (QOL) [13]. Moreover, healthy habits like a balanced diet, taking medication as prescribed, and regular PA serve as protective factors that promote emotional resilience and confidence in managing one's health [14]. Additionally, literature emphasized that PH is improved by QOL [15]. This research demonstrated the importance of QOL and PA to improve positive HB of employees, which significantly improves their PH. Therefore, the study focused on the impact of physical exercise and QOL on PH by enhancing healthy behavior.

PA and QOL impact on PH might be increased by cancer risk perception (CRP). Patients' perceptions of their cancer risk significantly influenced their motivation to adopt healthy behaviors, which in turn improved their mental well-being [16]. Equally, when the individual feels the risk of cancer, it could influence them to adopt positive behavior to minimize the cancer risk [17]. In the same vein, individuals who feel their risk of their cancer recurrence then they could engage in physical activities and also follow the guidelines of doctors for their medication [18]. In the same vein, people who perceive that there is a high risk of cancer then they tend to make healthier lifestyle choices, which leads to enhanced QOL and improved PH [19]. On the other hand, perception of cancer risk also affects a patient's mental health by encouraging adaptive coping mechanisms and a sense of control [16]. Additionally, Slovic [20] further suggested that individuals who perceive higher risks may be more motivated to take proactive steps, which leads to positive behavioral changes that can mitigate psychological distress. These studies highlighted that cancer perception is an integral factor that motivates cancer patients to engage in health-promoting behavior by increasing their engagement towards PA and QOL. Therefore, the study focused on the moderating role of CRP.

Despite a significant amount of research on the connection between cancer patients' PH, health behaviors, QOL, and PA, there are still several gaps in the theoretical, contextual, and practical viewpoints. Theoretically, although a lot of research focuses on how PA and QOL affect HB and PH on an individual level [21, 22], little research integrates these factors in a moderated and mediation framework, particularly when it comes to cancer patients. Kim, et al. [23], Rakovitch, et al. [24] examined that further studies on PA, QOL, and PH can be conducted in other contexts. CRP as a moderating role, particularly how perceptions of cancer recurrence might influence the adoption of behaviors that enhance PH [1, 25], has been unexplored. Therefore, this study focused on the moderated and mediated model to contribute to the extant literature. Contextually, most studies have been conducted on other respondents [26, 27], while having limited attention on the healthcare sector. Therefore, contribute to earlier research, this study concentrated on cancer patients. Addressing these gaps is crucial to creating more thorough models that can direct interventions meant to enhance cancer patients' PH outcomes. Hence, the purpose of the study was to examine how QOL and PA affect PH through healthy behavior. The moderating role of CRP was also tested on cancer patients.

The findings of this study hold significant practical implications for addressing the above gaps in the findings lie in creating more potent, research-based treatments for cancer patients. By combining health behavior, psychological well-being, QOL, and PA in a moderated mediated framework, medical professionals can create comprehensive, all-encompassing treatment regimens that precisely address cancer patients' physical and mental health. Understanding the role of CRP in influencing health behaviors will allow for more tailored interventions that motivate patients in the engagement of those activities that are health-

promoting, potentially improving their emotional resilience and QOL. Furthermore, these interventions can be more effectively tailored to the specific needs of patients from various cultural backgrounds by filling in the contextual gaps and taking into account a variety of demographics, making them both pertinent and easily accessible. Bridging these gaps will also enhance clinical practices by incorporating a multifaceted approach to cancer care that could lead to improving the patients' treatments. The study was further divided into four chapters. The second chapter was a literature review. The third chapter was the research methodology. The fourth chapter was the data analysis, where panel data regression techniques were analyzed. The fifth chapter was related to the discussion of the study.

Literature Review

Cancer care prioritizes psychological well-being, which impacts patients' resilience, treatment compliance, and quality of life [28]. It encompasses emotional health, life satisfaction, anxiety management, and a sense of purpose [3]. A cancer diagnosis, uncertainty about the future, and physical constraints can cause significant psychological distress in patients, hindering their emotional recovery [29]. Similarly, enhancing psychological health can strengthen coping abilities, improve immune function, and aid in the recovery process [30]. However, to promote psychological well-being, it's essential to understand the lifestyle and behavioral factors that impact it [31]. Therefore, effective treatments for cancer patients require an understanding of the behavioral and perceptual elements that influence psychological well-being [32]. Moreover, there are many components that affect psychological health, physical exercise and life quality are important factors.

Physical activity consisted of movement of physically from one place to another, place as walking, running, and swimming etc. [33]. In the same vein, physical activity also refers to the emotional and mental health of the individuals, including aspects such as mood, stress level and general mental function [34]. Other studies have also highlighted the importance of physical activity in improving psychological well-being by improving sleep quality and self-confidence [35]. Further empirical study of Mahindru, et al. [36] also emphasized the significance of physical activity to improve mental health through intermediaries such as mindfulness, emotional regulation, and flexibility. In addition to previous studies, other authors also recommended that physical activities like exercise, running could increase psychological health [37]. In order to promote psychological happiness, our findings highlight the significance of integrating regular physical activity into everyday routines.

Furthermore, a person's psychological state, degree of freedom, and key environmental characteristics are all aspects of their physical health that are included in the crucial concept of quality of life [38]. In the same vein, better psychological health is also linked to quality of life since it indicates satisfaction with life conditions and the capacity to engage in fulfilling activities [39]. In the meantime, quality of life could also help to reduce stress, better mood, and increase flexibility against their mental health disorders [40]. Further study examining the dissemination role of health promotion behavior found that high QOL individuals related more to health behavior, which in turn improved their psychological health [41]. In addition, study published in the analysis of general psychiatry emphasized that personality symptoms and combat strategies greatly affect health QOL, indicating a significant relationship between personal characteristics and QOL [42]. Additionally, these earlier studies suggested that more research be done in other nations to improve the findings' generalizability.

Furthermore, health behavior includes a variety of activities that have an impact on a person's health, such as exercising, eating a balanced diet, abstaining from bad habits like smoking, and listening to medical advice [43]. The positive health behavior is also important to improve psychological health because it leads to improving the mood of patients, reducing their anxiety [40]. In other words, this behavior enhances control self-efficacy, an essential factor in enhancing patients' psychological well-being [44]. An empirical study on cancer patients has been conducted, where they found positive attention towards the improvement of health behavior the psychological health [3]. In addition, the study that was published in the Journal of Cancer Education examined how people perceive cancer control and risk knowledge and revealed how health practices affect psychological outcomes [40]. These results suggest that encouraging healthy behavior can be a useful tactic to enhance mental well-being. Hence, a study has the following research hypothesis,

H1: Physical activity significantly improves psychological health.
H2: Quality of life significantly improves psychological health.
H3: Health behavior significantly improves psychological health.

Mediating Role of Health Behavior

Physical activity enhances people's psychological well-being. Research also highlighted that physical activity significantly improves psychological health with an indirect effect [45]. In this regard, improving health behavior can be used as a mediating variable. This highlighted that physical activity helps to improve psychological health by encouraging individuals to engage in healthy behavior. Being engaged in regular physical activity often develops other positive lifestyle habits, such as better diet, regular sleep, and better stress management, all of which increase psychological

welfare [46]. Other authors also recommended that improving health behavior improves the effectiveness of interventions, which improves the psychological health of the individuals [47]. Li, et al. [48] study also emphasized that people who have a focus on the improvement of physical activity then it could lead to improved health behavior, which is likely to result in better results of mental health. These studies emphasize the importance of physical activity in fostering positive health habits, which contribute to improved psychological health. Therefore, the study emphasized how healthy behavior acts as a mediator between psychological well-being and physical activity.

Better quality of life improves the positive health behavior of individuals, which increases their psychological health of the individuals. Therefore, the quality of life concept is a comprehensive concept leads to incorporates various elements like physical health, social interactions, and environmental influences [49]. Other research also indicated that raising healthy behaviors can empower individuals to enhance their overall mental well-being [50]. Berghöfer, et al. [51] also discovered the relationship and showed that patients with better self-respect improved in psychological conditions, which suggests that maintaining a good quality of life can motivate actions that protect mental health. Zheng, et al. [52] study also demonstrated that social support, an important aspect of QOL, encourages people to maintain a healthy lifestyle, which improves mental welfare, especially in patients with chronic diseases. According to previous literature, the study has the following hypothesis, where the health behavior mediating role is demonstrated.

H4: Physical activity significantly improves psychological health through the mediating effect of health behavior.

H5: Quality of life significantly improves psychological health through the mediating effect of health behavior.

Moderating Role of Cancer Risk Perception

Physical activity, quality of life, and psychological health are not clear [45, 53, 54]. For this purpose, cancer beliefs played an integral role in knowing how individuals reacted to the lifestyles of the people, particularly when it comes to participating in their daily life physical activities [55]. Literature highlighted that when individuals have their higher risk of cancer, then it could increase their attention towards regular exercise, which could increase their psychological health [56]. According to Rogers, et al. [57], health risk is an important driver for behavioral change, especially when individuals believe that preventive measures, such as exercising regularly, can reduce the risk. Similarly, Rock, et al. [55] found that individuals who acknowledge their risk for certain diseases are more likely to participate in health-enhancing activities, such as physical exercise, leading to improved overall health behaviors. In the context of cancer patients or high-risk individuals, this perception often leads to more obligation to lifestyle changes that support physical and psychological welfare [5]. These previous studies highlighted that cancer risk perception is an integral factor that helps to improve psychological health behavior. In this regard, when people are more aware of their cancer risk, the connection between physical activity and healthy behaviors becomes more significant, highlighting the importance of incorporating risk awareness into health programs.

The perception of cancer risk can also form how the quality of life (QOL) becomes health practice [58]. When people with high QOL also believe that they are at risk of cancer, they may be more motivated to use and maintain healthy behavior as a means of preserving their goodness. This feeling of vulnerability can increase the effect of a good QOL by strengthening the need for preventive functions such as regular medical examination, nutritious food and stress reduction practices [5]. Study like those of Rogers, et al. [57] indicates that people who feel their lives are more active in maintaining their health because of the alleged quality of life. It is especially relevant for people with a family history of cancer or for those who often become more aware of their health behavior. Furthermore, activities that promote mental and physical flexibility and enhance the connection between health behavior and quality of life may be preferred by cancer patients who are at continuous risk [59]. Overall, cancer risk perception is an integral factor that could strengthen the relationship. Thus, based on previous studies, a study has formulated the following hypothesis,

H6: Cancer risk perception significantly moderates between physical activity and health behavior.

H7: Cancer risk perception significantly moderates between quality of life and health behavior.

Research Methodology

This study aimed to examine the influence of physical activity and quality of life on psychological health through health behavior. The moderating role of cancer risk perception was also tested. This study's objectives are effectively addressed through a quantitative research approach, which yields regression results that help identify patterns and relationships within the data [60]. On the other hand, a cross-sectional research design for a collection of data used from the respondents, where cancer patient respondents are involved in the research process. This research design has been chosen because it is considered to be well-suited for understanding the variables' relation at a specific time [61, 62]. After viewing these studies, researchers used cross cross-sectional research design.

The study population comprises cancer patients from various regions. Using the sample table, 250 cancer patients were selected to ensure the study's significant

results, which provide suitable insights. In'nami and Koizumi [63] study results emphasized that in the Structural equation modeling (SEM), 250 sample size is enough for taking a true picture of the research objective. A 250 sample was selected via a purposive sampling technique, which provides a better sample size aligned with the study objective, like cancer patients, was used to choose the study's sample. In this regard, purposive sampling is a suitable method for this study, as it allows for the selection of participants with specific characteristics, such as a cancer diagnosis, which is crucial for addressing the research questions [64]. A total of 300 questionnaires were distributed, 250 came back, and all were valid for analysis.

Construct Development and Framework

The survey questionnaire adopted from previous studies. From the questionnaires, psychological health is measured using 12 items [4]. Quality of life comprises 7 items [65]. Health behavior comprises 4 items [66]. In other words, physical activity was measured from 4 items [67]. The cancer risk perception comprises 3 dimensions. Risk perception was examined across three dimensions, each measured by three items: numerical-deliberative, reflective-deliberative, and affective-experiential. These dimensions were based on the work of [68]. A 7-point Likert scale was employed to assess responses to the questionnaires. Instrumented variables are represented in Figure 1.

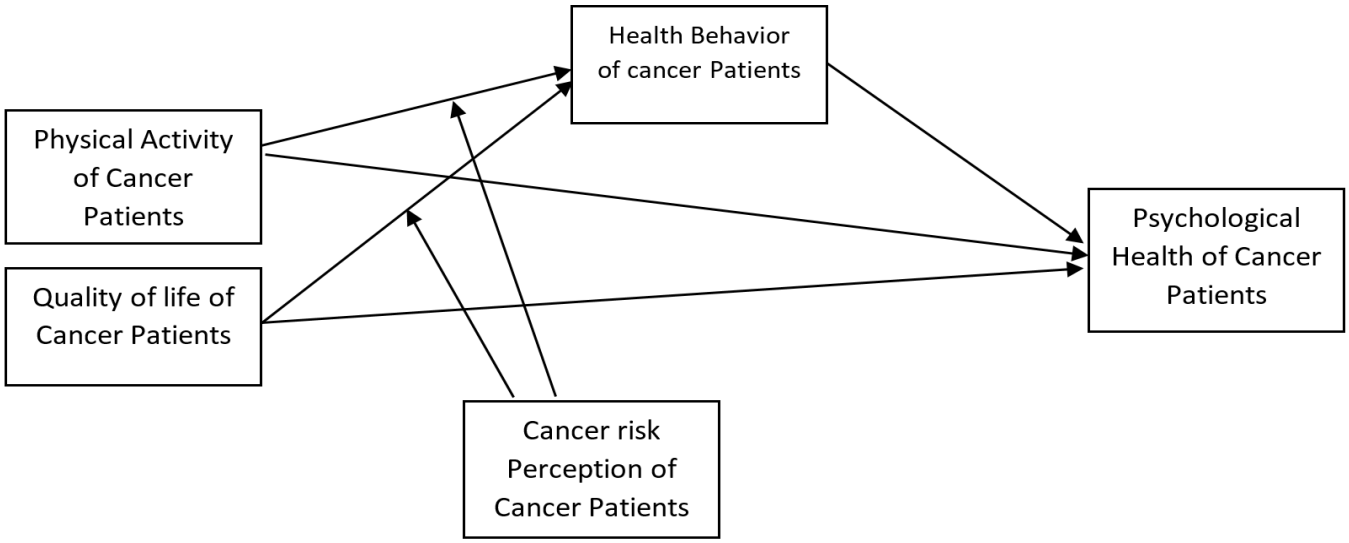

Figure 1: Research Framework

Data Analysis and Findings

Demographic Results

This section shows the study demographic results on 250 cancer patients, which shows a diverse sample in terms of age, gender, education, and cancer type. The majority of participants were females, with 55% and 45% male, which aligns with the higher incidence of cancers such as breast cancer among women. Educationally, 40% had higher education, indicating a moderately educated sample. In terms of cancer types, breast cancer was the most prevalent (30%), followed by lung (25%) and colon cancer (20%), reflecting common patterns in cancer epidemiology. Most participants were in the early stages of treatment (60%), with a significant portion having a family history of cancer (50%), suggesting potential genetic or environmental risk factors. This demographic distribution provides valuable context for understanding the diversity of the cancer patient population and could influence treatment approaches and outcomes in research. The above results is depicted in Table.1.

Table 1: Demographic Results

Demographic Variable	Category	Percentage (%)
Gender	Male	45
	Female	55
Education Level	No Formal Education	10
	Primary education	20
	Secondary education	30
	Higher Secondary Education	40
Cancer Type	Breast Cancer	30
	Lung Cancer	25
	Colon Cancer	20
	Prostate Cancer	15
	Other	10
Treatment Stage	Early Stage	60
	Intermediate Stage	25
	Advanced Stage	15
Family History of Cancer	Yes	50
	No	50

Measurement Model Results

The SEM technique is used for measurement and structural modeling in the AMOS software. The measurement model was tested for convergent and discriminant validity. Convergent validity comprises

factor loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). From these, loadings of each question should be greater than 0.5, which shows a strong reliability of the indicators [69]. Alpha values exceeded 0.70 for all variables, confirming internal consistency reliability [70]. Furthermore, CR values exceeded the 0.70 threshold, which confirms the construct reliability [71]. Furthermore, AVE values for all constructs exceeded 0.50, which shows adequate convergent validity and suggests that the constructs capture a substantial amount of variance, rather than error [72]. Table 2 predicted the study results.

Table 2: Convergent Validity

Construct Code	Item Code	Factor Loading	T-value	A	CR	AVE
PA	PA1	0.781	9.34	0.881	0.897	0.661
	PA2	0.813	10.11			
	PA3	0.843	9.76			
	PA4	0.850	10.95			
QL	QL1	0.763	8.92	0.871	0.9	0.641
	QL2	0.795	9.35			
	QL3	0.773	9.01			
	QL4	0.814	9.87			
	QL5	0.838	10.26			
	QL6	0.782	7.321			
	QL7	0.812	5.321			
HB	HB1	0.732	10.56	0.892	0.901	0.681
	HB2	0.743	10.88			
	HB3	0.812	9.98			
	HB4	0.824	10.31			
PH	PH1	0.825	10.12	0.921	0.911	0.731
	PH2	0.855	10.73			
	PH3	0.816	10.03			
	PH4	0.848	10.69			
	PH5	0.916	11.28			
	PH6	0.671	2.78			
	PH7	0.780	5.67			
	PH8	0.713	11.67			
	PH9	0.941	10.67			
	PH11	0.748	6.87			
	PH12	0.871	7.91			
NDRP	NDRP1	0.754	8.65	0.863	0.882	0.621
	NDRP2	0.784	9.12			
	NDRP3	0.773	8.89			
RDRP	RDRP1	0.783	3.43	0.892	0.904	0.761
	RDRP2	0.792	7.35			
	RDRP3	0.842	9.72			
AERP	AERP1	0.893	9.67	0.842	0.872	0.672
	AERP2	0.823	9.91			
	AERP3	0.783	0.87			

Note: Physical Activity, QL = Quality of Life, HB = Health Behavior, PH = Psychological Health, NDRP-Numerical-deliberative risk perception, RDRP-Reflective-deliberative risk perception, AERP-affective-experiential risk perception.

The next process in the measurement model is to test the discriminant validity. Henseler, et al. [73] highlighted that establishing discriminant validity is important as it ensures that each latent variable explains phenomena that are not captured by other constructs. Discriminant validity was assessed using the Fornell and Larcker [71] criterion through AMOS software, which compares the square root of the AVE for each construct with the inter-construct correlations. The findings showed that each variable's AVE square root was higher than every correlation, which confirms that each construct is distinct. This highlights that the construct fulfills the requirement of discriminant validity, which is highlighted in Table 3.

Table 3: Discriminant Validity

Construct	PA	QL	HB	PH	CRP	RDRP	AERP
PA	**0.813**						
QL	0.602	**0.800**					
HB	0.528	0.632	**0.825**				
PH	0.612	0.539	0.681	**0.855**			
NDRP	0.532	0.515	0.537	0.526	**0.788**		
RDRP	0.321	0.213	0.412	0.672	0.341	**0.872**	
AERP	0.621	0.562	0.123	0.513	0.73	0.521	**0.820**

Model fitness

The section highlighted the results of model fitness. Among the model fitness values, the Chi-Square/df ratio value is 1.57, which is below 3, suggesting an acceptable model fit [74]. The RMSEA value of 0.045 is significantly lower than the cutoff of 0.06 showing model fitness [75]. Lastly, the CFI score of 0.95 is higher than the 0.90 threshold, indicating that the model provides a good fit to the data [76]. These indices collectively offer compelling proof of the predicted model's validity, indicating that it accurately captures the underlying connections between the study's constructs. The above outcomes are highlighted in Table 4.

Table 4: Model Fitness

Fit Index	Value	Acceptable Threshold	Interpretation
Chi-Square/df	1.57	≤ 3	Indicates a good fit
RMSEA	0.045	≤ 0.06	Excellent fit
Comparative Fit Index (CFI)	0.95	≥ 0.90	Indicates a good fit

Hypothesis Results

The study hypothesis is then tested following the measurement model's outcomes. The initial structural model results highlight the significant positive impact of physical activity (PA) on mental well-being (PH) (PH) (β = 0.415, p = 0.001). In the same vein, quality of life (QOL) was also found to have a significant positive impact on PH (β = 0.312, p = 0.001). Health behavior (HB) was also found impact a significant impact on PH (β = 0.531, p = 0). Further, the mediating role of HB between PA and PHA was also supported, with a positive and significant impact (β = 0.431, p = 0.001). The mediating effect of HB was also observed in the relationship between QOL and PH (β = 0.352, p = 0). In other words, cancer risk perception was also found to significantly moderate the relationship between PA and HB (β = 0.433, p = 0.045). Lastly, cancer risk perception also moderated the relationship between QOL and HB with a positive and significant effect (β = 0.355, p = 0.07). The above results are depicted in Table 5 and Figure 2.

Table 5: Hypothesis Results

Independent Variable	Beta	Standard Error	t-value	p-value	Decision
PA->PH	0.415	0.122	3.402	0.001	Accepted
QOL->PH	0.312	0.132	2.364	0.001	Accepted
HB->PH	0.531	0.115	4.617	0.000	Accepted
PA->HB->PH	0.431	0.143	3.014	0.001	Accepted
QOL->HB->PH	0.352	0.094	3.745	0.001	Accepted
PA* CRP->HB	0.433	0.131	3.305	0.001	Accepted
QOL* CRP->HB	0.355	0.133	2.669	0.001	Accepted

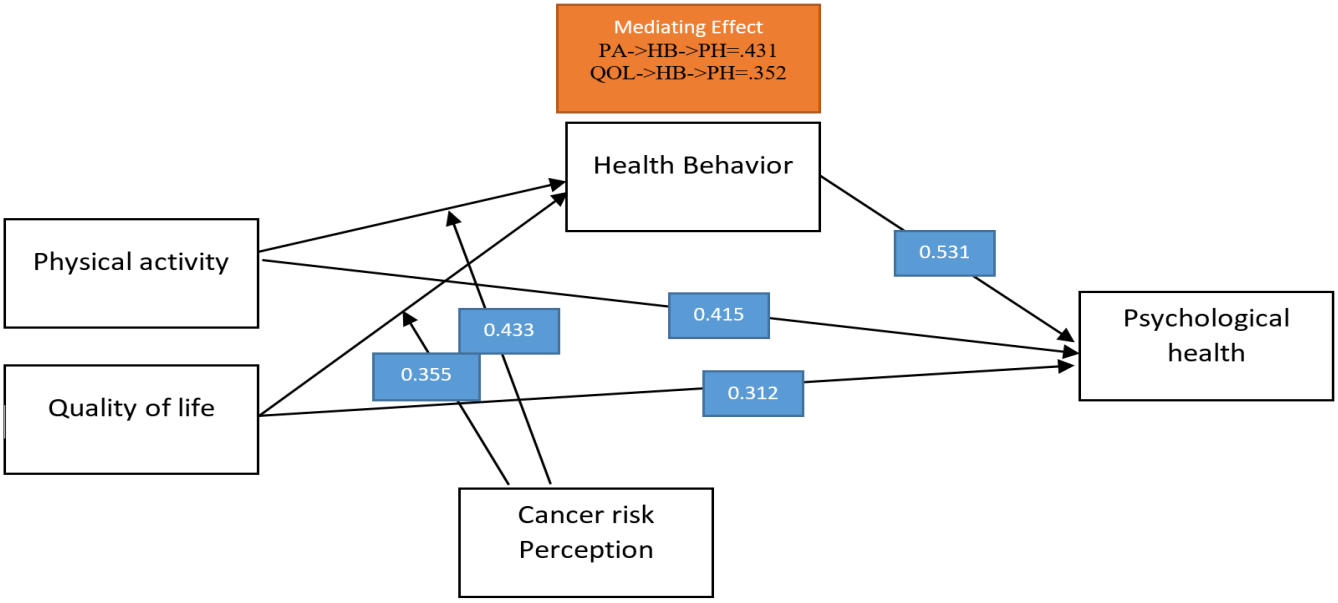

Figure 2: Path coefficients

Discussion

This study sought to investigate the influence of physical activity (PA), quality of life (QOL) on psychological health (PH) through health behavior (HB) of cancer patients. Moderating role cancer risk perception (CRP) also tested. To achieve this objective, the study utilized AMOS software. The study showed that physical activity (PA) significantly and positively affects the psychological health of cancer patients. This finding suggests that regular exercise helps cancer patients feel better both physically and emotionally. Furthermore, PA assists in producing endorphins, lowers stress hormones like cortisol, and enhances sleep quality, all of which are essential for preserving mental stability when ill. This finding is consistent with the study of Henshall, et al. [77], who claimed that physical exercise can also provide a sense of routine and normalcy, maintain emotional regulation of cancer patients, who often experience feelings of fear, sadness, and isolation. Moreover, the findings also align study of Ferrer, et al. [78], who noted that physical exercise interventions in cancer survivors significantly improved psychological outcomes such as reduced anxiety, enhanced mood, and better overall quality of life. These empirical findings highlight that rehabilitation programs should integrate structural physical activities as a non-psychological approach to strengthen cancer patient's psychological health.

Moreover, findings reported that QOL significantly and positively influences the PH of cancer patients. These results show that QOL is an integral factor in improving psychological health. Traditionally, QOL encompasses multiple domains including emotional well-being, physical comfort, social interactions, and family support. When these aspects are well-managed, patients are more resilient in coping with the psychological challenges that come with a cancer diagnosis and treatment. Similarly, a higher QOL can buffer stress and promote optimism, both of which are associated with lower risks of anxiety and depression. This finding is supported by Chambers, et al. [79], who highlighted that individuals who report higher life satisfaction and stable social environments are more likely to show improved psychological adjustment in cancer patients. Elkefi, et al. [1] further supported this finding by demonstrating that cancer patients' mental health and general well-being are enhanced when their quality of life (QOL) improves throughout therapy. These findings highlighted that for cancer patients, ensuring QOL in care practices could substantially improve psychological distress. Therefore, based on these findings, it highlights that hospitals and care

units must focus on the daily activities of patients rather than taking care of only medical outcomes to support their mental wellbeing throughout the treatment.

Furthermore, the results showed that HB significantly improves cancer patients' PH. The HB includes avoiding harmful substances like alcohol and tobacco, practicing yoga for relaxation, according to prescribed regimens, and keeping a healthy diet. This finding indicates that adoption of healthy behaviors not only improves physical health but also fosters psychological empowerment. Similarly, these healthy habits enable patients to feel that they are actively participating in their healing process, thus reducing feelings of helplessness and enhancing self-efficacy. Pudkasam, et al. [80] found the same results who claimed that healthy habits influence the PH of cancer patients and change their attitude positively toward their cancer. These findings affirmed that the psychological well-being of cancer patients is not merely influenced by medical treatment but also by their activities and actions that shape their attitude toward their healing process. Therefore, promoting and reinforcing healthier habits is crucial for emotional stability, mental well-being, and disease management of cancer patients.

In addition to the direct effect, the results further demonstrated that healthy behavior has a positive and significant impact on the relationship between both PA and psychological health, and between QOL and PH of cancer patients. This finding emphasized that PA and QOL not only impact PH separately but also work more effectively when patients adopt healthier habits. In light of this finding, it could mean that individuals who participate in physical activities and have a good QOL are more probably exhibit healthier habits like consuming nutritious food, adhering to medical schedules, seeking emotional control, and reducing sedentary behavior. These healthier habits boost the psychological well-being of cancer patients. These results align with those of Chang de Pinho, et al. [46], Strober, et al. [81] and Marquez, et al. [82] reported that physical activities contribute to healthier habits, which in turn, which in turn foster improvement in mood as well as emotional wellbeing. However, rather than the promotion of physical activities and QOL in isolation, the mediation impact of healthier behavior education must be incorporated into their study plans. Therefore, promoting healthier habits plays a crucial role in fostering long-term psychological resilience among cancer patients during treatment and recovery.

Likewise, the results also revealed that CRP significantly moderates between PA and HB, as well as between QOL and HB. This finding emphasizes the cognitive and emotional dimensions of how patients interpret their illness and make lifestyle decisions. Patients with cancer are more likely to convert their PA and QOL experiences into active HBs if they believe they are at a higher risk of complications or recurrence. Conversely, those with a low risk may feel less urgency to change their routines, even if they are physically active or feel emotionally supported. Ferrer and Klein [83] found same outcomes who argue that individuals with elevated risk perception demonstrate greater vigilance and proactive behavior in response to health indications. Furthermore, it is also supported by the views of Guo, et al. [84], who demonstrated that patients who have low risk perception exhibit less protective behavior, and do not include healthier habits in their routine. This means that the moderating effect is particularly crucial for cancer patients because their perceptions of vulnerability influence how seriously they take prevention and self-care. Even if the risk perception of cancer patients is low, they must avoid behaviors that are detrimental to both mental and physical well-being. Therefore, physicians need to identify patients with cancer-related risk perception using counseling, psychological support, and patient education. By taking this approach, it is possible to ensure that improvements in PA or QOL lead to meaningful behavioral changes, which will ultimately improve the PH of cancer patients.

Theoretical and Practical Contributions

The current study provides several theoretical contributions with a moderated mediation model, which has never been investigated in the context of cancer patients. One key finding is that HB serves as a mediator between PA and QOL, with psychological health. This finding is contributing to helping explain how and why these factors improve mental well-being. The second contribution is adding CRP as a moderator, and the study with this moderating effect shows that patients' personal beliefs about their illness can change the strength of their relationship between PA or QOL, and HB. It brings the existing health psychology models to a new dimension by showing how thinking and emotion contribute to behavior. The third contribution of the study results is that this research combined PA, QOL, and HB into a single model. So, this provides a more realistic view of the things affecting the psychosocial health of cancer patients, which can encourage future research to view health in a more interconnected and pragmatic way. The study also helps researchers to explore new research in the context of PH with the extended model.

From a practical side, this study also brings helpful contributions. One clear contribution is showing that just encouraging PA or improving QOL is not enough; patients also need support in developing good health habits. This means doctors and therapists should focus on helping patients turn their positive experiences into real lifestyle changes, like eating better, being more active, or managing stress. Another important contribution is recognizing how patients' perceptions of their cancer risk affect whether they take action. If patients don't feel at risk, they may not change their behavior even if they feel physically okay. Therefore, healthcare providers must honestly talk about cancer-

related risks in a way that enables patients to take better care of themselves. These results provide healthcare policymakers with evidence to support initiatives promoting both mental and physical well-being. The findings may enable doctors to provide more targeted care for cancer patients, potentially accelerating their recovery.

Conclusion

This study aimed to investigate how cancer patients' PA and QOL affected PH through HB. The study also tested the moderating role of CRP. Data were collected from 250 cancer patients using a purposive sampling technique. The data was analyzed by using AMOS to examine the proposed research model. The findings revealed that PA and QOL positively and significantly influence the PH of cancer patients. It indicates that individuals engaging in physical activities and exhibiting high QOL enhance mental and physical well-being. Moreover, HB plays a significant mediating role in the relationship between physical activity and psychological health, as well as between quality of life and psychological health. By promoting healthy habits, these factors indirectly enhance psychological well-being. In addition, cancer-related risk perception significantly and positively moderates between PA, QOL, and HB, which is assuring that the way patients perceive their risk can shape their attitude toward cancer. The study highlights the importance of promoting PA and enhancing QOL to support the PH of cancer patients.

Limitations and Future Directions

Despite the significant contributions, research has certain limitations that must be acknowledged. Initially, the ability to establish a causal association between variables is limited by cross-sectional research designs. Additionally, the study's reliance on self-reported data may have introduced biases, such as social desirability and recall bias, potentially limiting the generalizability of the findings. Moreover, cultural and geographical confinement also limit the study scope. Another limitation is that this study excludes all clinical variables such as cancer stage, type, and treatment modality, which may significantly impact behavioral and psychological health. To fulfill these limitations, future research should explore this concept in similar or diverse settings. Firstly, future studies should employ longitudinal approaches to observe changes over time. Secondly, future research should include more diverse samples across regions, cultures, and healthcare systems. Thirdly, enriching future models by including clinical variables would extend the analysis. Fourthly, future work should also examine the role of digital health interventions in enhancing PA and HB among cancer patients.

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Survey Instrument

Psychological health

1. I have been able to concentrate on what I'm doing.
2. I have lost much sleep over worry.
3. I have felt I was playing a useful part in things.
4. I have felt capable of making decisions about things.
5. I have felt constantly under strain.
6. I have felt I couldn't overcome my difficulties.
7. I have been able to enjoy my normal day-to-day activities.
8. I have been able to face up to my problems.
9. I have been feeling unhappy and depressed.
10. I have been losing confidence in myself.
11. I have been thinking of myself as a worthless person.
12. I have been feeling reasonably happy, all things considered.

Physical activity

1. I am able to improve my depressed mood through exercise.
2. I can release built-up stress and inner tension by exercising.
3. When I am feeling down, I can distract myself effectively with physical activity.
4. I am able to manage and regulate my mood through physical activity.

Health behavior

1. When I buy food products, I check the ingredients or nutritional information.
2. I actively look for information about healthy eating.
3. I check my body regularly for any physical changes, injuries, or abnormalities.
4. I perform self-examinations to monitor my health

Cancer Risk Perception

1. Numerical-Deliberative Risk Perception

1. How likely do you think it is that you will get one of these five cancers in the next 10 years?
2. On a scale from 0 to 100%, how would you rate the probability of developing one of these five cancers?
3. How do you think your chance of getting one of these five cancers compares to the average person your age?

2. Reflective-Deliberative Risk Perception

1. The way I look after my health means that my odds of getting one of these five cancers in the future are low.
2. When I think carefully about my lifestyle, it does seem possible that I could get one of these five cancers.
3. If I look at myself as if I were a doctor, I realize that my behavior puts me at risk of getting one of these five cancers.

3. Affective-Experiential Risk Perception

1. How worried/fearful/nervous/concerned are you about developing cancer in the future/lifetime?
2. When you think about cancer for a moment, to what extent do you feel fearful/worried/anxious?
3. How easy is it for you to imagine yourself developing cancer in the future?

Quality of Life

1. Reduced physical pain
2. Reduced addiction to medication
3. Increased energy levels
4. Increased ability to relax and sleep
5. Increased ability to carry out everyday