

Article

Psychological motivation and adherence to physical activity participation in patients recovering from cancer

Xiaoliang Liu¹, Lehai Lin², Fei Yang^{3,*}

¹ Department of Physical Education, Nanyang Institute of Technology, Nanyang 473000, China

² Physical Training College, Beijing Sport University, Beijing 100084, China

³ Department of Sports Art, Hebei Institute of Physical Education, Shijiazhuang 050000, China

* Corresponding author: Fei Yang, 2008006@hepec.edu.cn

CITATION

Liu X, Lin L, Yang F. Psychological motivation and adherence to physical activity participation in patients recovering from cancer. *Psycho-Oncologie*. 2026; 20(1): 4232. <https://doi.org/10.18282/po4232>

ARTICLE INFO

Received: 7 March 2025

Revised: 20 March 2025

Accepted: 26 March 2025

Available online: 5 January 2026

COPYRIGHT



Copyright © 2026 by author(s).

Psycho-Oncologie is published by PiscoMed Publishing Pte. Ltd. This work is licensed under the Creative Commons Attribution (CC BY) license.

<https://creativecommons.org/licenses/by/4.0/>

Abstract: Objective: To explore the types of motivation, adherence influences, and their interaction mechanisms of physical activity participation among patients in cancer rehabilitation and serve as a fundamental groundwork for devising tailored behavioral intervention strategies and enhancing adherence. **Methods:** A mixed research method was used to include 300 patients recovering from breast, colorectal, and lung cancers. Quantitative analyses were conducted through the revised physical activity Motivation Inventory (EMI-2) and adherence logs, and semi-structured interviews were conducted with 30 patients, and the data were integrated by using latent category analysis (LCA), multiple regression, and phenomenological analysis. **Results:** Patient motivations were categorized as health maintenance (45.67%), social engagement (30.33%), and medically driven (24.00%); self-efficacy ($\beta = 0.32, p = 0.007$) and the identification of core predictors, notably family support ($\beta = 0.25, p = 0.021$); and the qualitative interviews revealed that medical guidance (76.67%) and digital tools (53.33%) were key facilitators, while physical fatigue (63.33%) was the main barrier. Adherence scores were significantly higher in health maintenance patients (72.31 ± 12.14 vs. $58.93 \pm 18.29, p < 0.001$). **Conclusion:** Physical activity behavior of patients in cancer rehabilitation is driven by both intrinsic motivation and external support, and the construction of a “doctor-patient-family-community” triadic support system can improve long-term adherence, and future research needs to deepen the intervention strategy by combining metabolic-immune mechanisms.

Keywords: cancer; rehabilitation; physical activity; motivation; adherence

1. Introduction

Cancer poses a significant global public health challenge, marked by persistently high incidence and mortality rates. Advancements in medical technology have notably prolonged the survival of cancer patients, leading to an increasing number transitioning into the recovery phase. The cancer recovery stage is the stage of recovery that patients enter after major treatments such as surgery, chemotherapy, and radiotherapy, and patients in this stage face many challenges, including the decline of physiological functions, the increase of psychological pressure, and the risk of cancer recurrence [1]. Consequently, a pivotal area of contemporary medical research focuses on optimizing recovery for these patients, enhancing their physical functions, elevating their quality of life, and mitigating recurrence risks. Recently, the importance of physical activity in cancer rehabilitation has garnered substantial attention.

Cancer recovery usually refers to the stage after the patient completes tumor treatment and before returning to society. At this stage, patients not only need to restore physiological functions but also need to cope with psychological stress and the risk of cancer recurrence. Physiological function decline is mainly manifested as decreased cardiopulmonary function, weakened muscle strength, and reduced joint flexibility [2]. In terms of psychological stress, patients often suffer from anxiety and depression due to the fear of cancer recurrence. In addition, long-term side effects after treatment, such as osteoporosis and lymphedema, also cause many inconveniences to patients.

Research indicates that engaging in physical activity can bolster the immune systems of recovering cancer patients, specifically by augmenting CD8⁺ T-cell activity [3]. Aerobic physical activity helps to relieve patients' fatigue by improving cardiopulmonary function and promoting blood circulation. In addition, regular physical activity can also reduce cancer recurrence rates, especially in breast and colorectal cancer patients, and relevant studies have revealed a substantial reduction in the risk of tumor-related mortality among individuals who maintain regular physical activity routines [4].

Although the benefits of physical activity for cancer survivors have been widely validated, there are still significant limitations in existing research: First, most studies focus on Western populations, and there is a serious lack of exploration of the types of motivation (e.g., medically driven) and culture-specific mechanisms (e.g., collective decision-making in the family) in Chinese patients; and second, the existing theoretical models (e.g., SDT) tend to analyze intrinsic motivation in isolation and lack the integration of exogenous factors such as doctor-patient interactions and digital tools, and other exogenous factors have been analyzed in an integrated manner [5]. Thus, conducting a thorough examination of the factors that drive and sustain patients' engagement in physical activity during cancer rehabilitation is crucial for enhancing their quality of life and optimizing rehabilitation outcomes. This study aims to construct a dual-path model of 'motivation-adherence' applicable to the Chinese context through a mixed research methodology to fill the aforementioned gap between theory and practice.

Therefore, this study analyzes and explores the motivation and adherence of cancer recovery patients to participate in physical activities in order to provide a theoretical basis for relevant interventions and to promote better recovery of patients.

2. Theoretical research and the current situation

2.1. Psychological and physiological characteristics of patients in the cancer recovery period

Patients in the cancer rehabilitation period face many challenges in physiology and psychology. The decline of physiological function is mainly manifested in the decline of cardiopulmonary function, weakened muscle strength, and reduced joint flexibility. Moreover, the adverse effects of cancer treatment, including fatigue, nausea, and discomfort, exacerbate patients' physical condition; psychologically, patients often suffer from anxiety and depression due to the fear

of cancer recurrence [6]. These psychological burdens not only degrade their quality of life but may also impede their willingness and ability to engage in rehabilitation programs.

2.2. Advantages of engaging in physical activity for cancer rehabilitation patients

In recent times, the significance of physical activity in cancer rehabilitation has garnered increasing recognition. Research has demonstrated that engaging in physical activity can markedly enhance the immune system of cancer survivors, particularly by boosting CD8⁺ T-cell activity [7]. Aerobic physical activity helps to relieve patients' fatigue by improving cardiopulmonary function and promoting blood circulation [8]. Furthermore, maintaining a regular physical activity regimen has been shown to decrease the likelihood of cancer recurrence, especially in patients with breast cancer and colorectal cancer, and relevant studies have found that the risk of tumor-specific death is significantly reduced in regular exercisers [9]. Several guidelines and evidence for physical activity in cancer survivors have been developed and updated abroad, and it is advisable for cancer patients to aim for at least 150 min of moderate-intensity or 75 min of vigorous-intensity physical activity per week, coupled with resistance training sessions on at least two days a week [10].

2.3. Current status of physical activity participation among patients recovering from cancer

Although physical activity offers numerous benefits to cancer patients in their recovery phase, patient participation rates remain surprisingly low. Research indicates that cancer patients engage in suboptimal levels of physical activity, with a marked decline observed post-diagnosis compared to individuals without cancer [11]. A systematic review by Del Bianco et al., exploring the impact of physical activity in preoperative rehabilitation for cancer patients, underscores its crucial role in enhancing functional and physiological capabilities. Encompassing 96 studies across various cancer types, including gynecological, breast, urological, gastrointestinal, and lung cancers, the review analyzed the effects of physical activity on physical fitness indicators and postoperative outcomes, such as hospital stay duration and complications. The findings emphasize that physical activity can significantly improve physical fitness, postoperative results and expedite recovery, particularly in specific cancer types [12]. In China, physical activity surveys for cancer patients have focused on single cancer types, such as breast cancer and colorectal cancer, and have found that the number of people who can achieve the guideline-recommended amount of physical activity is only about 20% [13]. This suggests that there is a large gap in physical activity participation among patients recovering from cancer, which requires further research and intervention.

2.4. Factors affecting the participation of patients in physical activities during the cancer rehabilitation period

Factors affecting patients' participation in physical activities during cancer rehabilitation are multifaceted, including personal, social, and environmental factors.

Among the personal factors, cancer-induced fatigue (CRF) is a painful, persistent, and subjective physical sensation associated with a tumor or tumor treatment, and unlike other types of fatigue, CRF cannot be relieved by rest and is not related to the level of activity. The more fatigue a patient feels, the lower the level of physical activity [14]. In addition, psychological factors such as anxiety and depression can also affect patients' motivation to participate in physical activities. In terms of social support, the support and encouragement of family members are important influences on patients' participation in physical activity. However, some patients' family members often think that they should take more bed rest and discourage going out to physical activity after illness out of concern for the patients' bodies, and such overprotective behaviors can hinder patients' participation in physical activities [15]. Among the environmental factors, bad weather and inaccessible fitness facilities are common barriers to patients' participation in physical activities.

2.5. Motivation and adherence-related theories

Motivation and adherence-related theories are important in explaining and predicting the participation of patients in physical activity during cancer rehabilitation [16]. According to Self-Determination Theory (SDT), motivation can be divided into intrinsic and extrinsic types, where intrinsic motivation stems from personal interest and enjoyment in an activity, whereas extrinsic motivation arises from external rewards or pressures [17]. Conversely, the Theory of Planned Behavior (TPB) underscores the influence of attitudes, subjective norms, and perceived behavioral control on an individual's behavioral intentions [18]. These theories provide a theoretical framework for examining motivation and adherence to physical activity participation in patients recovering from cancer.

In conclusion, patients in cancer rehabilitation face many challenges in physiology and psychology, and physical activity has a significant role in improving their immune function, relieving fatigue, and reducing the recurrence rate [19]. However, the current status of patients' participation in physical activities is not satisfactory, and the factors affecting their participation are multifaceted. Given this context, conducting a thorough investigation into the motivations and adherence of patients engaging in physical activities during cancer rehabilitation is vital for enhancing their quality of life and the effectiveness of their rehabilitation process.

3. Research methods

3.1. Research subjects

For this study, cancer patients in recovery from the region were chosen as participants. To be eligible, individuals had to (1) be aged 20 or older; (2) have completed primary cancer treatment (such as surgery, chemotherapy, or radiotherapy) at least three months prior; and (3) be able to understand and voluntarily participate in this study.

The exclusion criteria were (1) the presence of severe cognitive impairment or communication disorders; (2) the presence of severe physical dysfunction that prevented participation in physical activities; and (3) not being enrolled in any other

related intervention studies. Ultimately, 300 patients met the criteria, comprising 163 males and 137 females, spanning an age range from 20 to 80 years, with an average age of $56.89 \text{ years} \pm 10.24$.

3.2. Research tools

3.2.1. Questionnaire

We utilized a self-administered questionnaire tailored for cancer rehabilitation patients, titled “Questionnaire on Physical Activity Participation Motivation and Adherence”. This questionnaire encompasses two main sections: The first details the patient’s demographic and medical background, including gender, age, cancer type, and treatment approach; the second part is the questions related to the motivation and adherence to physical activity, including motivational factors (e.g., health improvement, social needs, doctor’s advice, etc.) and adherence factors (e.g., self-efficacy, family support, environmental accessibility, etc.) [20]. The revised Exercise Motivation Inventory (EMI-2) was cross-culturally adapted: inapplicable entries such as “interest in athletics” were deleted, and “relapse prevention beliefs” were added (Cronbach’s $\alpha = 0.82$). The scale was validated for feasibility by a 30-case pre-test, and item analysis showed that the critical ratio (CR) for each entry was > 3.0 ($p < 0.01$). Responses were recorded on a 5-point Likert scale, ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). Notably, the questionnaire demonstrated high reliability and validity, with a Cronbach’s α coefficient of 0.84.

Interview texts were independently coded by two researchers, and coder agreement ($\kappa = 0.85$) was calculated by NVivo 12.0. Disagreements were resolved through group discussion with a third researcher arbitration.

3.2.2. Interview outline

Semi-structured interviews were also used in this study in order to gain insight into patient motivation and adherence [21]. The interviews lasted approximately 30 min, were audio-recorded, and were transcribed into textual material for subsequent qualitative analysis. The interview outline was designed based on Self-Determination Theory (SDT) and the Health Belief Model (HBM), covering four core dimensions: intrinsic motivation (such as health control needs), extrinsic motivation (such as doctor-patient interaction), persistence promotion factors (such as digital tools), and hindrance factors (such as physical fatigue). The outline was independently reviewed by three cancer rehabilitation experts. The content validity index (CVI) was 0.89, and the clarity of the problem expression was adjusted by pre-experiment ($n = 10$). The interview outline included the following questions: (1) Why did you start participating in physical activity? (2) What factors do you think have helped you stay physically active? (3) What difficulties have you encountered in your participation in physical activity? (4) What supports do you think have been most helpful in your participation in physical activity?

3.3. Data collection and analysis methods

3.3.1. Data collection

This study used a combination of questionnaires and semi-structured interviews to collect data. After securing patients’ consent to participate, the researcher personally

distributed the questionnaires on site, providing clear instructions to ensure comprehensive and accurate responses. Semi-structured interviews, on the other hand, were conducted after the completion of the questionnaire survey, and the location of the interviews was chosen to be in the patient's familiar environment to reduce the patient's nervousness.

The interview was conducted by two uniformly trained research assistants. The training included open-ended questioning techniques, non-verbal feedback notes, and ethical norms (e.g., avoidance of induced language). Immediately after each interview, a memo was written to record the emotional changes and key nonverbal information of the interviewees. Data saturation was determined by iterative coding, and recruitment was stopped when there was no new topic in five consecutive interviews.

3.3.2. Data analysis

(1) For quantitative analysis, the gathered data was processed using SPSS 26.0. Initially, descriptive statistics were employed to derive insights into patients' profiles and the general patterns of motivation and adherence to physical activities, including calculations of mean, standard deviation, and frequency. Subsequently, correlation analysis and multiple linear regression analysis were conducted to delve into the associations between various factors and patients' motivations for, as well as adherence to, physical activity participation.

(2) In terms of qualitative analysis, thematic analysis was applied to the interview data. This involved meticulously reading through the interview transcripts to identify and extract themes and sub-themes pertinent to the research inquiries. Then the themes were coded and categorized to form a preliminary thematic framework. Finally, the themes were discussed in depth in conjunction with the results of the quantitative analysis in order to gain a comprehensive understanding of patients' motivation and adherence to participating in physical activity.

4. Results

4.1. Quantitative analysis

4.1.1. Types of motivation

In this study, the types of motivation of cancer rehabilitation patients to participate in physical activities were analyzed through questionnaires. The results showed that the patients' motivation types were mainly categorized into health maintenance type, social participation type, and medically driven type (**Table 1**). Among them, the health maintenance type of motivation accounted for the highest proportion of 45.67% (137/300), indicating that the main purpose of most patients to participate in sports activities was to maintain and improve their health; the social participation type of motivation accounted for 30.33% (91/300), indicating that the patients hoped to make friends and participate in social activities through sports activities; and the medical origin driven type of motivation accounted for 24.00% (72/300), i.e., some patients were advised by doctors or medical professionals to participate in sports activities.

Table 1. Distribution of patients' motivation types for participating in physical activity ($n = 300$).

Type of motivation	Percentage (%)	Typical description (interview excerpt)	Theoretical model association
Health Maintenance Type	45.67(137/300)	"I want to regain my strength through physical activity to prevent cancer recurrence".	Health Belief Model (HBM)
Socially Engaged	30.33(91/300)	"Participating in walks organized by the patient group makes me less lonely".	Social Cognitive Theory (SCT)
Medically Driven	24.00(72/300)	"My doctor explicitly told me that I must take a 30-minute walk every day".	Self-Determination Theory (SDT)

Note: Motivational categorization was determined by latent category analysis (LCA) with model fit BIC = 120.32 and entropy = 0.89.

4.1.2. Predictors of adherence

Multiple linear regression analysis was further used to explore the factors affecting adherence to physical activity in patients recovering from cancer. The results showed that self-efficacy and family support were the main predictors of patient adherence (**Table 2**). The regression coefficient of self-efficacy was $\beta = 0.32$, $p < 0.01$, indicating that the stronger the patient's confidence in his/her ability to successfully participate in physical activity, the higher his/her adherence; the regression coefficient of family support was $\beta = 0.25$, $p < 0.05$, indicating that the encouragement and support of family members had a significant contributing effect on the adherence to physical activity of patients. Patients aged ≥ 60 years had significantly lower adherence scores ($\beta = -0.21$, $p = 0.033$), possibly due to declining physiologic function or elevated risk of complications. In addition, the overall explanatory power of the model was strong ($R^2 = 0.41$), and the multicollinearity was manageable ($VIF < 2.0$).

Table 2. Multiple regression analysis of predictors of physical activity adherence.

Variable	β coefficient	95% CI	p -value	Standardized effect size (η^2)
Self-efficacy	0.32	[0.181, 0.462]	0.007	0.27
Family support	0.25	[0.120, 0.383]	0.021	0.19
Frequency of medical direction	0.18	[0.054, 0.316]	0.043	0.12
Type of cancer (breast)	0.15	[-0.022, 0.329]	0.082	0.07
Age ≥ 60 years	-0.21	[-0.350, -0.077]	0.033	0.14

Note: Model metrics: $r^2 = 0.41$, adjusted $r^2 = 0.38$, $F = 9.67$, $p < 0.001$; dependent variables were physical activity adherence scores (range 0–100), and the independent variables were all < 2.0 by the Variance Inflation Factor (VIF) test.

4.2. Qualitative analysis

4.2.1. Theme 1: Authority of medical guidance

Through semi-structured interviews, this study extracted several themes related to patients' motivation and adherence to participating in physical activity. Among them, "authority of medical guidance" was an important theme. Many patients indicated that their doctor's advice was an important motivator for them to participate in physical activity. For example, one patient mentioned, "The doctor's advice gives me more confidence and I know it's for my health, so I'm very willing to try it". This suggests that advice from healthcare professionals carries a high level of authority in the minds of patients and can significantly enhance their motivation to participate.

4.2.2. Theme 2: Emotional connection of the movement community

Another important theme was the “emotional connection of the physical activity community”. Many patients reported that by participating in the physical activity community, they were able to build an emotional connection with other patients, and that this connection was an important motivator for their adherence to physical activity. One patient stated, “The patient group clocking in motivated me to stick with it, and when I saw everyone working hard, I didn’t want to be left behind”. This suggests that the physical activity community not only provided emotional support but also enhanced patient adherence through group motivation.

In-depth interview coding of 30 patients revealed (Table 3) that (1) major barriers: 63.33% of patients mentioned treatment-related fatigue (“feeling of weakness lasted for hours after physical activity”), and 36.67% had time conflicts due to family responsibilities; (2) Core facilitators: 76.67% of patients relied on personalized feedback from the healthcare team (“pain relief after the rehabilitator adjusted the program”), and 53.33% were motivated by the social features of the physical activity app (e.g., patient leaderboard). Coding consistency was high ($\kappa = 0.82$), ensuring confidence in the results (Table 4).

Table 3. Frequency of coding of barriers and facilitators of physical activity adherence in qualitative interviews.

Theme	Subcategory	Frequency of mention (%)	Representative statement
Barriers	Physical fatigue	63.33% (19/30)	“I get tired easily after chemotherapy, and I get weak after exercising for half an hour”.
	Time conflict	36.67% (11/30)	“Taking care of grandchildren doesn’t leave time for systematic training”.
Facilitators	Medical team feedback	76.67% (23/30)	“Rehabilitator adjusts my physical activity program weekly”.
	Digital tools	53.33% (16/30)	“The patient leaderboard in the app keeps me more motivated”.

Note: Coding reliability was Cohen’s $\kappa = 0.82$ (two researcher independent coding consistency test).

Table 4. Differences in physical activity adherence among patients with different motivation types (ANOVA).

Motivation type	Adherence score (mean $\pm$ SD)	Between group comparison (Tukey HSD)
Health maintenance type	72.31 $\pm$ 12.14	A
Socially engaged	65.44 $\pm$ 15.62	B
Medically driven	58.93 $\pm$ 18.29	C

Note: Statistical tests were $F(2,297) = 14.726, p < 0.001, \eta^2 = 0.21$; letters labeled: $A > B > C$ ($p < 0.05$).

4.3. “Motivation-adherence” dual-path model

Combining the results of quantitative and qualitative analyses, this study introduces a dual-path model titled “motivation-adherence”, which harmoniously blends Self-Determination Theory (SDT) with the Health Belief Model (HBM) [22]. In this model, the type of motivation (health maintenance, social engagement, medically driven) influences the patient’s initial willingness to participate in physical activity by affecting both intrinsic and extrinsic motivation. Adherence, on the other

hand, is influenced by a combination of factors such as self-efficacy, family support, medical guidance, and community motivation.

Path 1 (intrinsic motivation): Self-efficacy $\rightarrow$ physical activity duration ($\beta = 0.43$); Path 2 (extrinsic motivation): doctor's advice $\rightarrow$ physical activity frequency ($\beta = 0.29$); Moderating effect: Family support reinforces the path 1 effect ($\Delta R^2 = 0.11$). The model emphasizes the important role of motivation and adherence in the participation in physical activity of patients recovering from cancer and reveals the mechanisms by which the different factors interact. This model allows for a better understanding of the behavioral patterns of patients' participation in physical activity and provides a theoretical basis for the development of targeted interventions (**Figure 1**).

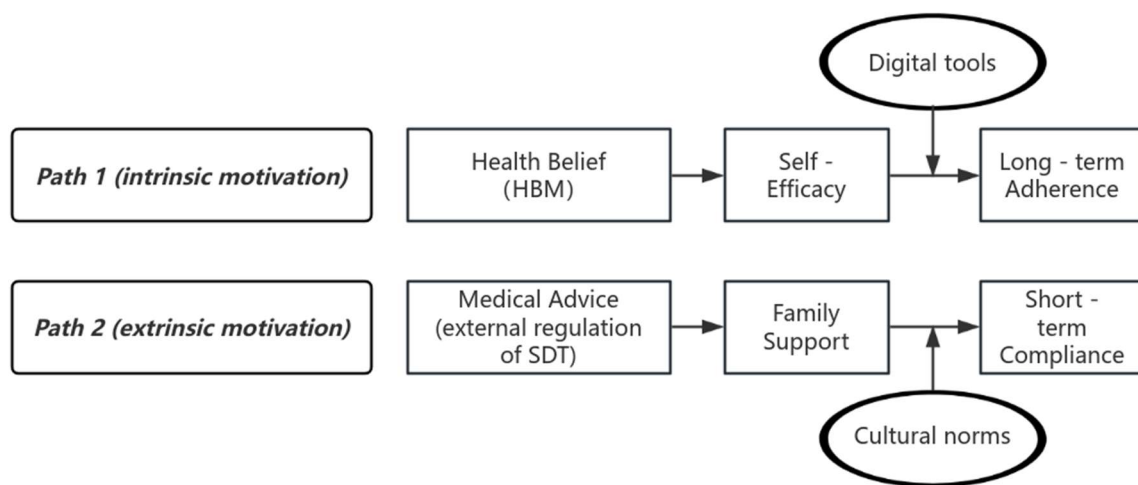


Figure 1: Dual - path Model of Motivation and Persistence (Integration of SDT and HBM)

Figure 1. Dual-path model of motivation and persistence (integration of SDT and HBM).

5. Discussion

5.1. Motivation of patients in cancer rehabilitation to participate in physical activities

Internal motivation refers to patients' motivation to participate in physical activity out of their own needs and intrinsic value. The findings revealed that among cancer survivors, key internal motivations for engaging in physical activities centered around (1) controlling an uncertain future: A heightened sense of health control was perceived by numerous patients, which subsequently alleviated their anxieties about cancer recurrence; (2) improvement of physical condition: Patients hoped that physical activity would enhance their physical fitness, improve their immunity, and improve the decline in physical function caused by cancer treatment.

External motivation refers to patients' motivation to participate in sports activities due to external factors. It was found that the main external motives include (1) social support: support from family, friends, and patients is an important driving force for patients to participate in sports activities. For example, encouragement and companionship from family members can significantly increase patients' motivation

to participate; (2) environmental factors: convenient sports facilities and a favorable sports environment also influence patients' participation decisions.

Qualitative analysis of the synergistic effects of medical authority and family support revealed that 'medical guidance authority' does not work in isolation but dynamically complements family support. For example, patients often translate doctors' recommendations into common family goals (e.g., "clocking in daily walks"), and behavioral compliance is reinforced by family monitoring. This "doctor-patient-family" alliance is particularly pronounced in collectivist cultures, in contrast to Western models that emphasize individual autonomy. In addition, stage-by-stage feedback from the physician (e.g., physical fitness assessment reports) can alleviate family resistance to intervention due to overprotection, confirming the synergistic mechanism of 'autonomy support' and 'structural support' in SDT.

5.2. Factors affecting adherence to physical activity in patients recovering from cancer

5.2.1. Personal factors

(1) Self-efficacy: Patients' self-efficacy is a key factor influencing their adherence to physical activity. Individuals with robust self-efficacy demonstrate a greater propensity to surmount challenges and maintain consistent physical activity.

(2) Anxiety and depressive mood: Psychological state has a significant effect on patients' adherence. Conversely, patients experiencing higher levels of anxiety and depression often face barriers in adhering to physical activity routines.

5.2.2. Social factors

(1) Family support: The support and understanding of family members have a significant impact on patient adherence. Active participation and encouragement from family members can significantly improve patients' adherence. (2) Group atmosphere: Participating in group physical activity or joining a physical activity community can enhance patients' sense of belonging and responsibility, thus improving adherence.

5.3. Differences in motivation and adherence among patients with different cancer types

The primary motivations of breast cancer patients were to improve body image and increase mental toughness. Many patients reported that physical activity helped patients rebuild their self-confidence and reduce the psychological burden of physical changes brought about by surgery and treatment. Adherence of breast cancer patients was significantly influenced by family support and group atmosphere. Patients involved in breast cancer patient groups were more likely to persist in physical activity over time.

The primary motivation for colorectal cancer patients was to improve digestive function and increase physical strength. Many patients reported that physical activity helped relieve fatigue and constipation after treatment. Adherence in colorectal cancer patients is significantly influenced by self-efficacy and medical guidance. Physician recommendations and individualized physical activity regimens contribute significantly to patient adherence.

For those diagnosed with various cancer types, such as lung cancer or prostate cancer, their motivations for engaging in physical activities are more diversified, encompassing enhancements in respiratory function and muscle building. The adherence of these patients is shaped by a multitude of factors, including personal inclinations, societal support, and environmental adaptations.

5.4. Interpretation and significance of the study results

This study delved into the motivation and adherence of patients in cancer rehabilitation to participate in physical activities through quantitative and qualitative analysis. The study findings categorize cancer rehabilitation patients' motivations into internal and external domains. Internal motivations mainly include a sense of control over the future and the need to improve physical condition, which reflect patients' sense of active management of their health. External motivations, on the other hand, include social support and environmental factors, which emphasize the positive influence of the social environment in which patients live on their behavior. In addition, factors influencing patients' adherence to physical activity involve both personal and social factors. Self-efficacy, anxiety, and depression among the personal factors, and family support and group atmosphere among the social factors, significantly influenced patients' adherence. These findings reveal the complexity of physical activity participation behaviors among patients recovering from cancer and emphasize the importance of comprehensive multifactorial interventions.

The proposed dual-pathway model of motivation-adherence, which merges Self-Determination Theory (SDT) with the Health Belief Model (HBM), offers a novel theoretical lens to comprehend the behavioral dynamics of cancer survivors. The model emphasizes the important roles of motivation and adherence in patients' participation in physical activities and reveals the interaction mechanisms of different factors. This model not only helps to explain patients' participation behavior but also provides a theoretical basis for developing targeted interventions.

The results of this study have some similarities and differences with related studies at home and abroad. In terms of motivation, consistent with existing studies, health maintenance motivation dominates among patients in cancer recovery [23]. This suggests that patients generally place a high value on health, regardless of the cultural context. However, the present study found that medically driven motivation also accounted for a certain percentage, which is different from the findings of some studies that emphasized patient-autonomous motivation. The proposed dual-pathway model of motivation-adherence, which merges Self-Determination Theory (SDT) with the Health Belief Model (HBM), offers a novel theoretical lens to comprehend the behavioral dynamics of cancer survivors, suggesting that there are differences in the influence of healthcare-derived factors on patient behavior in different healthcare systems [24].

In terms of adherence, the results of self-efficacy and family support as predictors are consistent with existing research [25]. This further confirms the central role of self-efficacy in behavioral adherence and the importance of family support in patients' recovery. However, the qualitative analysis in this study revealed that the authority of medical guidance and the emotional connection of the physical activity community

had a particularly significant effect on patient adherence. This contrasts with findings in some studies that focused only on individual psychological factors. This suggests that the role of social and environmental factors should not be overlooked in the physical activity participation of patients recovering from cancer.

5.5. Limitations of the study and future research directions

Despite the results of this study in exploring the motivation and adherence to physical activity participation among patients recovering from cancer, certain limitations persist in this study. Primarily, the sample size was modest and confined to a particular region, potentially restricting the applicability of the findings across broader populations. Second, the qualitative analysis of this study was mainly based on semi-structured interviews, which lacked follow-up observation of patients' long-term behavioral changes. In addition, the cross-sectional design of this study failed to capture the dynamic evolution of motivation and adherence; e.g., the authority effect of medical guidance may decay with the stage of treatment, and there may be a threshold effect for the enhancement of self-efficacy. Future studies could adopt a longitudinal mixed study design that combines quantitative and qualitative methods to track patients' engagement behaviors over time, with multiple time points at 6, 12, and 24 months after diagnosis and real-time monitoring of behavioral changes in conjunction with mHealth technologies (e.g., accelerometers) to gain a more comprehensive understanding of the developmental trajectories of motivation and adherence.

The dual-pathway model of motivation-adherence introduced in this study requires further validation. Based on this model, future studies could develop targeted interventions and evaluate their effects through randomized controlled trials (RCTs).

In summary, by comprehensively analyzing the motivation and adherence of patients who participated in physical activity during cancer rehabilitation, the study's findings indicated that the primary impetus for patients' participation in physical activity was their motivation for health maintenance, while self-efficacy and family support were important factors influencing patients' adherence. In addition, the authority of medical guidance and the emotional connection of the physical activity community played an important role in patient participation. Based on these findings, this study proposes a dual-path model of motivation-adherence, which provides new perspectives for future research and practice, as well as a theoretical basis for the development of relevant interventions.

Author contributions: Conceptualization, XL and FY; methodology, FY; software, XL; formal analysis, XL and LL; investigation, LL; data curation, XL and LL; writing—original draft preparation, XL and LL; writing—review and editing, XL; supervision, FY; funding acquisition, FY. All authors have read and agreed to the published version of the manuscript.

Institutional review board statement: The study was conducted in accordance with the Declaration of Helsinki, approved by the Institutional Review Board (IRB) of Hebei Institute of Physical Education (Approval number: 20247296; Date of approval: 2024.2.26).

Informed consent statement: All participants provided informed consent prior to the study.

Conflict of interest: The authors declare no conflict of interest.

References

1. Xiao J, Peng Y, Li Y, et al. Exploring the symptoms and psychological experiences among lung cancer convalescence patients after radical lobectomy: A qualitative study. *Cancer Medicine*. 2024; 13(15). doi: 10.1002/cam4.70048
2. Ran ZR, Sun RX, Jia JY, et al. New Advances in the Adjustment of Life Goals in Cancer Patients and Its Impact on Physical and Mental Health. *Chinese General Practice*. 2024; 27(23): 2822–2828.
3. Wei XY, Shi Y, ShiH, et al. The Mechanism of Exercise in Cancer Prevention and Treatment: A Review from the Perspective of Integrated Physiology and Tumor Immune Microenvironment. *Sports Science*. 2024; 44(3): 78–88.
4. Chen M, Shangguan RN, Zhang XB, et al. Research Progress on the Improvement and Mechanism of Multiple Types of Cancer by Exercise-Regulated miRNA. *China Sports Science and Technology*. 2023; 59(1): 104–112.
5. Brennan L, Sheill G, Collier S, et al. Personalised exercise rehabilitation in cancer survivorship: The percs triage and referral system study protocol. *BMC Cancer*. 2024; 24(1): 517. doi: 10.1186/s12885-024-12266-x
6. Liu MT, Shen X, Bao AG, et al. Research Progress on the Impact of Exercise Intervention on Chemotherapy-Induced Peripheral Neuropathy. *Chinese Journal of Rehabilitation Medicine*. 2023; 38(1): 120–123.
7. Xiao F, Xu TL, Zhu L, et al. The Significance of M1-Type Tumor-Associated Macrophage Infiltration in Hepatocellular Carcinoma Tissue. *Chinese Journal of Cancer*. 2024; 34(8): 726–733.
8. Wei XL, Luo ZY, Wu C. Application and Prospects of Aerobic Exercise in Breast Cancer Rehabilitation. *Chinese Medical Journal*. 2024; 59(1): 8–12.
9. García-Chico C, López-Ortiz S, Peñín-Grandes S, et al. Physical Exercise and the Hallmarks of Breast Cancer: A Narrative Review. *Cancers*. 2023; 15(1): 324. doi: 10.3390/cancers15010324
10. Lavery JA, Boutros PC, Knight D, et al. Association of exercise with pan-cancer incidence and overall survival. *Cancer Cell*. 2024; 42(2): 169–171. doi: 10.1016/j.ccell.2023.12.007
11. Dennett AM, Harding KE, Peiris CL, et al. Feasibility of increasing physical activity levels of hospitalized cancer survivors using goal setting and feedback (CanFit): A randomized controlled trial. *Physiotherapy*. 2025; 128: 101776. doi: 10.1016/j.physio.2025.101776
12. Del Bianco N, Borsati A, Toniolo L, et al. What is the role of physical exercise in the era of cancer prehabilitation? A systematic review. *Critical Reviews in Oncology/Hematology*. 2024; 198: 104350. doi: 10.1016/j.critrevonc.2024.104350
13. Kou YJ, Peng Y, Tan YR, et al. Research Progress on the Current Status and Influencing Factors of Physical Activity in Cancer Patients. *General Practice Nursing*. 2022; 20(26): 3632–3637.
14. Matsunaga M, He Y, Khine MT, et al. Prevalence, severity, and risk factors of cancer-related fatigue among working cancer survivors: A systematic review and meta-analysis. *Journal of Cancer Survivorship*. 2024. doi: 10.1007/s11764-024-01557-8
15. Kim MA, Yi J, Sang J, Kim SH. Perceptions of Child Vulnerability, Parental Overprotection, and Parenting Stress among Parents of a Child with Cancer. *Sage Open*. 2024; 14(2): 250–255. doi: 10.1177/21582440241260052
16. Tock WL. Enhancing exercise motivation in young adults with lymphoma: A self-determination theory-guided intervention [PhD thesis]. McGill University; 2024.
17. Ryan RM, Deci EL. Self-Determination Theory. In: *Encyclopedia of Quality of Life and Well-Being Research*. Springer International Publishing; 2024. pp. 6229–6235.
18. Wang C, Wang H, Li Y, et al. Factors Influencing University Students' Behavioral Intention to Use Generative Artificial Intelligence: Integrating the Theory of Planned Behavior and AI Literacy. *International Journal of Human-Computer Interaction*. 2024; 1–23. doi: 10.1080/10447318.2024.2383033
19. He A, Pu Y, Jia C, et al. The Influence of Exercise on Cancer Risk, the Tumor Microenvironment and the Treatment of Cancer. *Sports Medicine*. 2024; 54(6): 1371–1397. doi: 10.1007/s40279-024-02031-2
20. Svenningsen A, Söderström S, Bucher Sandbakk S, et al. Mind the intention-behavior gap: A qualitative study of post-myocardial infarction patients' beliefs and experiences with long-term supervised and self-monitored physical exercise. *BMC Sports Science, Medicine and Rehabilitation*. 2024; 16(1): 204. doi: 10.1186/s13102-024-00987-2

21. De Paoli S. Performing an Inductive Thematic Analysis of Semi-Structured Interviews With a Large Language Model: An Exploration and Provocation on the Limits of the Approach. *Social Science Computer Review*. 2023; 42(4): 997–1019. doi: 10.1177/08944393231220483
22. Chen Y, Tan R, Long X, Tu H. Applying behavioral change theories to optimize pulmonary rehabilitation in COPD patients: A review. *Medicine*. 2024; 103(22): e38366. doi: 10.1097/md.00000000000038366
23. Yan Y, López-Alcalde J, Stallings E, et al. Patient motivation as a predictor of digital health intervention effects: A meta-epidemiological study of cancer trials. *PLOS ONE*. 2024; 19(7): e0306772. doi: 10.1371/journal.pone.0306772
24. Van Cauwenbergh O, Willers N, Vandenbroucke T, et al. Sexuality after breast cancer treatment: A physician's survey of current clinical practice. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2024; 302: 317–324. doi: 10.1016/j.ejogrb.2024.09.020
25. Ma Q, Luo J, Cao H, et al. Social support, health behavior self-efficacy, and anxiety on physical activity levels among lung cancer survivors: A structural equation modeling. *Journal of Cancer Survivorship*. 2024. doi: 10.1007/s11764-024-01626-y