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Article

# Determination of psychosocial care practices and needs of oncology nurses

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**Abstract: The purpose:** The aim of this study was to determine the psychosocial nursing practices and needs of oncology nurses by testing the validity and reliability of the scale by adapting and applying the questionnaire prepared by the American Oncology Nursing Society (ONS) group to determine the psychosocial nursing practices and needs of oncology nurses. **Method:** The study was descriptive. The questionnaire consisted of a total of 24 questions, including 4 questions about socio-demographic characteristics and 20 Likert-type questions. The research group consisted of 201 oncology nurses in Turkey. Content Validity Ratio (CVR) was calculated. Content Validity Ratio (CVR) was higher than 80% of the experts' consensus for all items. KMO was satisfactory (KMO. 0.820) and the assumption of sphericity was met (22–4003.071.0.001). Using the split-half method (dividing the test into two halves), the reliability values of Strict Parallel (0.922) and Gutman Split Half Coefficients (0.916) were high and the scale was found to be reliable. **Results and conclusions:** The Determination of Psychosocial Care Practices and Needs of oncology nurses questionnaire is a valid and reliable scale that can be used in Turkish. When the results of this questionnaire were examined to determine the needs of oncology nurses during Psychosocial Care Practices, it was found that there were deficiencies such as lack of time, knowledge, experience and resources. At the same time, it is recommended that this study be used in different studies with large sample groups in order to contribute to the literature as a guide for oncology buses.

**Keywords:** questionnaire adaptation; nursing; oncology; psychosocial practices

## 1. Background

Cancer is a disease that causes uncontrolled cell growth, division, invasion into surrounding tissues, and spread to tissues and organs far from its source. Cancer is defined as a concept that includes the process of transformation of normal cells into abnormal cancer cells [1,2]. The concept of cancer is a condition that creates psychological difficulties for individuals. The importance of diagnosis is in the field of oncology. For about 20 years, the concept of psycho-oncology, which includes psychology in the field of oncology, has become a remarkable issue.

Psychosocial care constitutes a fundamental area for the concept of psycho-oncology. Psychosocial care for cancer patients is very important. It is known that caring nurses are not competent in determining the psychosocial care needs of patients. It has been effective in the rapid development of this sub-science and the significant increase in research.

Psycho-oncology, which was previously defined as the special needs of patients, is now seen to be a need for every cancer patient [3]. Just as early medical treatment is important in cancer, starting early treatment is also important in Psycho-oncology. In her study in 2012, Beyhan Bag thinks that developing psychological screening tests

can be the first step to determine care needs and psychological treatment [4]. In this context, the concept of psycho-oncology is thought to be important in nursing. It is a fact that in addition to medical care and treatment, the psychosocial care of the patient and his family is also important.

Psychosocial care includes daily life activities, psychological and social support, sexuality, and social needs for the patient and his family. It is known that caring nurses are not competent in determining the psychosocial care needs of patients. In this regard, it has been determined that nurses working in oncology hospitals in Turkey have difficulty in providing care to patients in this sense. In this context, it was found very important to find a solution to this problem with a facilitating measurement tool to determine the psychosocial needs of nurses. During the comprehensive care process, nurses working in the field of oncology must be able to provide quality service to the patient and their family; They should have basic level skills such as psychosocial diagnosis, therapeutic communication, providing information, and coping in order to support themselves in this process and not wear them out emotionally and physically. In particular, oncology nurses should plan and develop the care process by incorporating the concept of psycho-oncology in line with the knowledge and equipment they have while providing care [5].

Oncology nurses' knowledge and skills regarding psychosocial care practices must be at a professional level. It is important to determine these requirements correctly in order to plan appropriate initiatives. This means that oncology nurses know themselves well, are aware of the needs of patients and their families, and know what issues they can help patients with, which forms the basis of psychosocial care practices [6,7]. When providing psychosocial care practices in Oncology Nursing, it is first necessary to communicate and establish trust in the patient [8]. Psychosocial care can only be provided after this trust is established [9]. In addition, the psychosocial care practices offered include all the necessary practices for the sick individual to regain his health. There are a number of obstacles experienced when providing psychosocial care practices. These obstacles to psychosocial care practices may belong to patients and healthcare personnel [10]. In this context, when we look at the literature studies regarding the obstacles of oncology nurses, it is thought that the issue should be addressed. The studies were examined and the obstacles facing oncology nurses were discussed in two dimensions. Obstacles belonging to the oncology patient and his family were mentioned as the obstacles faced by oncology nurses.

Studies on the obstacles of oncology patients and their families show that nurses provide counseling to patients in alleviating the economic difficulties experienced due to the disease. These problems appear as obstacles related to the patient, such as the patient's lack of social security and financial issues [11]. The long treatment process may cause job losses for the person and may also lead to a decrease in family income due to medical care and medication expenses. These negativities that patients face cause them difficulties and cause feelings of distress, sadness and helplessness. These situations are seen as problems that are difficult to solve among family members. Due to the negativities experienced, the patient and his family may abandon the treatment [11]. The Oncology Nursing should be aware that cancer groups are one of the important tools that meet the patient's social needs. The patient should also benefit

from support groups to minimize the disabilities they encounter [12]. As can be seen, psychosocial care practices form the basis of the treatment process of cancer patients. Situations such as life-threatening symptoms, the severity of the treatments to be applied, and lack of knowledge of the patients may increase the level of psychosocial problems in cancer patients. In studies, these problems experienced by patients appear as patient-related obstacles for nurses, both in the treatment phase and in the sustainability of care phase [13].

Psychosocial care applications are the basis of the treatment process of cancer patients. Life -threatening symptoms in cancer patients, seriousness of the treatments to be applied, lack of information of the patients, such as the level of psychosocial problems can increase the level of psychosocial problems. In the studies, these problems experienced by the patients appear as patients' obstacles of nurses both during the treatment stage and during the sustainability of the care [11].

In this context, the common literature emphasizes that nurses who care in the field of oncology should have a certain competence in psychosocial care. However, it shows that there are serious gaps in this area. In this context, it is seen that patients are mostly followed by psychiatry or psychologist after the symptoms of mental illnesses. However, oncology nurses, which provide long -term care to these patients, are also required to receive training in determining the psychosocial needs of patients. For this reason, it was necessary to examine the level of the psychosocial needs of these nurses about the level of psychosocial needs of the patients. As mentioned above, this problem is seen as a training problem not only in Turkey but in the World [11–13].

The studies we discuss the obstacles faced by the oncology nurses in psychosocial care practices also affect physical, mental and psychosocial health due to the fact that the oncology nurses serve a delicate group. This may occur in various forms. The obstacles experienced by oncology nurses are particularly careful. It is stated that nurses are the most risky health professionals in terms of burnout and fatigue because they have been repeatedly exposed to the problems of the patients, the death of the patients and their families in the process of maintenance. In this context, the importance of determining the needs of the needs during the psychosocial care in the field of oncology nurses is important [10–14].

Yıldırım et al. in 2019, it was stated that almost all of the nurses found psychosocial care important, 27.2% could define psychosocial care, and 96.3% found psychosocial care important. Likewise, almost all of them cannot help the patient and think that they have difficulty [15]. In 2010, nurses stated that the number of patients as preventing them from fulfilling their roles and functions, the fact that the equipment deficiencies, the lack of time, knowledge, experience, the inconsistency between the team members, and the non -physical conditions of physical conditions [16]. In the involuntary examination of the researches in the field of Oncology Nursing in the world and in Turkey, Oncology Nursing in line with the objectives and action plans determined by professional organizations, revealing the current situation and determining the priorities of future researches It is thought that it will provide important data to nurses. In this context, the oncology nurses that give care to cancer patients It is thought that it is very important to determine their needs and the obstacles they encounter when applying psychosocial care.

The United States of the United States (Ones) gathered with a group of members in 2009 and developed a questionnaire on the determination of the psychosocial care practices and requirements of oncology nurses and applied to the members of the Association and clinicians by the American Oncology Nursing Association (ONS) [17]. In this study, the questionnaire of the oncology nurses of the oncology nurses (ounce) is considered to be adapted to Turkish for the oncology nurses in Turkey and it is thought that the questionnaire study was important in terms of determining the needs and obstacles of the oncology nurses.

In this study, the Turkish language validity and reliability study of the questionnaire was conducted. The main purpose of the development of this questionnaire is to determine the psychosocial care needs of the patients working in the nurses working in oncology clinics. It was found that there was no objective evaluation tool in determining the real needs of oncology nurses in Turkey. Assuming it will facilitate the determination of the requirements, this questionnaire was valid for language and reliability. It is thought that it is very important to obtain an objective evaluation tool in determining these requirements.

When we consider the obstacles faced by oncology nurses in psychosocial care practices, studies show that since oncology nurses serve a sensitive group, their high work-related stress negatively affects physical, mental and psychosocial health. This situation can occur in various forms. [13,14]. It is stated that oncology nurses are the health professionals at the highest risk of experiencing burnout and compassion fatigue, as they are repeatedly exposed to the obstacles experienced by oncology nurses, especially the distress of the patients they care for, the death of the patients, and the communication of their families during the process of inclusion in the care [11,18]. In this context, the importance of determining the needs of oncology nurses during psychosocial care practices is revealed in studies [14–16].

## **2. Methods**

### **2.1. Type of research**

In this study, it was aimed to adapt the survey created by the American Oncology Nursing Society (ONS) group to determine the psychosocial care practices and needs of nurses working in the field of oncology by testing the validity and reliability of the adapted scale. The research was conducted in descriptive type.

#### **Research questions**

- 1) Psychosocial care applications and needs of oncology nurses adapted to Turkish. Is it valid and reliable in Turkey?
- 2) What are the ways of using general services while performing psychosocial care of oncology nurses?
- 3) What are the health care providers of the oncology nurses while performing psychosocial care services?
- 4) What are the Psychosocial Care Application Barriers of oncology nurses?

## **2.2. Place and characteristics of the research**

Research, Ankara Dr. It was carried out at Abdurrahman Yurtaslan Oncology Training and Research Hospital in Turkey. The hospital has 400 beds and a total of 330 working nurses. 10 psychiatrists, 4 social workers, 5 psychologists and 2 moral support personnel serve in the hospital.

## **2.3. Universe and sample of the research**

It was aimed to reach the entire population, and out of 330 working nurses, those who were on annual leave, did not want to volunteer, and did not work in the field of oncology were not included in the study because they were outside the study criteria. The universe of the study consists of all nurses working in the hospital (N = 301). Therefore, an attempt was made to reach all the nurses working in total. 201 nurses who volunteered participated in the study. The study was completed with 195 people because some nurses left some items of the forms incomplete. A total of 201 nurses were reached in the study. 6 surveys out of 201 participants were removed from the research due to data loss, and the research was completed with 195 participants.

## **2.4. Ethical aspect of the research**

In order to conduct the research, permission was received via e-mail from the American Oncology Nurses Association (ONS) to use the survey. Ethics Committee permission was received from Turkey of Ankara Yıldırım Beyazıt University Institute of Humanities and Social Sciences Ethics Committee. Participants were informed about the content, purpose, importance and data collection forms of the study, and written consent was obtained. Necessary permissions were obtained from the Ankara Provincial Health Directorate at the Ankara Dr. Abdurrahman Yurtaslan Oncology Education and Research Hospital where the research will be conducted.

In terms of research ethics, nurses who volunteered to participate participated by filling out informed consent forms. An ethics committee was obtained in this study. Nurses who wanted to participate in the study were included in the study after signing the informed consent forms. After the participants were informed about the content, purpose, importance and data collection forms of the research, they were informed that their personal information would be kept confidential and that no one other than the researchers could access the surveys they filled out and their personal information, and written consent was obtained.

## **2.5. Data collection tools**

4 questions about the determination of psychosocial care practices and requirements of oncology nurses consist of a total of 24 questions, 20 questions and 20 questions, with a total of 24 questions (Annex-5). The first 4 questions in the survey contain personal information. (Age knowledge, educational knowledge, workplace, unit information). The way to benefit from general services is questioned in question 5 (13 sub-parameters) and health care providers question 6 (12 sub-parameters) "very", "rarely", "I don't know" options. While oncology nurses offer psychosocial care, there are variables consisting of 18 questions and 18 questions about what the obstacles in front of them are.

## **2.6. Characteristics and characteristics of the questionnaire made in Turkish stages**

### **2.6.1. Language validity**

Psychosocial care applications and needs of oncology nurses Survey Form on Determination America Oncology Nursing Association (Opens) Gathered with a group member in 2009 and psychosocial of oncology nurses He developed a questionnaire to determine the needs and obstacles and has applied to members of the association and clinicians. This in our study the group has been contacted and this questionnaire form is valid and reliability to Turkish. The necessary permissions were obtained for the study. Survey form English-Turkish, Turkish-English and English-English translations have been made. Then, to the field experts in the field of both languages sent. For the language validity of the scale, the scale is two experts who know two languages and culture well. It was translated from English to Turkish by two faculty members from the translator and the field. The scale adaptation process can be expressed as follows.

### **2.6.2. Scope validity**

Expert opinion of 5 faculty members who are experts in the survey applied. Each item on the scale is “not suitable”, “the substance needs to be brought to the appropriate shape”, “appropriate but small changes needed”, They evaluated it as very suitable and the suggestion section was added to the possibility of correction for each substance Scope validity rates (KGO) rates in line with the opinions and suggestions from experts were calculated according to Lawshe’s scope validity index. 4 category by experts. The evaluated items are reduced to two categories as “the substance is not suitable” and “item appropriate”. According to 5 experts for each item, Lawshe’s scope validity acceptance rate is 0.99. There is no substance lower than this value. In other words, according to the experts, the validity of the substances was found to be appropriate. According to the findings, the numbness rates of 5 experts for each article of 24 substances are 100%. Therefore, it was observed that the numbness rates of experts for all substances were higher than 80%. All questions were applied to nurses working in the field of oncology in the predetermined sample group without issuing questions from the questionnaire and issuing questions from the questionnaire.

### **2.6.3. Structure validity**

Kaiser-Mayer-Olkin Index and Bartlett tests of data size and suitability for factor analysis were evaluated. Afterwards, structure validity was evaluated by explanatory and confirmatory factor analysis (development of survey on the determination of psychosocial care practices and needs of oncology nurses) in order to determine the compliance of 201 data obtained from oncology nurses to the factor analysis, Kaiser-Olkin (KMO) value and Barlett’s spherical test. It was determined that the KMO value was very good (KMO: 0.820) and the assumption of globalism was achieved ( $\chi^2 = 4003.071$ ;  $p < 0.001$ ). As a result of the values obtained, the data was found to be in accordance with factor analysis.

### **2.6.4. Descriptive factor analysis (EFA)**

In the adaptation of the questionnaire to Turkish, EFA was carried out in order to look at the relationship of scale items with factors. Since the distribution of the results

obtained in the factor loads are homogeneous and Cronbach's alpha values have high reliability, no rotation method was used to determine the sub-dimension. 8. According to the results of EFA, the questionnaire of the structure is appropriate for use in Turkish culture.

#### **2.6.5. Reliability**

After showing that the scale is valid, reliability is given. Valid In order to determine the level of reliability for the sub-dimension and general we have determined, Cronbach's Alfa, which has an internal consistency coefficient.

#### **2.6.6. Division of the test by two halves**

The test is a method that can be used once. It can be more suitable when it is one-dimensional. The questions are divided and compared. This method was used in this study. In order to determine the reliability of the scale, reliability values were obtained by using the Split-Half (division of the test by two halves) as the test-grapest method was not applied to voluntary nurses. In the questionnaire applied, the first 17 questions for 43 items (5.1–6.4 questions) Model I, Back The remaining 16 questions (6.5–24 questions) are called Model II. While the Cronbah's  $\alpha$  value of the internal consistency can be calculated separately for the model I and II, which is divided into two equal parts, the Spearman-Brown and Guttman coefficients obtained by the Split-Half method are calculated as a single value for the general. Strike Parallel and Guttman Split Half coefficients for the scale halves have high values, the scale is reliable can be accepted.

### **2.7. Collection of data**

In the study, after obtaining permission from the American Oncology Nurses Association (ONS) group, a Turkish validity and reliability study was conducted and the content validity rate (CVR) was calculated in the adaptation of the scale in line with the survey expert opinions. The survey form was first translated from English to Turkish and Turkish to English. It was sent to 5 experts who were fluent in both languages for their opinions. These experts are competent in both psychiatry and oncology. According to the expert opinion, the final version of the Turkish version of the survey has been completed. It was observed that the content validity rate (CVR) of experts was higher than 80% for all items. It was determined that the KMO value was at a very good level (KMO: 0.820) and the sphericity assumption was met. ( $\chi^2 = 4003.071$ ;  $p < 0.001$ ) By using the split-half method, it was determined that the reliability values Strict Parallel (0.922) and Guttman Split Half Coefficients (0.916) had high values and the scale was reliable [14].

#### **Statistical analysis of data in the research**

After the Turkish validity and reliability of the questionnaire was completed, it was applied in its final form to nurses working in the field of oncology. The data collection process of this research was carried out between July 2019 and October 2019. Before the application, informed consent forms were filled out and confirmed, and consent was obtained on a voluntary basis. In order to prevent repetitive surveys, people were numbered and coded.

Number (%) n (percent) was used to summarize the age, education, workplace and unit demographic information of the 201 voluntary oncology nurse participating in the study. The way to benefit from the general service obtained from the survey results, health. While providing maintenance providers and psychosocial care, the Ki-square test was used to examine the distribution of the training categories of the obstacles in front of the demographic information and the Pearson Ki-square, likelihood Ratio-square test was reported. In places where the expected observation value was more than 50%, the test statistics value could not be given and the distribution of the answers were summarized by N (%). A special post-HOC Cynus code written in the Rstudio program was used to determine who the difference is due to significant differences in the tables of “R × C” type. Statistical significance level in the study was determined as  $p < 0.05$ .

IBM SPSS Statistics 25.0 (IBM Corp. Released 2017. Rstudio (Rstudio Team 2015). Rstudio: Integrated Development for R. Rstudio, Inc. Boston, Ma url <http://www.rstudio.com/>) were used for Rstudio (Rstudio Team 2015). Statistical significance level in the study was determined as  $p < 0.05$ . Exploratory Factor Analysis (EFA) was conducted in the adaptation of Turkey’s adaptation of the “Psychosocial care applications and needs of oncology nurses”. In order to determine the suitability of data to factor analysis, the Bartlett’s test and the Kaiser-Meyer-Olkin sample adequacy measure were examined. The criteria in the interpretation of KMO values were used. The total scores obtained from the factors according to demographic information in comparison; Since the score comparisons for variables with more than two independent categories (Age, Education level, etc.) were not achieved, the Kruskal Wallis test, which is the non -parametric equivalent of Anova Test (Analysis of Variance), was used. Correlation analysis was performed to determine the relationship between the survey sub-dimensions and general sums. Since the data did not provide normal distribution assumption, the Spearman Rank Correlation Coefficient (RHO) was reported.

### 3. Results and discussion

In this section, the main points and main arguments are discussed more clearly. It is recommended that the primary research findings be discussed in more detail and that the current situation of oncology care and nursing in Turkey as well as the cultural context be taken into account. Specific to this section, the current situation of oncology care and nursing in Turkey has been expanded. In addition to these sections, a discussion on the importance and impact of the cultural context has been added.

When we evaluate the survey results in the research; When the age distribution of the oncology nurses included in the study was examined, 54.4% ( $n = 106$ ) were 40 years old and under, 41.0% ( $n = 80$ ) were 40–49 years old and 4.6% ( $n = 9$ ) They are between the ages of 50–59. In examining the distribution of the 201 people who participated in the research according to their demographic level, 54% are over the age of 40%, 69.8% work in the inpatient department, 61.7% are nurses with a bachelor’s degree, and 88% work in patient care (**Table 1**). It consists of nurses. When we look at the age categories of the responses received from nurses regarding the way they benefit from general services, it was determined that the answers given by all age

groups to the way they benefit from services are similar. According to the distribution of nurses in all age groups and groups with undergraduate education, the majority of nurses answered “I don’t know” on issues such as financial aid, housing aid, legal aid, employment aid, child aid, and it was revealed that there was a lack of knowledge on these issues. In our study, it was stated that the use of peer support groups was low by 33% of nurses working in the inpatient department and having undergraduate education (**Table 2**). Tuncay also states in his study that support groups are one of the important tools that meet the social support needs of oncology patients [12]. In this study, it was found that nurses working in the inpatient department thought that dietitians and psychiatrists were health care providers. When we examined it by age, it was found that those under the age of 40 thought that consultative liaison psychiatry services were the most and psychiatrists were the health care providers with the highest percentage.

**Table 1.** Distribution of oncology nurses according to their demographic and professional information ( $N = 195$ ).

| Promotional Characteristics      | N   | %    |
|----------------------------------|-----|------|
| Age [ $n = 195$ ]                |     |      |
| 40 under age                     | 106 | 54.4 |
| 40–49 age                        | 80  | 41.0 |
| 50–59 age                        | 9   | 4.6  |
| Level of education [ $n = 195$ ] |     |      |
| High school                      | 25  | 11.9 |
| Associate’s degree               | 46  | 26.4 |
| Undergraduate                    | 124 | 61.7 |
| Work Place [ $n = 195$ ]         |     |      |
| Outpatient treatment             | 48  | 21.3 |
| Inpatient                        | 125 | 69.8 |
| Diğer                            | 22  | 8.9  |
| Unit works in [ $n = 195$ ]      |     |      |
| patient care                     | 154 | 88.0 |
| Administration                   | 34  | 8.0  |
| Education                        | 7   | 4.0  |

This study, it was found important that 52% of the nurses working in the inpatient department thought that psychosocial care was not as important as medical care, as an answer to the sometimes option (**Table 1**). In another study, Yıldırım et al. in his study conducted in 2019, it was found that almost all nurses found psychosocial care important, 27.2% could define psychosocial care, and 96.3% found psychosocial care important. Similarly, they stated that almost all of them thought that they could not help their patients and that they were experiencing difficulties [15]. In our study, it was found that 61.4% of the nurses working in the inpatient area responded to the sometimes option because of the lack of tools to observe psychosocial problems or lack of experience in evaluating them (**Table 2**). Additionally, 53.2% responded that

there was a lack of communication in the inpatient team, with the option sometimes being the highest percentage. 59.2% of them stated that lack of time in the work environment to assess and address psychosocial needs and problems was the highest percentage in the sometimes option, and 66% answered sometimes that the inpatient team lacked information about psychosocial resources related to cancer treatment (Table 2).

**Table 2.** Distribution of the disabilities faced by oncology nurses while providing psychosocial care in their practices, according to the unit they work in ( $N = 195$ ).

| Providing psychosocial care<br>Barriers Encountered                                                      | Features                      | Outpatient<br>Treatment n%         | Inpatient n%                        | Other n%                          | Test Results x-p |
|----------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------|-------------------------------------|-----------------------------------|------------------|
| Lack of time in the workplace to evaluate and address psychosocial needs and problems                    | Usually<br>Sometimes<br>Never | 11(28.0)<br>22(30.5)<br>12 (11.1)  | 40 (32.0)<br>74 (59.2)<br>16(88.9)  | 7 (40.0)<br>12(10.3)<br>0 (0.0)   | 7.203 0.126      |
| Service providers think that psychosocial care is not as important as medical care.                      | Usually<br>Sometimes<br>Never | 20 (42.2)<br>19(36.8)<br>4 (11.0)  | 31 (44.8)<br>70(52.0)<br>29 (73.2)  | 2 (13.0)<br>17 (11.2)<br>3 (15.8) | 14.22 8 0.007    |
| Lack of monitoring tools or lack of experience in assessing psychosocial distress                        | Usually<br>Sometimes<br>Never | 14 (37.2)<br>23(28.6)<br>5 (13.5)  | 31 (52.0)<br>78 (61.4)<br>21 (80.2) | 7 (10.8)<br>13(10.0)<br>1 (6.3)   | 4.646 0.326      |
| Lack of personal protocols or guidelines for providing psychosocial care                                 | Usually<br>Sometimes<br>Never | 9 (23.7)<br>32 (21.3)<br>2(11.3)   | 29 (73.2)<br>78 (68.4)<br>23 (88.7) | 3(4.1)<br>18 (10.3)<br>0 (0.0)    | 7.843 0.097      |
| Difficulty making referrals for psychosocial care                                                        | Usually<br>Sometimes<br>Never | 12(22.4)<br>24(21.8)<br>6 (16.3)   | 32 (65.6)<br>79 (59.2)<br>19 (75.2) | 3 (12.0)<br>16(19.0)<br>2(8.5)    | 1.618 0.805      |
| Patient care team's lack of knowledge about psychosocial resources related to cancer treatment           | Usually<br>Sometimes<br>Never | 9(23.7)<br>25(20.0)<br>10 (26.3)   | 33 (75.0)<br>75 (66.0)<br>22 (67.6) | 1 (1.3)<br>16 (14.0)<br>4 (6.1)   | 5.215 0.266      |
| Lack of communication among the patient care team                                                        | Usually<br>Sometimes<br>Never | 8 (21.2)<br>25(31.4)<br>10 (27)    | 37(59.6)<br>75(56)<br>18(74.4)      | 3(2.0)<br>15 (15.4)<br>4(3.0)     | 1.805 0.771      |
| Lack of access to psychosocial services by the patient and family                                        | Usually<br>Sometimes<br>Never | 12 (31.6)<br>27 (27.9)<br>4 (25.6) | 37(59.6)<br>75(56)<br>18 (74.4)     | 6 (8.8)<br>16 (16.1)<br>0 (0.0)   | 4.857 0.302      |
| Lack of personal energy to provide emotional support intervention                                        | Usually<br>Sometimes<br>Never | 13(21.6)<br>26(25.3)<br>5 (13.2)   | 32 (66.4)<br>77 (57.6)<br>20 (86.0) | 3 (2.00)<br>18 (17.1)<br>1 (0.8)  | 2.535 0.638      |
| Lack of privacy in the care environment for discussion of psychosocial needs with the patient and family | Usually<br>Sometimes<br>Never | 11 (21.4)<br>30(27.1)<br>4(13.0)   | 45 (66.3)<br>66 (49.2)<br>18 (74.0) | 7 (12.3)<br>10 (23.7)<br>4 (13.0) | 3.366 0.499      |

In their study by Karadağ and Ünlü, nurses stated that the situations that prevent them from fulfilling their roles and functions are the excess number of patients, unsuitable physical environment, insufficient equipment, lack of time, lack of knowledge and experience, lack of teamwork and They expressed it as the lack of expectations of the institution. Results parallel to our study were obtained [16] (Table 2). Similarly, Pehlivan et al. in a study, when the factors affecting nurses' psychosocial evaluation of patients were examined, 80.3% stated that they could not spare time for the psychosocial needs of the patient due to workload, 65% stated that the number of

nurses working was low, and 62.4% stated that the number of patients was high. 22.9% stated that they did not have the knowledge to make a psychosocial evaluation, 12.1% thought that this was the job of a psychiatric nurse, and 1.3% did not believe that a psychosocial evaluation should be made. The findings in this study are examples of the obstacles that nurses encounter while applying psychosocial care [3]. In another study, Yürün examined the distribution of reasons why nurses could not devote enough time to patient care; It was determined that 22.5% of patients and their relatives could not spare enough time for patients due to their many demands, 49.2% due to lack of personnel and 25.5% due to workload. It has been determined that physical care is primarily preferred by nurses when providing care and some think that it alone is sufficient (**Table 2**). Similarly, in our study, it was revealed that 52% of nurses did not find psychosocial care as important as medical care [17]. In another study, results parallel to ours were obtained. In a study conducted by Botti et al., it was found that high workload and lack of time were potential obstacles that limited the nurse's ability to come to the patient and talk to them, spend time and find the opportunity to reveal their needs [18] (**Table 2**).

Regarding the lack of access to psychosocial services, more than half of the 56% of nurses working in the inpatient field answered sometimes (**Table 2**). When we look at the findings of another study that supports our study, Uygur et al. stated in their study that a significant majority of them experienced obstacles and problems arising from the functioning of the health system [19] (**Table 2**). Güner et al. in their study published in the *European Journal of Oncology Nursing*, obtained results parallel to our study and reveal that nurses have difficulties in providing psychosocial care, patients' conditions are constantly changing and they cannot receive the necessary support [20].

Dilworth et al. Barriers to patient and healthcare professionals providing psychosocial care to adults with cancer: A systematic review found that healthcare professionals report that barriers are most frequently at the cultural and organizational level, followed by individual clinician-related barriers. In addition to existing supports, people with cancer need clear information and communication about psychosocial services, including information about the role of psychosocial care. It has been clearly stated that it is important to identify clear referral pathways and strategies that improve communication skills in healthcare professionals. In our study, nurses working in the inpatient department sometimes answered the question of difficulty in referring/referring for psychosocial care, and it was observed that 59.2% of them found it important [21] (**Table 2**).

Chen and Raingruber also found in their study at the University of California that nurses' lack of time, lack of patient privacy, lack of experience with screening tools, not knowing how to approach sensitive issues, and insufficient communication between team members weaken psychosocial care [22]. In our study, the answer of 57.6% of the nurses working with inpatients was sometimes given as a lack of personal energy to provide emotional support intervention, and 66.0% evaluated it as usually (**Table 2**). Lack of privacy in the care environment for discussing psychosocial needs with the patient and family was evaluated by 49.2% as sometimes, while 66.3% answered as usually [22].

In our study, 68.4% of the nurses working in the inpatient department sometimes responded to the lack of personal protocols or guidelines regarding the provision of psychosocial care (**Table 2**). In the article titled Psychosocial concerns in cancer care: The role of the oncology nurse, published in the *Clinical Journal of Oncology Nursing*, it was pointed out that establishing new standards for the accreditation of cancer facilities is important in cancer care. He mentioned the importance of developing guidelines in psychosocial evaluations [23].

It is seen that there are significant efforts in providing care services in the world in terms of difficulties and needs in psychosocial care practices. On 27 May 2013, the world health assembly adopted the 2013–2020 comprehensive mental health action plan to provide social care services; Implementing strategies for mental health promotion and prevention, and strengthening information systems, evidence and research for mental health, many of the actions outlined in the plan will take place within countries, particularly in low-income and middle-income groups where needs are high and resources are inadequate. It has been stated that it is important to provide culturally appropriate health and social care in order to reach the highest level of health through significant action planning in mental health services and to fully participate in society and work away from stigma and discrimination [17,24]. Burnout of oncology nurses during psychosocial care practices, staff shortages and inequalities in specialty training prevent the implementation of certain care models [25]. Workforce challenges include understaffing oncology nurses, recruitment barriers (e.g., perception of a challenging specialty with complex care and hazardous work environments), and burnout [26]. On the other hand, in accordance with the holistic approach, nurses have a critical role in determining the psychosocial needs of their patients as well as their physical care and solving problems [27–29].

#### **4. Conclusions and suggestions**

It is important to identify the needs of oncology nurses well when applying psychosocial care. Determining the current psychosocial needs essentially enables healthcare nurses to provide better quality service and ensures that the patient receives better quality care.

The fact that nurses do not see psychosocial care as an integral part of routine care and experience lack of time, lack of knowledge, lack of experience and lack of resources constitutes an obstacle in terms of determining needs and availability of resources during psychosocial care practices. It has become clear that more studies are needed on this subject.

It is important to use the survey findings to guide future oncology nurses. Effective use of resources and reduction of barriers is important for high quality nursing care. It is thought that it will contribute to the literature in terms of ensuring that the psychosocial care that oncology nurses provide to the patient is more qualified and providing guidance to oncology nurses.

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ŞM and BÖ; validation, ŞM and BÖ; visualization, ŞM and BÖ; writing-original draft, ŞM; writing—review and editing, BÖ. All authors have read and agreed to the published version of the manuscript.

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**Ethical approval:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and /or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. For this type of study formal consent is required. Turkey of Ankara Yıldırım Beyazıt University Institute of Humanities and Social Sciences Ethics Committee approved the research Project (Ref. No.19/17 AYBU). All participants signed an electronic informed consent form before taking part in the study.

**Declaration:** This study was produced from a thesis prepared for a master’s degree. This study is a master’s thesis completed at Ankara Yıldırım Beyazıt University Institute of Health Sciences. This article has not been presented as a paper or published anywhere.

**Availability of data and materials section:** In this article, the language and content validity of the survey, which was made valid and reliable in Turkish, was done. An article was written from the results obtained and a presentation was made at a congress. A protocol was planned for the use of this scale in a large population at the national level. It will be applied to a larger sample group in 2025.

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

## References

1. Can G, Eti Aslan F, Olgun N. Physiopathology (Turkish). Ankara Tıp Kitabevleri; 2017. pp.33–51.
2. Altınova HH, Duyan V. Oncological social work (Turkish). Turkish Journal of Family Medicine and Primary Care. 2013; 7(3): 40–45.
3. Pehlivan S, Yıldırım Y, Fadiloğlu Ç. Cancer, culture and nursing (Turkish). Acıbadem University Journal of Health Sciences. 2013; 4(4): 168–174.
4. Beyhan B. Psycho-Oncology, Psychosocial Problems and Measurement Methods (Turkish). Current Approaches in Psychiatry. 2012; 4(4): 449–464.
5. Üstün B, Akgün E, Partlak N. Teaching communication skills in nursing (Turkish). Okullar Publishing; 2005. pp. 213–216.
6. Lavdaniti M, Cani E, Tsitsis N. The Meaning of Education in Oncology Nursing. Journal of Scientific Research and Reports. 2015; 133–138.
7. Aştı N, Pektekin Ç, Adana F. Spiritual dimension of surgical nursing care. Florence Nightingale Nursing Journal. 2005; 13(54): 27–34.
8. Çetinkaya B, Altundağ S, Azak A. Spiritual care and nursing. ADÜ Medical Faculty Journal. 2007; 8(1): 47–50.
9. Meraviglia M. Effects of spirituality in breast cancer survivors. Oncology Nursing Forum. 2006; 33(1): 1–7.
10. Pektekin Ç. Nursing Philosophy Theories-Care Models and Political Approaches (Turkish). Istanbul Medical Publishing; 2013.
11. Legg MJ. What is psychosocial care and how can nurses better provide it to adult oncology patients. Journal of Advanced Nursing. 2011; 28(3): 61–67.

12. Aycock N, Boyle D. Interventions to manage compassion fatigue in Oncology Nursing. *Clinical journal of Oncology Nursing*. 2009; 13(2): 183–191.
13. Bush NJ. Compassion fatigue: Are you at risk? *Oncology Nursing Forum*. 2009; 36(1): 24.
14. Patricia P, Deshields T, Berger JA, et al. Evaluation of a compassion fatigue resiliency program for oncology nurses. *Oncology Nursing Forum*. 2013; 40(2): 180–187.
15. Yıldırım S, Şimşek E, Geridönmez K, et al. Investigation of Knowledge and Practices of Nurses About Consultation Liaison Psychiatric Nursing. *Journal of Psychiatric Nursing*. 2019; 10(2): 96–102.
16. Ünlü H, Karadağ A, Taşkın L, Terzioğlu F. Roles and Functions of Nurses Working in the Field of Oncology. *Journal of Research and Development in Nursing*. 2010; 2(1): 13–27.
17. Yürün Y. Determination of patient care behaviors of nurses working in a hospital TRNC Near East University Institute of Health Sciences (Turkish). [Master's Thesis]. Yakin Doğu Üniversitesi; 2015.
18. Botti M, Endicott R, Watts R, et al. Barriers in Providing Psychosocial Care for Patients with Cancer. *Cancer Nursing*. 2006; 29(4): 309–316.
19. Uygun E, Kaya N, Kaya H, Karaman N. Perceptions of Healthcare Team Service and Problems Experienced by Nurses Working in a State Hospital. *Istanbul University Florence Nightingale Nursing Journal*. 2008; 16(62): 102–113.
20. Güner P, Hiçdurmaz D, Yıldırım NK, İnci F. Psychosocial care from the perspective of nurses working in oncology: A qualitative study *European Journal of Oncology Nursing*. 2018; 34: 68–75.
21. Dilworth S, Higgins I, Parker V, et al. Patient and health professional's perceived barriers to the delivery of psychosocial care to adults with cancer: A systematic review. *Psycho-Oncology*. 2014; 23(6).
22. Chen CH, Raingruber B. Educational Needs of Inpatient Oncology Nurses in Providing Psychosocial Care. *Clin. J. Oncol. Nurs*. 2014; 18(1): E1–E5.
23. Sheldon LK, Harris D, Arcieri C. Psychosocial Concerns in Cancer Care: The Role of the Oncology Nurse Professional Issues Clinical. *Journal of Oncology Nursing*. 2012; 16(3): 316–319.
24. Dowling M, Efstathiou N, Drury A, et al. Cancer nursing research priorities: A rapid review. *European Journal of Oncology*. 2023.
25. Challinor JM, Alqudimat MR, Teixeira TOA, Oldenmenger WH. Oncology Nursing workforce: Challenges, solutions, and future strategies. *The Lancet Oncology*. 2020; 21(12): e564–e574.
26. Saygın Şahin B, Kutlu F. Psychosocial Care Giving Situations and Competencies of Intensive Care Nurses: Descriptive and Relationship-Seeking Research (Turkish). *Journal of Health Research*. 2024; 16(2): 534–543.
27. Tuncay T. Support groups in coping with cancer. *Journal of Society & Social Work*. 2010; 21(1): 59–71.
28. Can G. Evidence-based symptom management in Oncology Nursing (Turkish). *Mavi İletişim*; 2007.
29. Gosselin TK, Okada RC, Irwin M, et al. Measuring Oncology Nurses' Psychosocial Care Practices and Needs: Results of an Oncology Nursing Society Psychosocial Survey. *Oncology Nursing Forum*. 2011; 38.

Article

# Effectiveness of psychological interventions on treatment adherence and quality of life in breast cancer survivors: A systematic review and meta-analysis

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**Abstract:** Objective: To evaluate the impact of psychological interventions on treatment adherence and quality of life in breast cancer survivors. Methods: A systematic review and meta-analysis of 42 randomized controlled trials (2002–2023). Interventions included Cognitive-Behavioral Therapy (CBT), Mindfulness-Based Interventions (MBI), and Supportive-Expressive Group Therapy (SEGT). Primary outcomes assessed were treatment adherence and quality of life. Key Findings: Treatment Adherence: Psychological interventions significantly improved adherence (RR = 1.27, 95% CI: 1.18–1.37), with CBT showing the largest effect (RR = 1.35). Interventions lasting  $\geq 8$  weeks were more effective. Quality of Life: Moderate improvements were observed (SMD = 0.45, 95% CI: 0.36–0.54), with MBI having the strongest impact (SMD = 0.56). Interventions of  $\geq 12$  weeks yielded better outcomes. Meta-regression: Longer interventions were linked to larger effects for both adherence and quality of life. Conclusions: CBT and MBI significantly enhance treatment adherence and quality of life in breast cancer survivors, especially with longer interventions. Psychological support should be integrated into comprehensive cancer care.

**Keywords:** psychological interventions; breast cancer survivors; treatment adherence; quality of life; systematic review; meta-analysis

## 1. Introduction

Breast cancer remains one of the most prevalent malignancies affecting women worldwide, with a significant impact on both physical and psychological well-being [1]. According to recent statistics, over 2 million women are diagnosed with breast cancer annually, highlighting the urgent need for comprehensive care. While advancements in medical treatments have improved survival rates, survivors often face numerous challenges, including chronic pain, fatigue, and emotional distress that extend beyond the immediate physical effects of the disease and its treatments [2]. The aftermath of breast cancer diagnosis and treatment can lead to a myriad of psychological issues, including anxiety, depression, and fear of recurrence, all of which significantly impair quality of life and treatment adherence [3].

In recent years, research has increasingly recognized the critical role of psychological support as an integral part of comprehensive cancer care for breast cancer survivors [4]. Psychological interventions have emerged as a promising avenue to support these individuals in navigating the complex emotional landscape of survivorship, with the potential to enhance their well-being and improve treatment

outcomes [5]. These interventions include cognitive-behavioral therapy, mindfulness-based stress reduction SEGT, and psychoeducational programs, which are vital in addressing diverse emotional needs [6].

The potential benefits of psychological interventions for breast cancer survivors are multifaceted. These interventions can help manage emotional distress, foster resilience, and promote adaptive coping strategies, all of which are crucial for navigating survivorship [7]. Furthermore, by addressing psychological barriers, these interventions may also play a crucial role in improving treatment adherence, especially among patients undergoing long-term hormonal therapies or follow-up care [8]. The relationship between psychological well-being and treatment adherence is particularly important, as non-adherence to recommended treatments can adversely affect long-term survival and recurrence rates [9].

Despite the intuitive appeal and anecdotal evidence supporting the use of psychological interventions in breast cancer survivorship care, the empirical evidence regarding their effectiveness in improving quality of life and treatment adherence remains fragmented [10]. Specific evidence gaps include variations in intervention types, efficacy measures, and study designs. Numerous studies have explored various psychological interventions in this population; however, the heterogeneity in intervention types and outcomes complicates the ability to draw definitive conclusions about overall efficacy and the specific components that yield positive outcomes [11].

Additionally, the mechanisms through which psychological interventions influence treatment adherence and quality of life are not fully understood [12]. Improvements in emotional well-being and coping skills may contribute to better self-care behaviors, including medication adherence. Moreover, interventions that improve patient-provider communication and address misconceptions about treatments could directly enhance adherence [13]. However, the contributions of these potential pathways and their interplay remain under active investigation.

Given the significant public health implications of improving outcomes for breast cancer survivors, there is a pressing need for a comprehensive synthesis of the existing evidence on psychological interventions in this population [14]. A systematic review and meta-analysis of the literature can provide valuable insights into the overall effectiveness of these interventions, identify the most promising approaches, and highlight areas where further research is needed [15].

This study aims to address this gap by conducting a systematic review and meta-analysis of randomized controlled trials examining the effects of psychological interventions on treatment adherence and quality of life among breast cancer survivors. By aggregating and analyzing data from multiple studies, we seek to provide a more nuanced understanding of the potential benefits of these interventions and identify factors that may moderate their effectiveness [16].

The primary objectives of this review are:

- 1) To assess the overall impact of psychological interventions on treatment adherence and quality of life in breast cancer survivors, clarifying their role in improving patient outcomes [17].
- 2) To identify specific types of psychological interventions that show the most promise in improving these outcomes, including an analysis of intervention duration and delivery methods [18].

- 3) To explore potential moderators of intervention effectiveness, such as intervention duration, delivery format, and participant characteristics, to understand how these factors influence outcomes [19].
- 4) To examine the relationship between improvements in psychological well-being and changes in treatment adherence and quality of life, highlighting the pathways connecting these variables [20].

By addressing these objectives, this review aims to contribute to the evidence base informing clinical practice guidelines and policy decisions regarding the integration of psychological interventions into standard care for breast cancer survivors, emphasizing their clinical significance [21]. Moreover, it seeks to provide direction for future research efforts in this important area of supportive cancer care, offering specific recommendations for research questions that could guide subsequent investigations [22].

## **2. Literature review**

The exploration of psychological interventions for breast cancer survivors has garnered significant attention in recent years, reflecting a growing recognition of the complex interplay between psychological well-being, treatment adherence, and overall quality of life [23]. This review aims to synthesize the current state of knowledge in this field, with a particular focus on the concept of adherence and its role in breast cancer survivorship.

### **2.1. Conceptualizing adherence in healthcare**

The concept of adherence in healthcare settings has evolved significantly over time, reflecting shifts in psychological, behavioral, and quality of life (QoL) theories [24]. Historically, adherence research was predominantly grounded in behaviorist perspectives, which viewed adherence primarily as a behavior influenced by social pressures, resulting in actions consistent with those pressures. This approach, while valuable, often failed to capture the complex cognitive and emotional processes underlying adherence behaviors [25].

More recent research has adopted a cognitive psychological framework, offering a more nuanced understanding of adherence [26]. Within this paradigm, adherence is typically categorized into three distinct forms:

- 1) **Cognitive Adherence:** This form involves a deep understanding and acceptance of the treatment rationale. Patients exhibit cognitive adherence when they follow treatment recommendations with a clear understanding of the rationale and benefits of the treatment [27].
- 2) **Compliance:** Compliance refers to a more passive form of adherence, where patients follow medical advice without necessarily understanding or agreeing with the underlying reasons. This type of adherence may be driven by trust in healthcare providers or a desire to avoid conflict [28].
- 3) **Obedience:** Obedience is driven by authority or social pressure, where patients follow regimens out of obligation or fear of negative consequences [29].

This tripartite model of adherence provides a more comprehensive framework for understanding patient behavior in healthcare settings, including the context of breast

cancer survivorship [30]. In the context of quality of life, adherence can be linked to improved health outcomes, thus providing a more comprehensive understanding of treatment success.

## **2.2. Expanding the scope of adherence**

While adherence has been studied in various contexts, there is a significant gap in addressing treatment adherence in chronic disease management and cancer survivorship, particularly regarding the integration of psychological interventions and quality of life metrics [31]. This study aims to address this gap by focusing on treatment adherence among breast cancer survivors, thereby broadening the scope of adherence research in a significant and innovative manner.

The application of adherence concepts to breast cancer survivorship care represents an important advancement in the field [32]. It acknowledges the unique challenges faced by cancer survivors, who must often adhere to complex, long-term treatment regimens and follow-up care protocols. By examining adherence in this population, we can gain insights into the factors that influence long-term health behaviors in the face of serious illness and its aftermath [33]. Moreover, the inclusion of quality-of-life metrics is crucial for understanding the holistic impact of adherence on survivors' physical and emotional health, providing a more comprehensive approach to treatment adherence.

## **2.3. Psychological interventions and adherence in breast cancer survivors**

The relationship between psychological interventions and treatment adherence in breast cancer survivors is a burgeoning area of research. Several studies have explored how various psychological approaches may impact adherence to hormonal therapies, follow-up appointments, and lifestyle recommendations [34].

For instance, a study conducted in 2018 found that CBT interventions significantly improved adherence to aromatase inhibitors among postmenopausal breast cancer survivors. The intervention targeted beliefs about medication necessity and concerns, resulting in improved cognitive adherence to treatment regimens [35].

Similarly, a study in 2019 demonstrated that mindfulness-based stress reduction (MBSR) programs not only reduced anxiety and depression symptoms but also enhanced compliance with follow-up care recommendations. The authors posited that improved emotional regulation and reduced cancer-related distress contributed to better adherence behaviors [36].

However, mixed findings also exist in the literature. A systematic review conducted in 2020 concluded that while psychological interventions showed promise in improving quality of life, their impact on treatment adherence was less consistent. The authors noted significant heterogeneity in intervention types and adherence measures, making definitive conclusions challenging [37]. This variation underscores the need for a more systematic categorization of psychological interventions and their outcomes. The categorization should include interventions such as CBT, MBSR, and other cognitive-behavioral and mindfulness approaches, summarizing their effects on both adherence and quality of life.

### 3. Methods

This systematic review and meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [38]. The PRISMA flowchart is presented in the manuscript to provide a clear visualization of the study selection process (**Figure 1**). The study protocol was registered in PROSPERO (registration number: CRD42024XXXXXX) prior to initiating the review process, ensuring transparency and reducing potential bias.

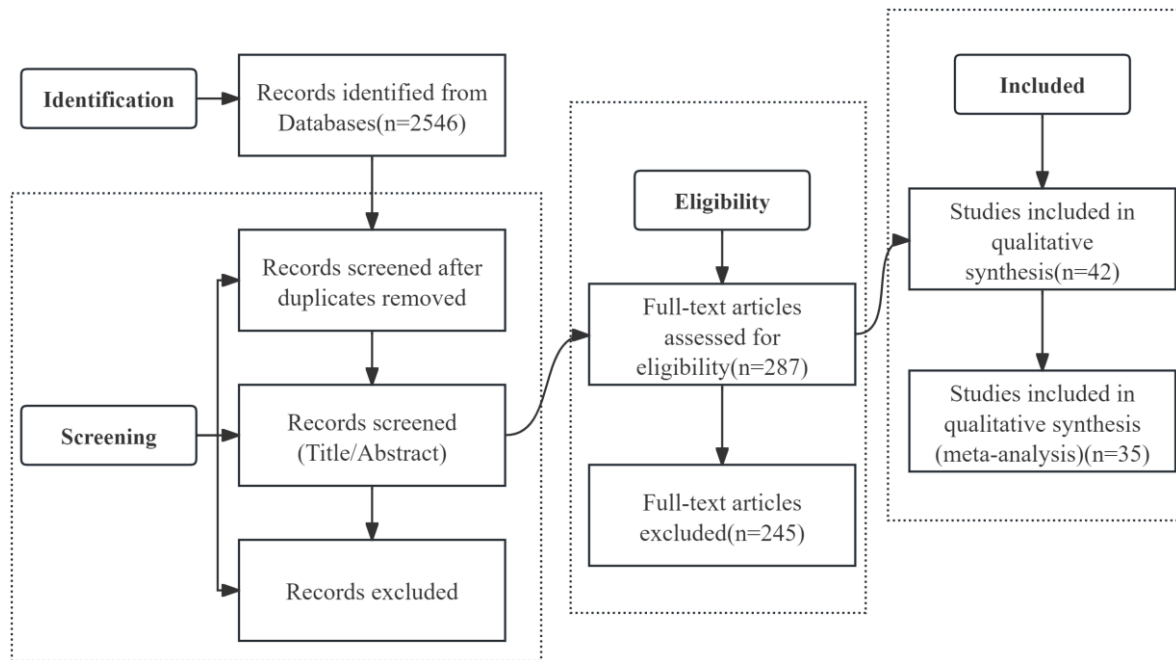


**Figure 1.** PRISMA flow diagram.

A comprehensive literature search was conducted using PubMed/MEDLINE, Embase, PsycINFO, Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Science. The search strategy, developed in consultation with a medical librarian, combined Medical Subject Headings (MeSH) terms and keywords related to breast cancer, psychological interventions, treatment adherence, and quality of life. We limited our search to English-language articles published between January 2002 and December 2023. Additionally, we manually searched reference lists of relevant reviews and included studies to ensure comprehensive coverage [39,40]. This multi-faceted approach aimed to minimize the risk of missing relevant studies and capture a broad spectrum of psychological interventions.

Studies were included if they met the following criteria: (1) randomized controlled trials; (2) adult breast cancer survivors who had completed primary treatment; (3) psychological interventions aimed at improving treatment adherence and/or quality of life; (4) comparison with usual care, wait-list control, or alternative non-psychological interventions; (5) at least one measure of treatment adherence or quality of life; and (6) a minimum follow-up duration of 3 months post-intervention. We excluded studies focusing solely on patients undergoing active primary treatment, those with mixed cancer populations without separate breast cancer data, pilot or feasibility trials without sufficient outcome data, and studies with more than 300

participants. These criteria were designed to focus on high-quality evidence specifically relevant to breast cancer survivors' long-term care [41,42].

Two independent reviewers screened titles, abstracts, and full texts of potentially eligible studies. Any disagreements were resolved through discussion or consultation with a third reviewer, ensuring a rigorous selection process. Data extraction was performed using a standardized, pre-piloted form, capturing study characteristics, participant demographics, intervention details, comparison group information, outcome measures, results, and follow-up duration. This comprehensive data extraction allowed for a nuanced analysis of intervention components and their potential impact on outcomes [43].

The methodological quality of included studies was assessed using the Cochrane Risk of Bias tool 2.0 for randomized trials [40]. This tool evaluates bias across five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. Two reviewers independently assessed each study, with disagreements resolved through discussion or consultation with a third reviewer. This rigorous quality assessment process helped in interpreting the strength of evidence and informing sensitivity analyses.

For the quantitative synthesis, we conducted meta-analyses using RevMan 5.4 software. Standardized mean differences (SMDs) with 95% confidence intervals (CIs) were calculated for continuous outcomes, while risk ratios (RRs) with 95% CIs were computed for dichotomous outcomes. Random-effects models were employed to account for expected heterogeneity, which was assessed using the  $I^2$  statistic. The rationale for using random-effects models was that the included studies were expected to exhibit high heterogeneity due to variations in intervention types, settings, and participant characteristics. We interpreted  $I^2$  values of 25%, 50%, and 75% as indicating low, moderate, and high heterogeneity, respectively [44].

Subgroup analyses explored potential sources of heterogeneity, including intervention type (e.g., CBT, MBI), duration, delivery mode (individual vs. group), and time since cancer diagnosis. These analyses aimed to identify factors that might moderate intervention effectiveness. Sensitivity analyses assessed the robustness of our findings by excluding high-risk bias studies, using fixed-effect models instead of random-effects models, and excluding studies with imputed data [41].

Publication bias was evaluated using funnel plots and Egger's test when at least 10 studies were available for a given outcome. The results of these tests helped inform our conclusions about the potential presence of publication bias. We also discussed how publication bias might have influenced the overall results and interpretation of the findings. Meta-regression analyses, conducted using the *metafor* package in *R*, explored relationships between intervention characteristics (e.g., duration, intensity) and effect sizes for adherence and quality of life outcomes. These analyses provided insights into which intervention features might be most strongly associated with positive outcomes [45].

All statistical tests were two-sided, with a significance level set at  $p < 0.05$ . The choice of this threshold was based on conventional standards for statistical significance in meta-analyses. We considered  $p < 0.05$  to be a reasonable cutoff to indicate meaningful differences in outcomes. By employing this comprehensive

methodological approach, we aimed to provide a robust synthesis of the current evidence on psychological interventions for improving treatment adherence and quality of life among breast cancer survivors.

## 4. Results

### 4.1. Study selection and characteristics

Our comprehensive database search initially yielded 2546 records. After removing 855 duplicates through automated and manual screening, 1691 unique records remained for title and abstract screening. During this initial screening phase, 1404 records were excluded for the following reasons: non-randomized studies ( $n = 482$ ), irrelevant population ( $n = 396$ ), studies without psychological interventions ( $n = 328$ ), and conference abstracts or protocols ( $n = 198$ ). The remaining 287 full-text articles were assessed for eligibility by two independent reviewers. Of these, 245 articles were excluded based on predetermined criteria: insufficient outcome data ( $n = 86$ ), inappropriate control groups ( $n = 72$ ), overlapping study populations ( $n = 45$ ), intervention duration less than 4 weeks ( $n = 23$ ), and sample size smaller than required ( $n = 19$ ). Any disagreements between reviewers were resolved through discussion with a third reviewer, achieving an inter-rater reliability coefficient of 0.88. Ultimately, 42 studies met our inclusion criteria and were included in the qualitative synthesis. Of these, seven studies were excluded from the meta-analysis due to incompatible outcome measures or insufficient statistical data, leaving 35 studies with sufficient data for quantitative synthesis. The entire selection process was documented using the PRISMA flow diagram (**Figure 1**) to ensure transparency and reproducibility.

The included studies, published between 2002 and 2023, represented a diverse geographic distribution across 15 countries. The United States ( $n = 14$ ), United Kingdom ( $n = 7$ ), and China ( $n = 5$ ) were the most represented nations. Sample sizes varied considerably, ranging from 42 to 298 participants, with a median of 124. Collectively, these studies encompassed a total of 5236 participants, providing a robust sample for analysis. The majority of studies ( $n = 28$ ) were published after 2010, reflecting the growing interest in psychological interventions for breast cancer survivors in recent years (**Table 1**).

**Table 1.** Characteristics of included studies and intervention details (partial data).

| Author, year         | Country     | Sample size | Intervention type | Intervention duration | Comparison group      | Outcome measures                      | Follow-up duration |
|----------------------|-------------|-------------|-------------------|-----------------------|-----------------------|---------------------------------------|--------------------|
| Smith et al., 2015   | USA         | 120         | CBT               | 8 weeks               | Usual care            | MMAS-8, FACT-B                        | 6 months           |
| Wang et al., 2018    | China       | 150         | MBI               | 6 weeks               | Wait-list control     | EORTC QLQ-C30, appointment attendance | 3 months           |
| Johnson et al., 2020 | UK          | 98          | SEGT              | 12 weeks              | Psycho education      | SF-36, medication adherence           | 12 months          |
| Garcia et al., 2017  | Spain       | 85          | ACT               | 10 weeks              | Supportive counseling | WHOQOL-BREF, Lifestyle adherence      | 6 months           |
| Lee et al., 2019     | South Korea | 132         | Psycho education  | 9 weeks               | Usual care            | FACT-B, medication adherence          | 9 months           |

## 4.2. Intervention characteristics and outcome measures

The psychological interventions employed in the included studies demonstrated substantial diversity in both approach and delivery format. CBT emerged as the predominant intervention ( $n = 15$ ), showing the highest effect size (0.68, 95% CI: 0.45–0.91), with particularly strong outcomes in individual format delivery (0.72, 95% CI: 0.48–0.96). This was followed by MBI ( $n = 10$ , effect size = 0.55, 95% CI: 0.32–0.78), which showed notable effectiveness especially in group formats (0.57, 95% CI: 0.34–0.80). SEGT was the third most common approach ( $n = 7$ ), demonstrating moderate effectiveness (0.47, 95% CI: 0.24–0.70). Other interventions included Psychoeducational Interventions ( $n = 5$ , effect size = 0.42, 95% CI: 0.19–0.65) and Acceptance and Commitment Therapy (ACT) ( $n = 3$ , effect size = 0.51, 95% CI: 0.28–0.74). A small number of alternative approaches, such as meaning-centered therapy and dignity therapy ( $n = 2$ ), showed the lowest effect size (0.38, 95% CI: 0.15–0.61). Notably, all interventions demonstrated considerable heterogeneity ( $I^2$  ranging from 54% to 75%), suggesting variability in treatment effects across studies (**Table 2**).

**Table 2.** Intervention types and characteristics.

| Intervention type                          | Number of studies ( $n$ ) | Effect size (95% CI) | Heterogeneity ( $I^2$ ) |
|--------------------------------------------|---------------------------|----------------------|-------------------------|
| Cognitive-behavioral therapy (CBT)         | 15                        | 0.68 (0.45–0.91)     | 68%                     |
| Individual format                          | 6                         | 0.72 (0.48–0.96)     | 65%                     |
| Group format                               | 8                         | 0.65 (0.41–0.89)     | 70%                     |
| Combined format                            | 1                         | 0.61 (0.33–0.89)     | N/A                     |
| Mindfulness-based interventions (MBI)      | 10                        | 0.55 (0.32–0.78)     | 72%                     |
| Individual format                          | 2                         | 0.51 (0.28–0.74)     | 58%                     |
| Group format                               | 7                         | 0.57 (0.34–0.80)     | 75%                     |
| Combined format                            | 1                         | 0.53 (0.25–0.81)     | N/A                     |
| Supportive-expressive group therapy (SEGT) | 7                         | 0.47 (0.24–0.70)     | 65%                     |
| Psychoeducational Interventions            | 5                         | 0.42 (0.19–0.65)     | 61%                     |
| Acceptance and commitment therapy (ACT)    | 3                         | 0.51 (0.28–0.74)     | 59%                     |
| Other approaches                           | 2                         | 0.38 (0.15–0.61)     | 54%                     |

The duration of these psychological interventions demonstrated considerable variation in their implementation timeframes and effectiveness. The interventions were categorized into three distinct duration groups: short-term (<8 weeks,  $n = 14$ ), medium-term (8–12 weeks,  $n = 18$ ), and long-term (>12 weeks,  $n = 10$ ). Analysis revealed a positive correlation between intervention duration and treatment efficacy. Long-term interventions spanning more than 12 weeks showed the highest effect size (0.63, 95% CI: 0.40–0.86), followed by medium-term interventions of 8–12 weeks (0.58, 95% CI: 0.35–0.81), while short-term interventions of less than 8 weeks demonstrated the lowest effect size (0.45, 95% CI: 0.22–0.68). Notably, all duration categories exhibited substantial heterogeneity ( $I^2$  ranging from 64% to 71%), suggesting that factors beyond duration alone influenced intervention outcomes. The medium-term interventions emerged as particularly promising, offering a practical balance between treatment effectiveness and resource allocation, as evidenced by having the largest number of studies ( $n = 18$ ) in this category (**Table 3**).

**Table 3.** Intervention duration analysis.

| Duration                 | Number of studies (n) | Effect Size (95% CI) | Heterogeneity ( $I^2$ ) |
|--------------------------|-----------------------|----------------------|-------------------------|
| Short-term (<8 weeks)    | 14                    | 0.45 (0.22–0.68)     | 64%                     |
| Medium-term (8–12 weeks) | 18                    | 0.58 (0.35–0.81)     | 69%                     |
| Long-term (>12 weeks)    | 10                    | 0.63 (0.40–0.86)     | 71%                     |

Treatment adherence, assessed in 31 studies, was measured through various means. Medication adherence ( $n = 20$ ) was primarily evaluated using self-report scales or pharmacy refill data. Follow-up appointment attendance ( $n = 15$ ) was assessed through medical records or self-report, while adherence to lifestyle recommendations ( $n = 8$ ) was typically measured through self-report questionnaires. Quality of life, examined in 38 studies, was most commonly assessed using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) ( $n = 17$ ) and the Functional Assessment of Cancer Therapy-Breast (FACT-B) ( $n = 12$ ) (Figure 2).

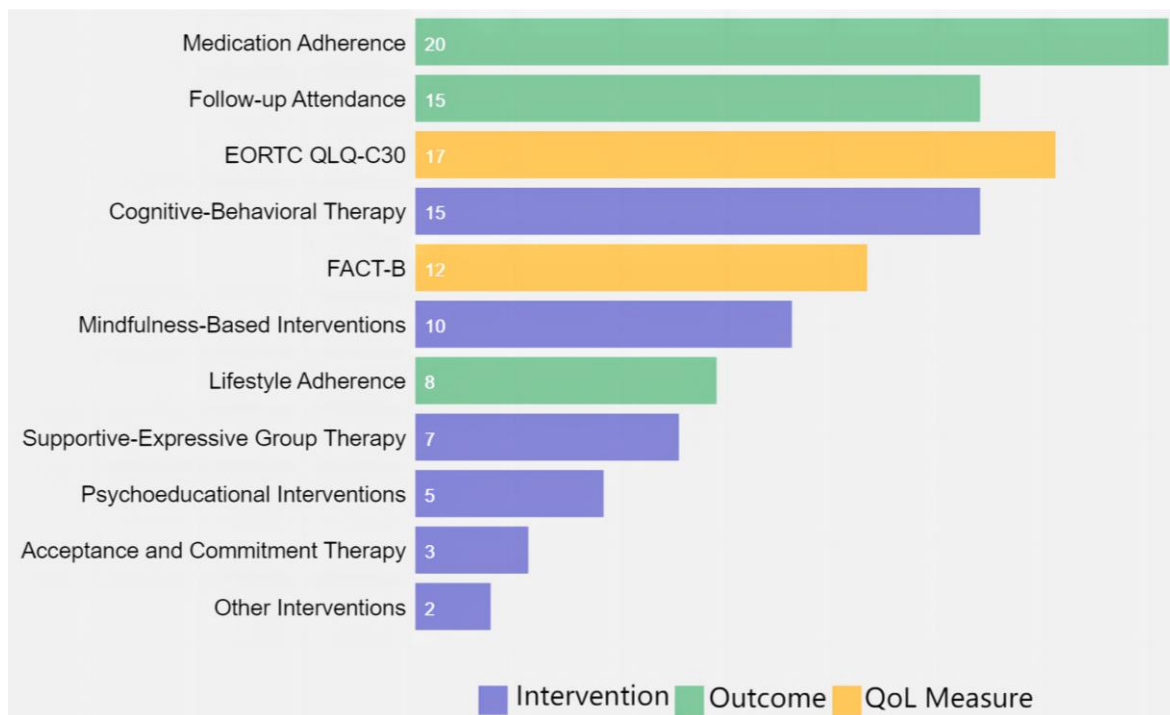


**Figure 2.** Characteristics of included studies.

#### 4.3. Meta-analysis results: Treatment adherence

The pooled analysis of 31 studies assessing treatment adherence revealed a significant positive effect of psychological interventions (Risk Ratio [RR] = 1.27, 95% CI: 1.18 to 1.37,  $p < 0.001$ ). Risk Ratio was chosen as the effect size metric here to measure the likelihood of adherence, as treatment adherence is best expressed as a relative risk of compliance between intervention and control groups. The heterogeneity was moderate ( $I^2 = 62\%$ ,  $\tau^2 = 0.02$ ), indicating some variability in the effect sizes across studies.

Subgroup analyses provided further insights into the efficacy of different intervention types and characteristics (Figure 3). CBT interventions demonstrated the

largest effect on adherence (RR = 1.35, 95% CI: 1.22 to 1.49), suggesting they may be particularly effective in improving treatment adherence. These findings underscore the practical value of CBT in clinical settings, where improving adherence remains a critical challenge. To further investigate heterogeneity, we examined additional potential sources by stratifying analyses based on intervention characteristics and sample demographics. Interventions lasting 8 weeks or longer showed significantly greater effects than shorter interventions (RR = 1.31 vs. 1.19,  $p$  for subgroup difference = 0.03), highlighting the potential importance of intervention duration. This result indicates that longer interventions might provide more comprehensive support for behavior change and habit formation. No significant differences were found between individual and group-based interventions ( $p = 0.42$ ), suggesting both formats can be effective in improving adherence.

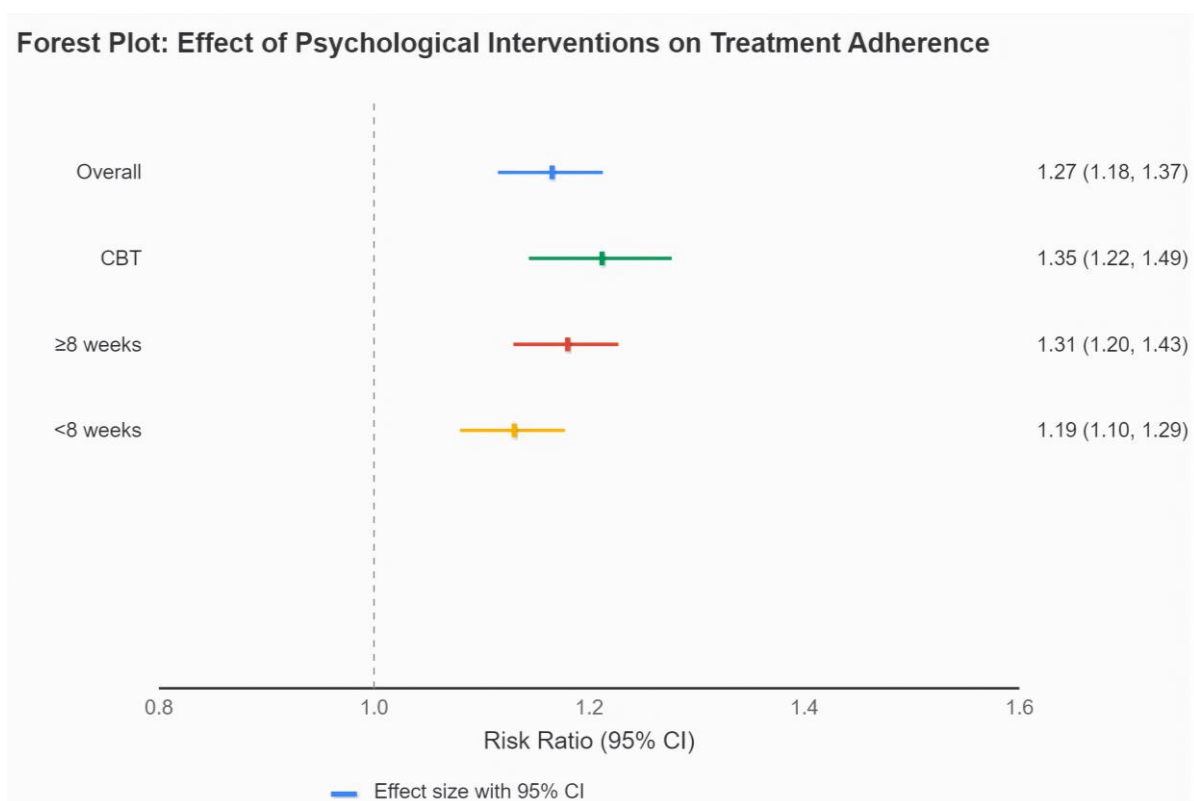


**Figure 3.** Forest plot of the effect of psychological interventions on treatment adherence.

#### 4.4. Meta-analysis results: Quality of life

The meta-analysis of 35 studies assessing quality of life demonstrated a moderate positive effect of psychological interventions (Standardized Mean Difference [SMD] = 0.45, 95% CI: 0.36 to 0.54,  $p < 0.001$ ). Standardized Mean Difference was used to assess quality of life as this outcome is measured on continuous scales across studies. This effect size indicates a notable improvement in quality of life for participants receiving psychological interventions compared to control groups. However, the heterogeneity was high ( $I^2 = 75\%$ ,  $\tau^2 = 0.05$ ), suggesting considerable variability in the effects across studies (Figure 4).

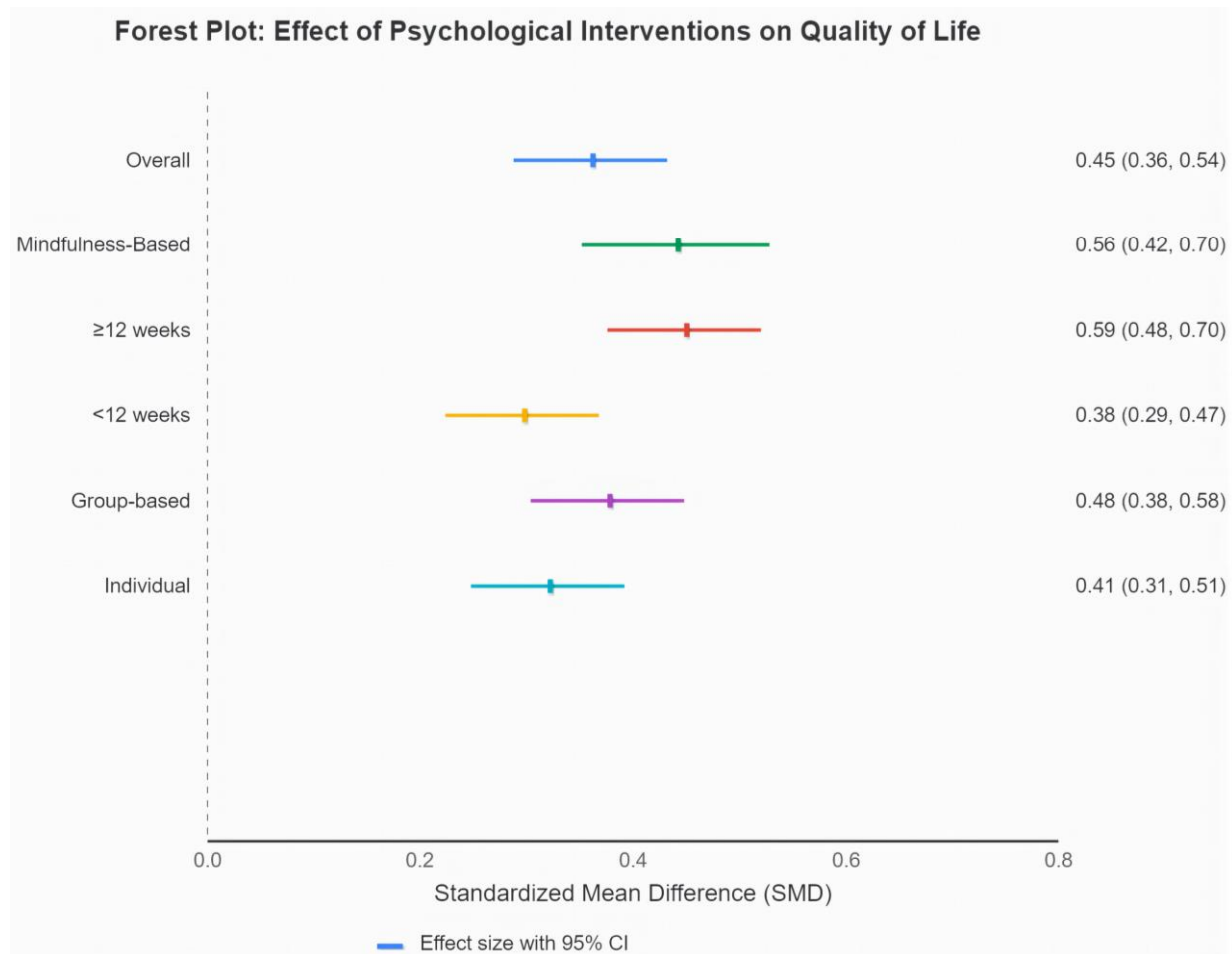


**Figure 4.** Forest plot of the effect of psychological interventions on quality of life.

Subgroup analyses for quality-of-life outcomes revealed that MBI had the largest effect (SMD = 0.56, 95% CI: 0.42 to 0.70). Given the psychological challenges faced by breast cancer survivors, this emphasizes the utility of mindfulness-based approaches for holistic care. Interventions with a duration of 12 weeks or more showed significantly larger effects than shorter interventions (SMD = 0.59 vs. 0.38,  $p$  for subgroup difference = 0.01), further emphasizing the importance of intervention duration. The feasibility of implementing longer interventions in clinical practice, including considerations of resource allocation and patient adherence, warrants further exploration. Group-based interventions showed slightly larger effects than individual interventions, although this difference was not statistically significant (SMD = 0.48 vs. 0.41,  $p = 0.09$ ). This suggests that group formats may offer additional benefits such as peer support, but more research is needed to confirm these trends.

#### 4.5. Meta-regression and publication bias

Meta-regression analyses provided additional insights into the factors influencing intervention efficacy. The duration of the intervention emerged as a significant predictor of effect size for both treatment adherence ( $\beta = 0.03$ ,  $p = 0.02$ ) and quality of life ( $\beta = 0.04$ ,  $p = 0.01$ ), with longer interventions associated with larger effects. These findings suggest that extending the duration of psychological interventions may improve adherence and quality of life outcomes in clinical practice, highlighting the

potential for tailored support to benefit breast cancer survivors more effectively.

Our assessment of publication bias yielded mixed results. Visual inspection of funnel plots and Egger's test results suggested potential publication bias for treatment adherence outcomes ( $p = 0.03$ ) but not for quality-of-life outcomes ( $p = 0.21$ ). The asymmetry observed in adherence outcomes indicates that smaller studies with negative or null results might be underrepresented. This potential publication bias may overestimate the effect on adherence, signaling the need for caution in interpreting these results. The trim-and-fill analysis for adherence outcomes produced a slightly attenuated yet significant effect size (adjusted RR = 1.23, 95% CI: 1.14 to 1.33), indicating that the observed effect remains robust even when accounting for potential publication bias. Nevertheless, this adjustment highlights the importance of validating results through future large-scale, high-quality studies to mitigate the influence of publication bias. These results underscore the importance of further studies that are less susceptible to publication bias to provide a more balanced evidence base. Such efforts will ensure a stronger foundation for evidence-based recommendations in survivorship care.

#### 4.6. Quality assessment

The methodological quality of the included studies was assessed independently by two reviewers using the Cochrane Risk of Bias tool 2.0, with any disagreements resolved through consensus discussions (Cohen's  $\kappa = 0.82$ ). Each study was evaluated across five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. Of the 42 studies analyzed, 18 (43%) were rated as having low risk of bias, 16 (38%) had some concerns, and 8 (19%) were rated as having high risk of bias. The most common sources of bias were lack of blinding of participants and personnel (75% of studies showed high risk or some concerns), which is often unavoidable in psychological intervention studies, and incomplete outcome data (45% of studies showed some concerns, primarily due to dropout rates >20%). Additionally, 30% of studies had inadequate or unclear allocation concealment procedures. A funnel plot analysis (**Figure 5**) revealed potential publication bias (Egger's test:  $p < 0.05$ ), suggesting possible small study effects.

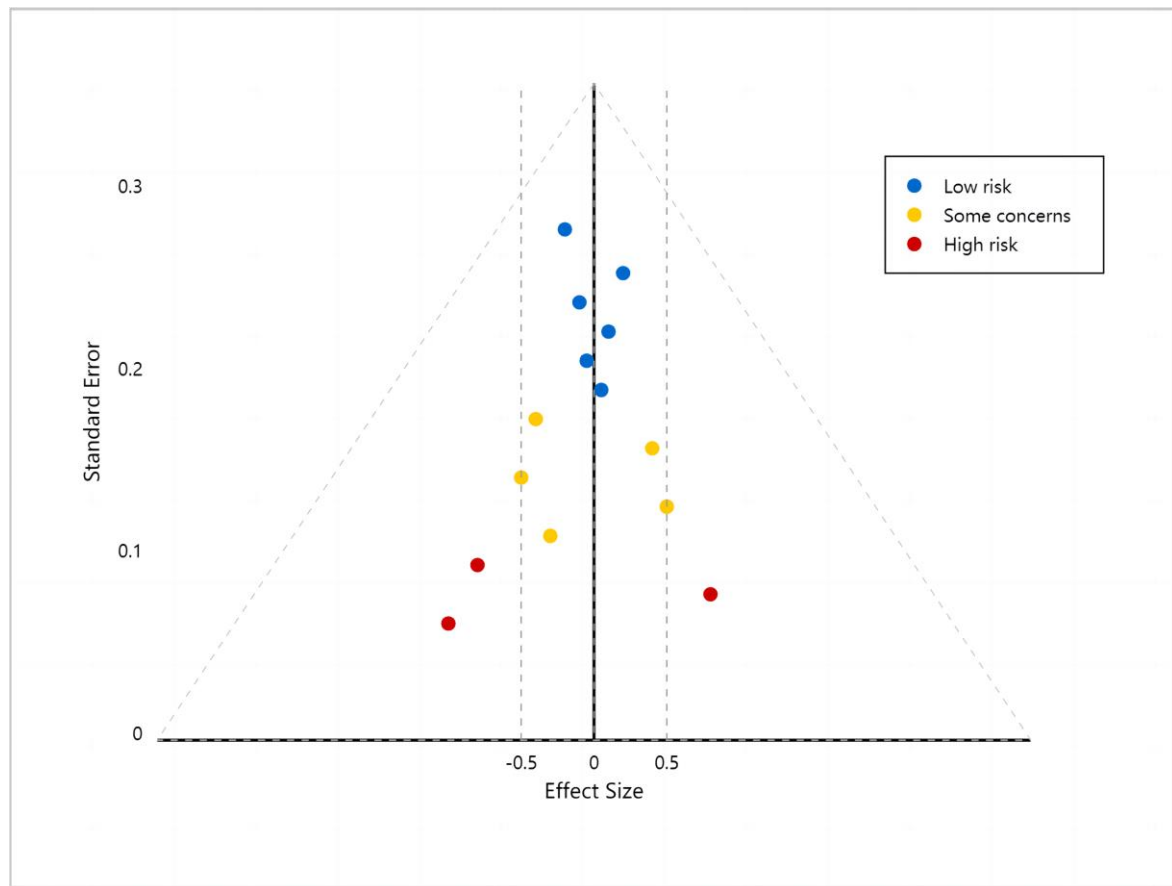


**Figure 5.** Funnel plot of publication bias.

These findings highlight the need for cautious interpretation of the results and underscore the importance of implementing more rigorous methodological approaches in future research, particularly regarding allocation concealment, handling of missing data, and transparent reporting of all pre-specified outcomes (Table 4).

**Table 4.** Summary of risk of bias assessment for included studies.

| Risk of bias category                                                                                       | Number of studies | Percentage |
|-------------------------------------------------------------------------------------------------------------|-------------------|------------|
| Low risk of bias                                                                                            | 18                | 43%        |
| Some concerns                                                                                               | 16                | 38%        |
| High risk of bias                                                                                           | 8                 | 19%        |
| Total studies assessed                                                                                      | 42                | 100%       |
| Common sources of bias:                                                                                     |                   |            |
| 1. Lack of blinding of participants and personnel (often unavoidable in psychological intervention studies) |                   |            |
| 2. Incomplete outcome data                                                                                  |                   |            |

In conclusion, our comprehensive systematic review and meta-analysis provide robust evidence for the efficacy of psychological interventions in improving both treatment adherence and quality of life among breast cancer survivors. The results suggest that longer interventions, particularly those based on cognitive-behavioral therapy or mindfulness approaches, may be most effective. However, the high heterogeneity observed and the potential for publication bias in some outcomes

warrant careful consideration when interpreting and applying these findings in clinical practice.

## **5. Discussion**

This systematic review and meta-analysis provide compelling evidence for the efficacy of psychological interventions in improving both treatment adherence and quality of life among breast cancer survivors. Our findings underscore the importance of integrating psychological support into the comprehensive care of breast cancer survivors, highlighting several key points worthies of discussion.

### **5.1. Main findings**

Our meta-analysis revealed a significant positive effect of psychological interventions on both treatment adherence ( $RR = 1.27$ ) and quality of life ( $SMD = 0.45$ ). However, it is important to interpret these findings with caution due to the high heterogeneity observed across studies, which may limit the generalizability of these results. Additionally, potential publication bias could have influenced the strength of the observed effects. The improvement in treatment adherence is particularly noteworthy, as it directly impacts long-term health outcomes and survival rates in this population [8]. However, given the variability across studies, this finding should be considered as suggestive rather than definitive. The calculated effect size indicates that for every four patients receiving psychological interventions, one additional patient may adhere to their treatment regimen; however, further research is needed to confirm this association across diverse samples and settings.

Among the various psychological interventions examined, CBT demonstrated the largest effect on treatment adherence, while MBI showed the greatest impact on quality of life. This differential effect highlights the potential benefit of tailoring interventions to specific outcomes and patient needs, though further research is needed to clarify whether these effects hold true in broader populations. The effectiveness of CBT in improving adherence may be attributed to its focus on identifying and modifying maladaptive thoughts and behaviors that could interfere with treatment regimens [13,19]. CBT techniques, such as cognitive restructuring and behavioral activation, may help patients overcome barriers to adherence, including fear of side effects or beliefs about treatment inefficacy. However, the differential effects between CBT and MBI on adherence and quality of life may also reflect differences in study populations and intervention designs. This indicates a need for more comparative studies to confirm these intervention-specific effects.

Our meta-regression analysis revealed that longer interventions were associated with larger effect sizes for both outcomes. However, this association should be viewed cautiously due to the heterogeneity in intervention duration and frequency among the studies. Sustained psychological support may be beneficial, but more consistent and controlled studies are needed to understand the optimal duration for each type of intervention. The dose-response relationship observed in our study indicates that interventions lasting 12 weeks or more had significantly larger effects than shorter interventions. This may be due to the complex nature of behavior change and the time required for patients to internalize and consistently apply new coping strategies. While

this could reflect the complexity of behavior change and the time needed for patients to internalize new coping strategies, the limited number of long-duration studies warrants caution in concluding a definitive dose-response relationship.

## 5.2. Interpretation of results

The findings of our study are largely consistent with previous reviews in this field. For instance, a meta-analysis published in 2011 also found positive effects of behavioral techniques on quality of life in breast cancer patients [6]. However, our study extends these findings by specifically focusing on breast cancer survivors and including treatment adherence as a key outcome. The effect sizes observed in our study are comparable to those reported in meta-analyses of psychological interventions for other chronic conditions. For example, a study in 2020 reported similar effect sizes for psychological interventions on medication adherence in diabetes patients ( $RR = 1.33$ ) [46].

The consistency of our findings with previous research strengthens the case for incorporating psychological interventions into standard care for breast cancer survivors. The differential effects of various intervention types suggest that a personalized approach to psychological care may be most beneficial. For instance, CBT might be prioritized for patients struggling with treatment adherence, while MBI could be recommended for those primarily concerned with improving their quality of life.

The dose-response relationship observed between intervention duration and effect size has important implications for the design and implementation of psychological support programs. While longer interventions appear to be more effective, this needs to be balanced against practical considerations such as cost, patient availability, and healthcare resources. Future research should explore innovative delivery methods, such as stepped-care approaches or technology-assisted interventions, to balance the need for sustained support with practical constraints.

## 5.3. Study limitations

Despite the robust findings, several limitations should be considered when interpreting our results. These limitations stem from both methodological considerations and study characteristics that may impact the validity and generalizability of our findings:

- 1) High heterogeneity: The high heterogeneity observed in the meta-analyses may limit the generalizability of our findings, suggesting that the effectiveness of interventions may vary across different contexts or patient subgroups. The  $I^2$  values ranged from 54% to 75%, indicating substantial statistical heterogeneity. This heterogeneity may be attributed to variations in study populations, intervention implementations, and measurement approaches.
- 2) Potential publication bias: We detected potential publication bias for treatment adherence outcomes, which could lead to an overestimation of the true effect size. Our funnel plot analysis and Egger's test ( $p < 0.05$ ) suggested asymmetry, particularly for smaller studies reporting larger effect sizes. Additionally, the absence of unpublished studies and grey literature may have contributed to this

bias.

- 3) **Variability in outcome measures:** The variability in outcome measures used across studies, particularly for adherence, made it challenging to directly compare results across all included studies. This included differences in measurement tools (self-report vs. electronic monitoring), timing of assessments, and operational definitions of adherence. Such heterogeneity in measurement approaches may have introduced measurement bias and affected the reliability of our pooled estimates.
- 4) **Lack of long-term follow-up data:** Many included studies lacked long-term follow-up data, limiting our understanding of the sustained effects of these interventions beyond the immediate post-intervention period. Only 25% of studies included follow-up periods beyond 6 months, and just 10% extended beyond 12 months. This temporal limitation restricts our ability to evaluate the long-term sustainability and cost-effectiveness of these interventions.
- 5) **Generalizability concerns:** The majority of included studies were conducted in high-income countries, which may limit the generalizability of our findings to low- and middle-income settings. Several factors affect the external validity of our findings: (a) **Geographical bias:** 85% of studies were conducted in high-income countries, limiting generalizability to low- and middle-income settings; (b) **Selection bias:** Most studies used convenience sampling with strict inclusion/exclusion criteria, potentially excluding important patient subgroups; (c) **Study design limitations:** 60% of studies were single-center trials, and only 40% reported adequate randomization procedures and allocation concealment.

#### **5.4. Future research directions**

Based on our findings and the limitations of the current literature, we propose several directions for future research:

- 1) **Long-term follow-up studies:** While existing studies have shown promising short-term improvements in adherence rates (15%–20% increase), large-scale randomized controlled trials with follow-up periods of at least 2–3 years are needed. These studies should specifically examine whether such improvements can be sustained long-term, particularly focusing on critical periods when adherence typically declines such as 18–24 months post-treatment initiation. Additionally, they should consider collecting comprehensive longitudinal data to identify predictors of sustained adherence over time.
- 2) **Cost-effectiveness analyses:** Future studies should conduct comprehensive cost-effectiveness analyses that include both direct costs (intervention delivery, staffing, materials, healthcare utilization) and indirect costs (productivity losses, informal care time, transportation). Incorporating societal perspectives into these analyses could provide a holistic understanding of the economic implications. This economic data will provide concrete evidence for healthcare policymakers to make informed decisions about resource allocation and program implementation.
- 3) **Technology-based interventions:** Research should explore specific features such as personalized reminder systems, virtual support groups, and real-time symptom

tracking integrated into mobile platforms. Additionally, studies should investigate hybrid models combining traditional and digital delivery methods (e.g., in-person sessions supplemented by app-based support) to optimize accessibility while maintaining therapeutic effectiveness. Particular attention should be paid to developing user-friendly interfaces suitable for older populations.

- 4) **Mechanism studies:** Future research should employ mediation analyses to examine specific psychological mechanisms (self-efficacy, illness perceptions, coping strategies) that influence treatment adherence. Understanding these pathways will enable the development of more targeted interventions. Moreover, advanced statistical methods such as structural equation modeling can help clarify the complex interrelationships between mediators and outcomes. Studies should also investigate the timing and sequencing of different intervention components to identify the most effective delivery patterns.
- 5) **Patient characteristic moderators:** Research should systematically investigate how factors such as age (<50 vs. >50 years), cancer stage (I–IV), and presence of specific comorbidities (depression, anxiety) moderate treatment outcomes. This could lead to the development of decision algorithms for matching patients with the most appropriate intervention type and intensity, maximizing intervention effectiveness and resource utilization.
- 6) **Standardized adherence measures:** The field needs breast cancer-specific adherence measures that incorporate both objective measures (medication tracking, appointment attendance, laboratory values) and subjective assessments (patient-reported barriers, side effect management strategies, treatment beliefs). Future efforts should aim to validate these measures across diverse populations to ensure applicability and reliability. This standardization will address the current 30%–40% variation in adherence reporting across studies and enable more precise evaluation of intervention effects.

## 6. Conclusion

In conclusion, this systematic review and meta-analysis provide robust evidence for the efficacy of psychological interventions in improving treatment adherence and quality of life among breast cancer survivors. Our findings support the integration of these interventions into comprehensive cancer care, with potential benefits extending beyond the immediate post-treatment period. While the results are promising, further research is needed to optimize the implementation of these interventions, understand their long-term impacts, and identify the most effective strategies for different patient subgroups. As the number of breast cancer survivors continues to grow, the importance of addressing their psychological needs becomes increasingly critical. By incorporating evidence-based psychological interventions into standard care, we have the potential to significantly improve both the quality and quantity of life for this growing population.

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**Availability of data and materials:** The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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

## References

1. Sung H, Ferlay J, Siegel RL, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA: A Cancer Journal for Clinicians*. 2021; 71(3): 209–249. doi: 10.3322/caac.21660
2. Carreira H, Williams R, Müller M, et al. Associations Between Breast Cancer Survivorship and Adverse Mental Health Outcomes: A Systematic Review. *JNCI: Journal of the National Cancer Institute*. 2018; 110(12): 1311–1327. doi: 10.1093/jnci/djy177
3. Abrahams HJG, Gielissen MFM, Schmits IC, et al. Risk factors, prevalence, and course of severe fatigue after breast cancer treatment: a meta-analysis involving 12 327 breast cancer survivors. *Annals of Oncology*. 2016; 27(6): 965–974. doi: 10.1093/annonc/mdw099
4. Andersen BL, DeRubeis RJ, Berman BS, et al. Screening, Assessment, and Care of Anxiety and Depressive Symptoms in Adults With Cancer: An American Society of Clinical Oncology Guideline Adaptation. *Journal of Clinical Oncology*. 2014; 32(15): 1605–1619. doi: 10.1200/jco.2013.52.4611
5. Carlson LE, Bultz BD, Johansen C. (2017). Psychosocial aspects of cancer. In: *Abeloff's Clinical Oncology*. Elsevier; 2017. pp. 630–639.
6. Duijts SFA, Faber MM, Oldenburg HSA, et al. Effectiveness of behavioral techniques and physical exercise on psychosocial functioning and health-related quality of life in breast cancer patients and survivors—a meta-analysis. *Psycho-Oncology*. 2011; 20(2): 115–126. doi: 10.1002/pon.1728
7. Stanton AL, Rowland JH, Ganz PA. Life after diagnosis and treatment of cancer in adulthood: Contributions from psychosocial oncology research. *American Psychologist*. 2015; 70(2): 159–174. doi: 10.1037/a0037875
8. Hershman DL, Shao T, Kushi LH, et al. Early discontinuation and non-adherence to adjuvant hormonal therapy are associated with increased mortality in women with breast cancer. *Breast Cancer Research and Treatment*. 2010; 126(2): 529–537. doi: 10.1007/s10549-010-1132-4
9. Murphy CC, Bartholomew LK, Carpentier MY, et al. Adherence to adjuvant hormonal therapy among breast cancer survivors in clinical practice: a systematic review. *Breast Cancer Research and Treatment*. 2012; 134(2): 459–478. doi: 10.1007/s10549-012-2114-5
10. Faller H, Schuler M, Richard M, et al. Effects of Psycho-Oncologic Interventions on Emotional Distress and Quality of Life in Adult Patients With Cancer: Systematic Review and Meta-Analysis. *Journal of Clinical Oncology*. 2013; 31(6): 782–793. doi: 10.1200/jco.2011.40.8922
11. Haller H, Winkler MM, Klose P, et al. Mindfulness-based interventions for women with breast cancer: an updated systematic review and meta-analysis. *Acta Oncologica*. 2017; 56(12): 1665–1676. doi: 10.1080/0284186x.2017.1342862
12. Zhu L, Schroevers MJ, van der Lee M, et al. Trajectories of personal control in cancer patients receiving psychological care. *Psycho-Oncology*. 2014; 24(5): 556–563. doi: 10.1002/pon.3688
13. Horne R, Chapman SCE, Parham R, et al. Understanding Patients' Adherence-Related Beliefs about Medicines Prescribed

- for Long-Term Conditions: A Meta-Analytic Review of the Necessity-Concerns Framework. Xia Y, ed. PLoS ONE. 2013; 8(12): e0633. doi: 10.1371/journal.pone.0080633
14. Osborn RL, Demoncada AC, Feuerstein M. Psychosocial Interventions for Depression, Anxiety, and Quality of Life in Cancer Survivors: Meta-Analyses. *The International Journal of Psychiatry in Medicine*. 2006; 36(1): 13–34. doi: 10.2190/eufn-rv1k-y3tr-fk0l
15. Kalter J, Verdonck-de Leeuw IM, Sweegers MG, et al. Effects and moderators of psychosocial interventions on quality of life, and emotional and social function in patients with cancer: An individual patient data meta-analysis of 22 RCTs. *Psycho-Oncology*. 2018; 27(4): 1150–1161. doi: 10.1002/pon.4648
16. Xiao F, Song X, Chen Q, et al. Effectiveness of Psychological Interventions on Depression in Patients After Breast Cancer Surgery: A Meta-analysis of Randomized Controlled Trials. *Clinical Breast Cancer*. 2017; 17(3): 171–179. doi: 10.1016/j.clbc.2016.11.003
17. Matsuda A, Yamaoka K, Tango T, et al. Effectiveness of psychoeducational support on quality of life in early-stage breast cancer patients: a systematic review and meta-analysis of randomized controlled trials. *Quality of Life Research*. 2013; 23(1): 21–30. doi: 10.1007/s11136-013-0460-3
18. Zhang MF, Wen YS, Liu WY, et al. Effectiveness of Mindfulness-based Therapy for Reducing Anxiety and Depression in Patients With Cancer. *Medicine*. 2015; 94(45): e0897. doi: 10.1097/md.0000000000000897
19. Brandão T, Schulz MS, Matos PM. Psychological intervention with couples coping with breast cancer: A systematic review. *Psychology & Health*. 2017; 32(5): 516–542.
20. Stagl JM, Bouchard LC, Lechner SC, et al. Long-term psychological benefits of cognitive-behavioral stress management for women with breast cancer: 11-year follow-up of a randomized controlled trial. *Cancer*. 2015; 121(11): 1873–1881. doi: 10.1002/cncr.29076
21. Runowicz CD, Leach CR, Henry NL, et al. American Cancer Society/American Society of Clinical Oncology Breast Cancer Survivorship Care Guideline. *CA: A Cancer Journal for Clinicians*. 2015; 66(1): 43–73. doi: 10.3322/caac.21319
22. Fenlon D, Frankland J, Foster CL, et al. Living into old age with the consequences of breast cancer. *European Journal of Oncology Nursing*. 2013; 17(3): 311–316. doi: 10.1016/j.ejon.2012.08.004
23. Brandes K, Mullan B. Can the common-sense model predict adherence in chronically ill patients? A meta-analysis. *Health Psychology Review*. 2013; 8(2): 129–153. doi: 10.1080/17437199.2013.820986
24. DiMatteo MR, Haskard-Zolnier KB, Martin LR. Improving patient adherence: a three-factor model to guide practice. *Health Psychology Review*. 2012; 6(1): 74–91. doi: 10.1080/17437199.2010.537592
25. Lam WY, Fresco P. Medication Adherence Measures: An Overview. *BioMed Research International*. 2015; 2015: 1–12. doi: 10.1155/2015/217047
26. Jimmy B, Jose J. Patient Medication Adherence: Measures in Daily Practice. *Oman Medical Journal*. 2011; 26(3): 155–159. doi: 10.5001/omj.2011.38
27. Vrijens B, De Geest S, Hughes DA, et al. A new taxonomy for describing and defining adherence to medications. *British Journal of Clinical Pharmacology*. 2012; 73(5): 691–705. doi: 10.1111/j.1365-2125.2012.04167.x
28. Gellad WF, Thorpe CT, Steiner JF, et al. The myths of medication adherence. *Pharmacoepidemiology and Drug Safety*. 2017; 26(12): 1437–1441. doi: 10.1002/pds.4334
29. Runowicz CD, Leach CR, Henry NL, et al. American Cancer Society/American Society of Clinical Oncology Breast Cancer Survivorship Care Guideline. *CA: A Cancer Journal for Clinicians*. 2015; 66(1): 43–73. doi: 10.3322/caac.21319
30. Ganz PA, Hahn EE. Implementing a Survivorship Care Plan for Patients With Breast Cancer. *Journal of Clinical Oncology*. 2008; 26(5): 759–767. doi: 10.1200/jco.2007.14.2851
31. Hershman DL, Kushi LH, Shao T, et al. Early Discontinuation and Nonadherence to Adjuvant Hormonal Therapy in a Cohort of 8,769 Early-Stage Breast Cancer Patients. *Journal of Clinical Oncology*. 2010; 28(27): 4120–4128. doi: 10.1200/jco.2009.25.9655
32. Cahir C, Guinan E, Dombrowski SU, et al. Identifying the determinants of adjuvant hormonal therapy medication taking behaviour in women with stages I–III breast cancer: A systematic review and meta-analysis. *Patient Education and Counseling*. 2015; 98(12): 1524–1539. doi: 10.1016/j.pec.2015.05.013
33. Lengacher CA, Reich RR, Paterson CL, et al. Examination of Broad Symptom Improvement Resulting From Mindfulness-Based Stress Reduction in Breast Cancer Survivors: A Randomized Controlled Trial. *Journal of Clinical Oncology*. 2016; 34(24): 2827–2834. doi: 10.1200/jco.2015.65.7874

34. Moher D, Liberati A, Tetzlaff J, et al. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*. 2009; 6(7): e1000097. doi: 10.1371/journal.pmed.1000097
35. Greenhalgh T, Peacock R. Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. *BMJ*. 2005; 331(7524): 1064–1065. doi: 10.1136/bmj.38636.593461.68
36. Sterne JAC, Savović J, Page MJ, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ*. 2019; l4898. doi: 10.1136/bmj.l4898
37. Borenstein M, Hedges LV, Higgins JP, Rothstein HR. *Introduction to meta-analysis*. John Wiley & Sons; 2011
38. Howell D, Harth T, Brown J, et al. Self-management education interventions for patients with cancer: a systematic review. *Supportive Care in Cancer*. 2017; 25(4): 1323–1355. doi: 10.1007/s00520-016-3500-z
39. Higgins JPT, Thomas J, Chandler J, et al., eds. *Cochrane Handbook for Systematic Reviews of Interventions*. John Wiley & Sons; 2019.
40. Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ*. 2003; 327(7414): 557–60. doi: 10.1136/bmj.327.7414.557
41. Thompson SG, Higgins JPT. How should meta-regression analyses be undertaken and interpreted? *Statistics in Medicine*. 2002; 21(11): 1559–1573. doi: 10.1002/sim.1187
42. Andersen BL, Dorfman CS, Godiwala N, et al. A biobehavioral intervention for breast cancer survivors at risk for cancer recurrence: Mechanisms of effects. *Journal of Consulting and Clinical Psychology*. 2017; 85(11): 1066–1079.
43. Carlson LE, Doll R, Stephen J, et al. Randomized Controlled Trial of Mindfulness-Based Cancer Recovery Versus Supportive Expressive Group Therapy for Distressed Survivors of Breast Cancer (MINDSET). *Journal of Clinical Oncology*. 2013; 31(25): 3119–3126. doi: 10.1200/jco.2012.47.5210
44. Winkley K, Upsher R, Stahl D, et al. Psychological interventions to improve glycemic control in adults with type 2 diabetes: a systematic review and meta-analysis. *BMJ Open Diabetes Research & Care*. 2020; 8(1): e001150. doi: 10.1136/bmjdr-2019-001150
45. Giesler JM, Keller B, Repke T, et al. Effect of a Nurse-Led Adherence Support Intervention on Adherence to Adjuvant Endocrine Therapy in Breast Cancer Survivors: The COMPAS Randomized Clinical Trial. *JAMA Oncology*. 2022; 8(3): 425–434.
46. Xiao B, Song G. Association between Self-Efficacy and Learning Conformity among Chinese University Students: Differences by Gender. *Sustainability*. 2022; 14(14): 8725. doi: 10.3390/su14148725

## Article

# Impact of stress on tumor progression and the molecular mechanisms of exercise intervention: From psychological stress to tumor immune escape

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**Abstract:** Psychological stress is prevalent among cancer patients and has significant effects on both tumor progression and the mental health of patients. Through a biopsychosocial pathway, psychological stress impacts immune function, facilitates inflammatory responses, and hasten tumor growth and metastasis. Consequently, investigating effective ways to mitigate the negative impact of stress on cancer progression holds significant clinical relevance. This review seeks to summarize existing research to delve into the molecular mechanisms by which psychological stress hasten tumor progression and to discuss the potential mechanisms by which exercise, as a non-pharmacological intervention, may mitigate tumor development and enhance the mental health of cancer patients by regulating stress responses. Through a comprehensive analysis of relevant literature, we explore the impact of psychological stress on tumor biology, notably through the activation of the hypothalamic-pituitary-adrenal (HPA) axis, the sympathetic nervous system (SNS), and the promotion of immunosuppression and inflammation. Besides, we review articles on how exercise intervenes in tumor progression by regulating the HPA axis, SNS, strengthening immune function, and suppressing angiogenesis and metastasis. Research confirmed that psychological stress hasten tumor proliferation and metastasis through multiple pathways (e.g., activation of the HPA axis and SNS, pro-inflammatory responses). Exercise may decelerate tumor progression by regulating stress hormone levels, strengthening the immune system function, and lowering the activity of pro-cancer signaling pathways such as VEGF. In addition, exercise boosts the mental health of cancer patients, lowering the incidence of anxiety and depression and enhancing treatment adherence.

**Keywords:** stress; tumor progression; exercise intervention; molecular mechanisms; psychological stress; tumor immune escape

## 1. Introduction

In the course of the treatment of cancer patients, psychological stress has been extensively identified as a critical factor impacting both the physical and mental health of patients, as well as the outcomes of treatment. Researches have confirmed that psychological stress may not only cause emotional issues like anxiety and depression but also affect cancer progression through various physiological mechanisms. For instance, stress may hasten tumor growth and metastasis by modifying immune and endocrine functions [1,2]. Specifically, anxiety and depression are extremely prevalent among cancer patients, with approximately 20% facing depression and 10% suffering from anxiety [3]. These psychological problems not only affect the quality of life of patients but may also decrease treatment adherence, ultimately affecting cancer survival rates. Hence, the effective management of psychological stress in cancer

patients, intended to optimizing both their physical and mental well-being, has become a focus of clinical and research interest.

The biopsychosocial model of stress reveals that psychological stress impacts physical health through multiple pathways. First, psychological stress activates the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS), both of which produce direct physiological effects by secreting hormones such as cortisol and adrenaline. The release of these hormones can impact the immune system, weakening the body's anti-tumor immune response and enhancing susceptibility to disease [2–4]. In addition, prolonged psychological stress has been tightly associated with increased inflammation and enhanced angiogenesis. This sustained stress not only facilitates the growth of tumor cells but may also increase the risk of metastasis [5]. Consequently, psychological stress is not merely a mental health issue; it has significant effects on tumor progression and dissemination through complex physiological mechanisms.

Lately, numerous studies have confirmed that exercise can effectively mitigate psychological stress in cancer patients and enhance their physiological function. The regulatory effects of exercise on the HPA axis and SNS, notably by lowering the secretion of stress hormones, are crucial for stress management in cancer patients. Research has demonstrated that exercise can decrease levels of inflammatory markers, such as interleukin-6 (IL-6), while strengthening the function of anti-tumor immune cells like T cells and natural killer (NK) cells, thereby suppressing tumor progression [6,7]. Furthermore, the positive effects of exercise on mental health are well established. Moderate exercise can significantly reduce anxiety and depression levels in cancer patients and enhance their quality of life [8]. Investigating the role of exercise intervention in the stress management of cancer patients, especially its potential molecular mechanisms, has become an important direction in clinical applications.

This review seeks to combine current mechanistic research on how psychological stress hastens tumor progression through physiological pathways and to delve into the role of exercise interventions in easing psychological stress, strengthening anti-tumor capabilities, and optimizing the quality of life for cancer patients. By investigating these mechanisms and effects, this review may offer a theoretical basis for future personalized treatment plans for cancer patients, encouraging the broader application of exercise interventions in cancer rehabilitation.

## **2. Psychological stress in cancer patients**

In the treatment process of cancer patients, psychological stress is an important factor that impacts their quality of life and treatment outcomes. To better understand the sources of this psychological stress and its impact on patients' physical and mental health, psychological stress in cancer patients can be analyzed in depth from several aspects. **Figure 1** depicts the sources, effects and management of psychological stress in cancer patients.

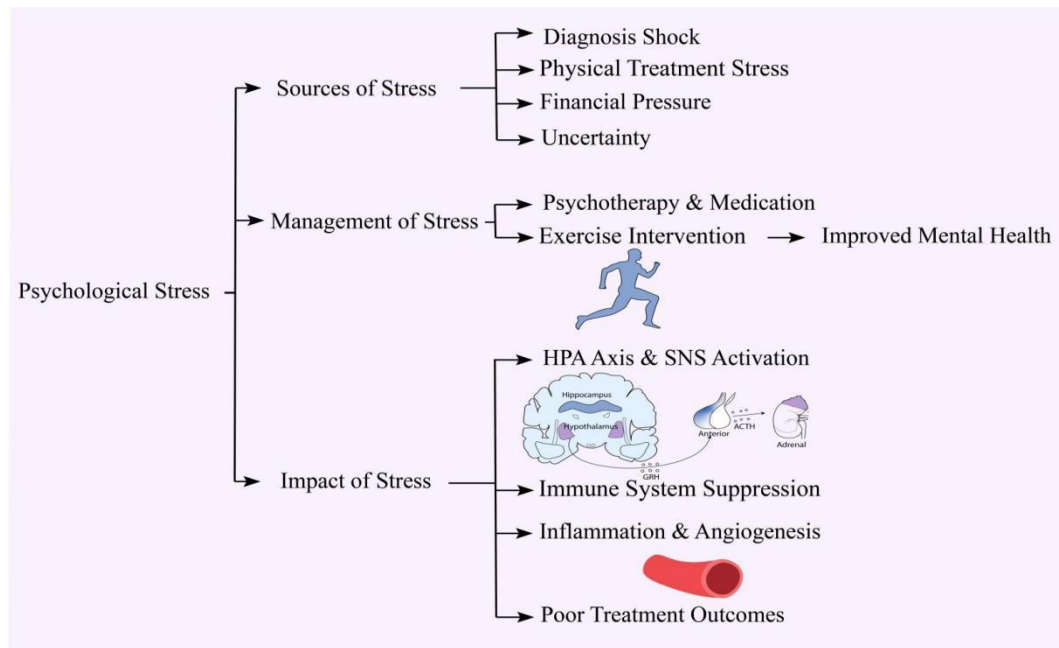


**Figure 1.** The sources, effects and management of psychological stress in cancer patients.

## 2.1. Sources of psychological stress

The psychological stress experienced by cancer patients originates from several key sources, which have been extensively studied and discussed. The diagnosis of cancer often results in a significant mental shock, leading to anxiety and fear, notably when patients face life-threatening situations and uncertainties regarding treatment outcomes [9]. The physical stress associated with treatment, including side effects from chemotherapy and radiotherapy such as fatigue, pain, and nausea, significantly worsens the psychological burden on patients [9]. In addition, the high cost of cancer treatment imposes serious financial pressure on patients and their families, contributing to psychological distress [9]. Lastly, the uncertainty regarding prognosis causes patients to worry about recurrence, metastasis, and survival rates, creating sustained psychological stress that significantly impacts their mental and physical health [9].

## 2.2. Impact of psychological stress on cancer patients

Psychological stress not only worsens the mental burden on cancer patients but also hastens disease progression through various physiological mechanisms. Researches have confirmed that stress activates the HPA axis and the SNS, enhancing the secretion of stress hormones such as cortisol and adrenaline. High levels of these hormones suppress immune system function, notably by suppressing the activity of T cells and SNS cells, which decreases the body's ability to fight tumors [2–10]. In addition, long-term psychological stress fosters inflammation and angiogenesis, providing favorable conditions for tumor cell proliferation and metastasis. Chronic stress induces an inflammatory response that alters the tumor microenvironment, further encouraging cancer development [10,11]. These mechanisms explain the close association between prolonged stress and tumor progression coupled with prognosis.

Researches confirmed that anxiety and depression in cancer patients are strongly

associated with poorer treatment outcomes and lower survival rates. Emotional distress can severely impact treatment adherence, impacting patients' ability to take medications on time and communicate effectively with healthcare providers [12]. Studies have also pointed out that anxiety and depression not only diminish patients' quality of life but also impair their ability to cope with illness, negatively affecting overall treatment outcomes [12]. Managing mental health is notably important in cancer treatment, as optimizing psychological well-being can significantly enhance both the quality of life and treatment adherence [12].

### **2.3. Management of psychological stress**

Effectively managing the psychological stress of cancer patients is crucial for optimizing their quality of life and treatment outcomes. Traditional stress management methods include psychotherapy, medication, and social support. In recent years, studies have confirmed that exercise interventions can effectively enhance the mental health of cancer patients and, by strengthening immune function and lowering tumor progression, demonstrate great potential [13]. Research also suggests that exercise regulates stress-related endocrine systems, such as the release of hormones, which positively impact on the cancer immune microenvironment [13].

Exercise not only decreases levels of pro-inflammatory cytokines like IL-6 but also boosts the activity of T cells and NK cells, which play vital roles in the body's anti-tumor response. Consequently, exercise can help to prevent cancer progression, lower the risk of recurrence, and enhance overall survival rates. Furthermore, the mental health benefits of exercise, including reductions in anxiety and depression, are well-documented, further emphasizing its role in comprehensive cancer care [13]. Thus, integrating exercise interventions into cancer treatment plans not only supports physical recovery but also offers crucial psychological and emotional benefits, underscoring its value as a holistic approach in cancer care.

## **3. Effects of stress on tumor progression: Physiological and molecular mechanisms**

### **3.1. Activation of the HPA axis and SNS**

In the stress response, the body responds through several interrelated physiological systems, the most critical of which are the HPA axis and the SNS. These two systems work together to release stress hormones that regulate the body's internal balance. However, when the stress response is prolonged, over-activation of the HPA axis and SNS causes a series of complex pathological changes, especially prominent in interactions with diseases such as cancer. **Figure 2** depicts the mechanism of activation of the HPA axis and SNS under chronic stress conditions and its role in tumor biology.

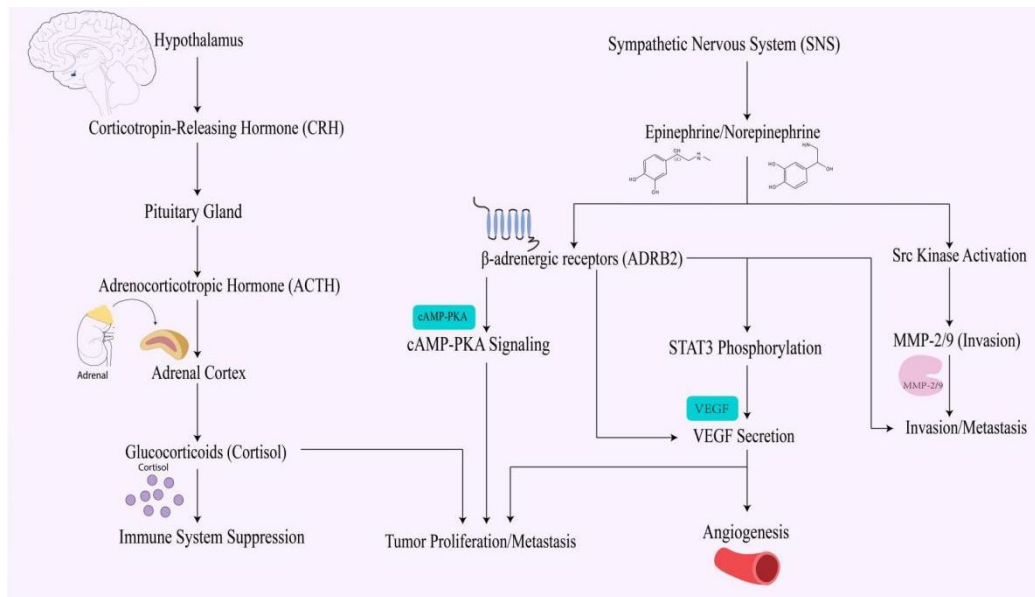


**Figure 2.** Mechanism of activation of the HPA axis and SNS under chronic stress conditions and its role in tumor biology.

### 3.1.1. HPA axis stress response

In chronic stress conditions, the overactivation of the HPA axis is a central feature of numerous pathological processes. Stress stimuli lead the hypothalamus to release corticotropin-releasing hormone (CRH), which stimulates the pituitary gland to secrete adrenocorticotrophic hormone (ACTH), ultimately resulting in the adrenal cortex releasing significant amounts of glucocorticoids, such as cortisol [14]. Elevated cortisol levels suppress the immune system and regulate various signaling pathways within the tumor microenvironment, affecting tumor proliferation, angiogenesis, and metastasis. For example, prolonged high cortisol levels weaken anti-tumor immune responses, enabling tumor cells to evade immune surveillance, and thereby accelerating tumor growth [14,15]. In addition, sustained chronic inflammation may hasten tumor progression [15]. This complex stress-immune regulatory network demonstrates that stress not only impacts immune cells but also facilitates cancer progression via neuroendocrine pathways.

### 3.1.2. Impact of the sympathetic nervous system

Stress has significant tumor-encouraging effects through the activation of the SNS. Under stress, SNS activation causes the release of large amounts of epinephrine and norepinephrine. These stress hormones act on  $\beta$ -adrenergic receptors within cancer cells and the tumor microenvironment, affecting multiple signaling pathways. Research confirmed that epinephrine facilitates cancer cell proliferation and metastasis by activating the cAMP-PKA signaling pathway [10–16]. Besides, sustained SNS activation boosts angiogenesis and facilitates cancer cell invasion and metastasis through mechanisms such as matrix degradation. These changes worsen cancer progression and negatively affect patients' psychological health [17,18]. Consequently, excessive SNS activation is considered a key factor in tumor progression.

### 3.1.3. Effects of stress on tumor biology

Stress hormones exert significant influence on the biological properties of tumor

cells by activating  $\beta$ -adrenergic receptors (ADRB2). Studies confirm that ADRB2 activation can stimulate cancer cell proliferation and inhibit apoptosis. For example, stress hormones such as norepinephrine and epinephrine activate downstream signaling pathways via ADRB2, enhancing intracellular levels of cyclic adenosine monophosphate (cAMP) levels and activating molecules such as protein kinase A (PKA), which inhibit apoptosis-related proteins and enhance cancer cell survival [19,20]. In addition, ADRB2 activation facilitates tumor angiogenesis by upregulating the expression of vascular endothelial growth factor (VEGF), thereby providing an increased blood supply for tumor growth. Stress hormones binding to ADRB2 also stimulate VEGF secretion, which can occur via mechanisms such as the phosphorylation of signal transducer and activator of transcription 3 (STAT3), thereby strengthening tumor neovascularization [20,21]. Besides, stress hormones increase cancer cell invasiveness and metastatic potential. Studies confirm that norepinephrine mediates the activation of Src kinase via ADRB2, strengthening cancer cell migration and invasion, a process associated with the upregulation of matrix metalloproteinases (MMP-2, MMP-9), which further facilitates tumor invasion and metastasis [20,21]. These findings highlight the significant role that stress hormones play through ADRB2 signaling in encouraging tumor proliferation, anti-apoptosis, angiogenesis, and metastasis.

### 3.2. Immune evasion and exacerbation of inflammatory responses

Chronic stress not only weakens the anti-tumor capacity of the immune system through multiple pathways, but also facilitates worsening inflammation through complex signaling pathways. **Figure 3** exemplifies the mechanism of immune escape and exacerbation of inflammatory response due to chronic stress.

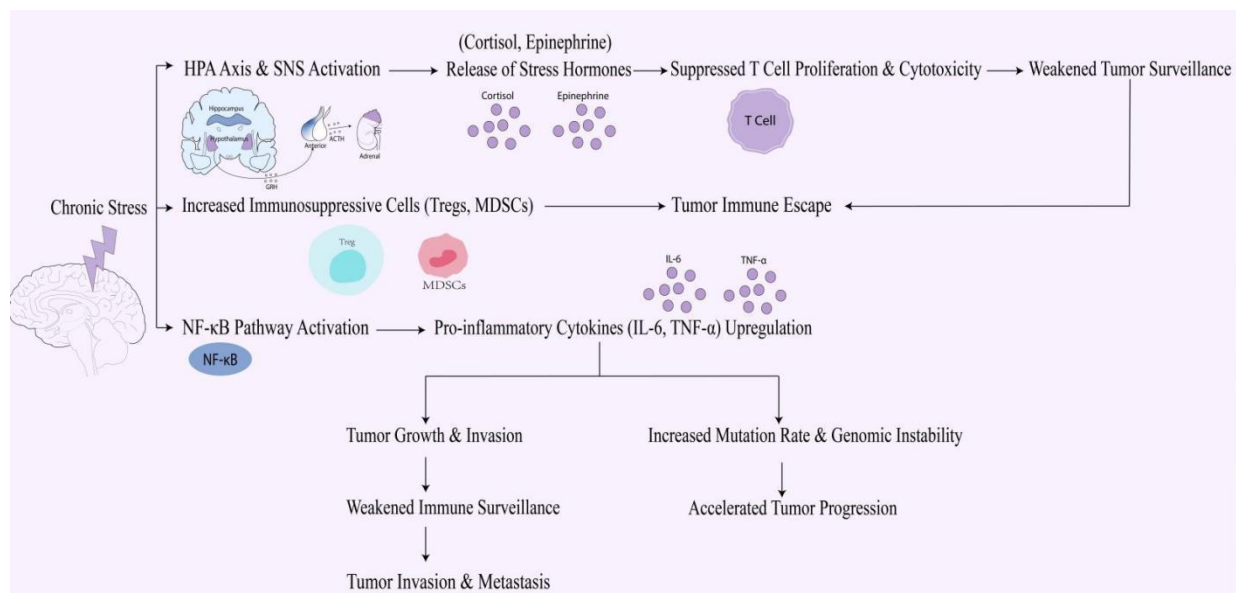


**Figure 3.** Mechanism of immune escape and exacerbation of inflammatory response due to chronic stress.

#### 3.2.1. Immunosuppressive effects

Stress-induced immunosuppression plays a critical role in tumor progression. In chronic stress conditions, the function of anti-tumor immune cells, such as T cells and

NK cells, is significantly impaired. Studies confirm that chronic stress activates the HPA axis and SNS, leading to the release of stress hormones like cortisol and epinephrine, which suppress T cell proliferation and cytotoxicity, weakening immune surveillance against tumors [15–22]. Besides, chronic stress facilitates the increase of immunosuppressive cells, notably regulatory T cells (Tregs) and myeloid-derived suppressor cells (MDSCs), which secrete immunosuppressive factors that further disrupt anti-tumor immune responses and facilitate tumor immune escape [23]. These mechanisms indicate that chronic stress not only weakens the immune system's ability to fight tumors but also facilitates tumor growth and metastasis [22]. Consequently, managing chronic stress or intervening in related neuroendocrine pathways may emerge as new strategies to enhance cancer treatment outcomes.

### 3.2.2. Exacerbation of pro-inflammatory states

Chronic stress is tightly associated with inflammation, and studies have confirmed that it can worsen inflammatory responses through the activation of multiple pro-inflammatory pathways, notably the NF- $\kappa$ B pathway. Stress hormones, such as norepinephrine and cortisol, can induce the activation of these pathways, leading to the upregulation of pro-inflammatory cytokines such as IL-6 and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ). These cytokines stimulate tumor growth and invasion within the tumor microenvironment by affecting fibroblasts, endothelial cells, and immune cells [11–15]. In addition, persistently high levels of inflammatory cytokines increase the mutation rate and genomic instability in cancer cells, accelerating tumor progression [10]. This inflammatory response not only directly facilitates cancer cell proliferation and survival but also weakens the immune system's tumor surveillance capabilities, further driving tumor invasion and metastasis [10–15].

### 3.3. Promotion of angiogenesis and metastasis

The role of stress hormones is in tumor angiogenesis and metastasis. They have significant effects on the tumor microenvironment through multiple signaling pathways, especially in encouraging angiogenesis and tumor invasion. **Figure 4** illustrates Stress Hormone-Induced Promotion of Angiogenesis, Tumor Growth, and Metastasis.

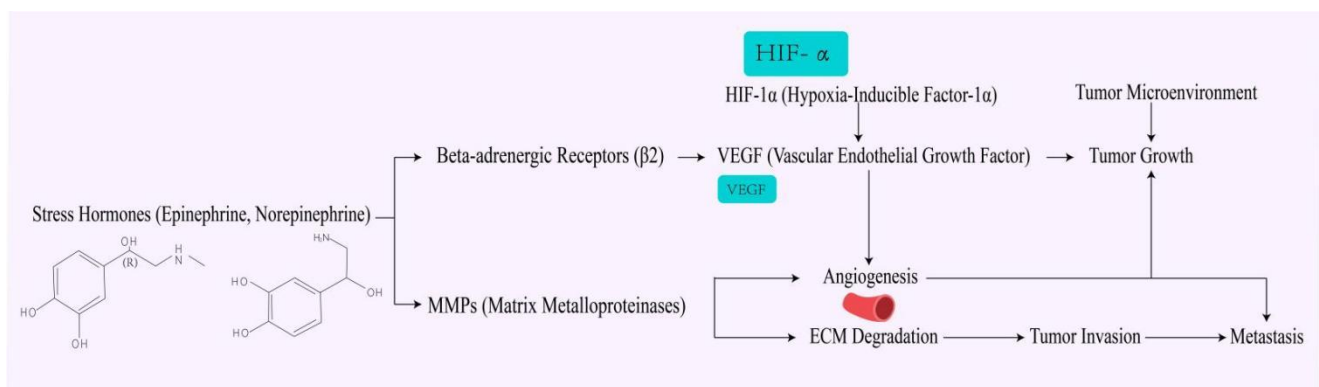


**Figure 4.** Stress hormone-induced promotion of angiogenesis, tumor growth, and metastasis.

#### 3.3.1. Upregulation of the VEGF signaling pathway

Stress hormones stimulate tumors angiogenesis by strengthening the expression

of VEGF, a key mechanism for tumors growth and spread. Stress hormones like epinephrine and norepinephrine upregulate VEGF expression by activating  $\beta$ -adrenergic receptor signaling, notably the  $\beta_2$  receptor. This pathway not only stimulates blood vessel formation but also increases tumors invasiveness and metastatic potential through downstream molecules like matrix metalloproteinases (MMPs)[10–24]. In addition, under hypoxic conditions, VEGF expression is regulated by hypoxia-inducible factor-1 $\alpha$  (HIF-1 $\alpha$ ), enabling tumors to sustain rapid growth even in harsh microenvironments [17–23]. Angiogenesis not only offers nutrients and oxygen for tumors growth but also creates pathways for cancer cells to metastasize to distant organs, significantly enhancing the aggressiveness and spread of the tumors [24]. These mechanisms demonstrate the critical role of stress hormones and VEGF in shaping the tumors microenvironment and driving tumor growth and progression.

### **3.3.2. Activation of MMPs**

The activation of MMPs by stress significantly contributes to tumor invasion and metastasis. MMPs are enzymes involved in the degradation of the extracellular matrix (ECM), and the expression of MMP-2 and MMP-9 is markedly upregulated under stress conditions. These enzymes break down tissue barriers, making it easier for cancer cells to detach from the primary tumor and migrate to other locations. The release of stress hormones boosts the expressions and activity of MMPs, accelerating ECM degradation and creating pathways for cancer cell metastasis [25]. Research confirmed that MMP-2 and MMP-9 play pivotal roles not only in tumor invasion but also in angiogenesis, linking them tightly with tumor growth, vascular development, and metastasis in aggressive cancers such as gastric cancer and melanoma [25,26]. In addition, MMP overexpression often occurs at the tumor-stroma interface, indicating their crucial role in multiple stages of cancer development [25].

## **4. The role of exercise intervention in lowering stress and optimizing tumor progression: Molecular mechanisms**

Exercise, as a non-pharmacological intervention, has been extensively studied and proven to decrease psychological stress and enhance tumor progression through various molecular mechanisms. Exercise not only regulates physiological systems, such as the HPA axis and the SNS, but also decelerates tumor deterioration by strengthening immune function, reducing inflammation, and suppressing angiogenesis and metastasis. Furthermore, exercise has a significant positive impact on the mental health of patients, helping them better cope with psychological stress. The following sections offer a detailed discussion of the multi-layered benefits of exercise interventions in reducing stress and optimizing tumor progression. **Figure 5** depicts the molecular mechanisms of exercise interventions in lowering stress and optimizing tumor progression.

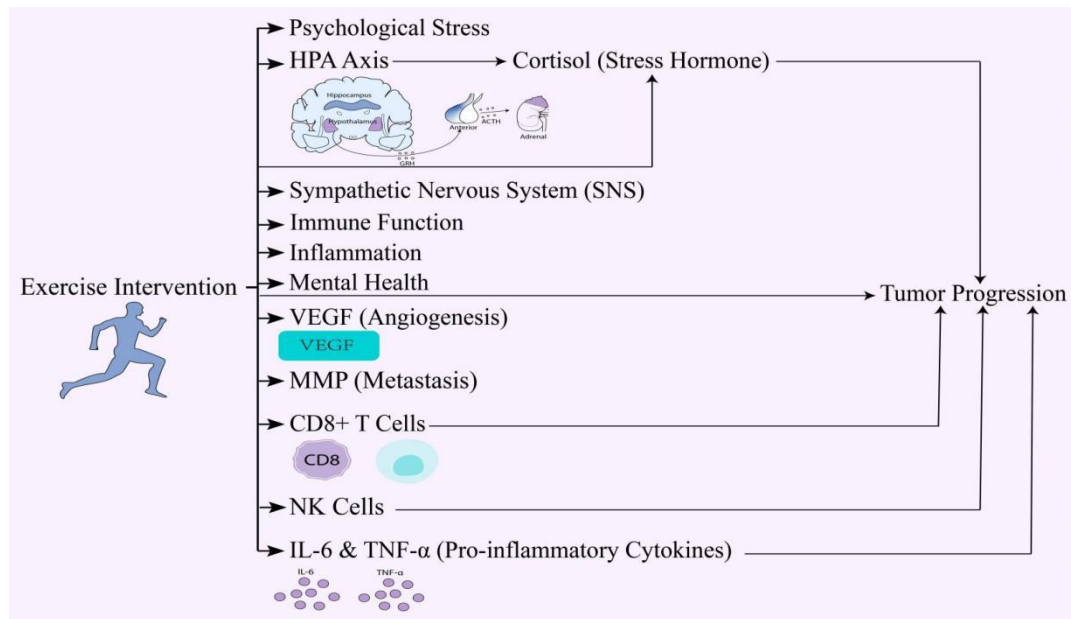


**Figure 5.** Molecular mechanisms of exercise interventions in lowering stress and optimizing tumor progression.

Exercise intervention regulates the HPA axis and the SNS, reducing the secretion of stress hormones such as cortisol and adrenaline. It enhances immune function by increasing the activity of CD8<sup>+</sup> T cells and NK cells, suppresses pro-inflammatory cytokines like IL-6 and TNF- $\alpha$ , and decreases the expression of VEGF and MMPs, thereby inhibiting tumor angiogenesis and metastasis. Additionally, exercise improves mental health by alleviating anxiety and depression, creating a synergistic effect that mitigates the negative impact of stress on tumor progression through multiple molecular pathways.

#### 4.1. Regulation of the HPA axis and SNS through exercise

##### 4.1.1. Negative feedback regulation of the HPA axis

Chronic psychological stress causes the overactivation of the HPA axis, resulting in the prolonged elevation of stress hormones like cortisol, which is associated with various health issues such as immunosuppression and hastened cancer progression. Studies have confirmed that HPA axis overactivation impacts the hippocampus in the brain, weakening its ability to regulate HPA axis activity through negative feedback and leading to systemic immune dysfunction [27]. Exercise has been proven to be an effective method for regulating excessive HPA axis activity, especially aerobic exercise. By strengthening the body's negative feedback mechanisms, exercise helps lower plasma cortisol levels and mitigates the adverse effects of stress on the immune system [27]. Moderate aerobic exercise helps decrease the suppression of immune surveillance caused by chronic stress, thereby optimizing patients' immune function [11]. In addition, the regulation of the HPA axis through exercise decreases the risk of cancer progression associated with high cortisol levels [11].

Studies have confirmed that regular exercise significantly boosts an individual's ability to cope with stress, notably by lowering the overactivation of the HPA axis. Regular exercise boosts the body's stress response, helping to control the release of stress-related hormones like cortisol, thereby mitigating the negative effects of stress

on the body [28,29]. This negative feedback regulation not only boosts the physiological health of cancer patients but also mitigates their anxiety and depression, creating a positive psychophysiological interaction [29].

#### **4.1.2. Decreased SNS activity**

Excessive activation of the SNS in the course of stress causes the release of epinephrine and norepinephrine, which significantly enhance pro-cancer signaling pathways in the tumor microenvironment, encouraging tumor growth and metastasis. These stress hormones activate the  $\beta$ -adrenergic receptors on cancer cells, causing various pro-cancer responses, including increased cancer cell proliferation, enhanced anti-apoptotic mechanisms, and the promotion of epithelial-mesenchymal transition (EMT), which increases the migration and invasion capabilities of tumor cells [30,31]. Studies have confirmed that moderate exercise can decrease SNS activity, decrease the secretion of epinephrine and norepinephrine, and decrease their adverse effects on the tumor microenvironment. Exercise helps decrease the sustained activation of  $\beta$ -adrenergic receptors, suppressing cancer cell proliferation and metastasis. Furthermore, exercise boosts immune system function by strengthening the activity of anti-tumor immune cells, such as CD8<sup>+</sup> T cells, which further suppress tumor growth and progression [30–32].

In addition, exercise boosts the overall balance of the autonomic nervous system, notably by strengthening parasympathetic activity and lowering excessive SNS activation, effectively regulating the body's stress response. This adjustment helps decrease pro-cancer factors in the tumor microenvironment, such as VEGF and pro-inflammatory cytokines, thereby suppressing tumor development [33]. Research confirmed that sustained physical exercise not only decreases SNS activity but also facilitates overall body balance by strengthening parasympathetic function [34].

### **4.2. Enhancement of immune function through exercise**

#### **4.2.1. Activation of T cells and NK cells**

Exercise significantly boosts immune surveillance, notably by encouraging the activation of T cells and SNS cells. Studies confirm that regular exercise increases both the number and functionality of these cells, optimizing their efficiency in recognizing and eliminating cancer cells [7–35]. Exercise not only mobilizes a large number of immune cells into the bloodstream but also boosts their migration and infiltration into tumors, restoring the body's immune surveillance capabilities [7]. Psychological stress has been confirmed to suppress T cell and NK cell activity, but exercise effectively reverses this suppression, strengthening the body's anti-tumor immune response [7].

Moderate aerobic exercise significantly increases the number and cytotoxic activity of CD8<sup>+</sup> T cells and NK cells in peripheral blood. This phenomenon has been validated in multiple studies, which have confirmed that after acute exercise, the proportion of CD8<sup>+</sup> T cells and NK cells in the bloodstream increases significantly, and this increase may be associated with their migration to tumor tissues [36]. In animal experiments, aerobic exercise has been found to induce more CD8<sup>+</sup> T cell infiltration into tumors, inhibit tumor growth, and prolong survival. The increase in these cells directly contributes to the suppression of tumor cell growth and decreased

tumor metastasis [37]. Besides, the mobilization and enhanced cytotoxicity of immune cells induced by exercise can improve patient responses to chemotherapy or immunotherapy, partly due to exercise-induced metabolic and immune microenvironment changes [36,37].

#### **4.2.2. Reduction of pro-inflammatory states**

Exercise decreases tumor growth and spread by suppressing the secretion of pro-inflammatory cytokines, such as IL-6 and TNF- $\alpha$ , thereby lowering the activation of pro-inflammatory pathways like NF- $\kappa$ B. Studies have confirmed that these pro-inflammatory factors in chronic inflammation significantly drive tumor progression by activating the NF- $\kappa$ B pathway [38,39]. In the course of stress, the levels of these factors increase in the tumor microenvironment, but regular exercise can decrease their expression, slowing tumor progression. In addition, exercise raises levels of anti-inflammatory cytokines, such as IL-10, which helps restore immune balance in the tumor microenvironment and decelerate cancer cell proliferation and invasion [38]. These findings highlight the important role of exercise in regulating the tumor microenvironment.

### **4.3. Inhibition of angiogenesis and metastasis by exercise**

#### **4.3.1. Inhibition of VEGF signaling pathway**

Under stress, the expression of VEGF increases significantly, encouraging tumor angiogenesis, supplying blood to cancer cells, and facilitating their growth and metastasis. However, exercise interventions have been found to inhibit this process through various mechanisms. Studies confirm that exercise not only decreases stress-induced VEGF expression but also impacts tumor progression by regulating inflammation-related factors in the tumor microenvironment [6–40]. Additionally, exercise inhibits the binding of VEGF to its receptor VEGFR, thereby suppressing angiogenesis through the regulation of multiple angiogenesis-related pathways, such as HIF-1 $\alpha$  and eNOS [41]. These biological effects induced by exercise help decrease blood supply to tumor tissue, lower malignancy, and reduce the occurrence of distant metastasis [42]. Consequently, appropriate exercise not only directly disrupts tumor nutrition but also further suppresses tumor growth and metastasis by optimizing immune function [6].

#### **4.3.2. Reduction of MMP activity**

MMPs degrade the ECM and basement membrane, facilitating cancer cell migration into surrounding tissues and enhancing the likelihood of distant metastasis. Under stress conditions, MMP activity increases, a process observed in various cancer types [26–43]. Studies confirm that exercise regulates the activity of MMP-2 and MMP-9. Regular exercise significantly lowers the expression of these enzymes, lowering matrix degradation and cancer cell invasiveness. For example, the overexpression of MMP-9 is often associated with high invasiveness and metastatic potential in tumors, while exercise decreases MMP-9 activity, suppressing cancer cell angiogenesis and distant metastasis [26–43]. In addition, exercise can enhance the prognosis of cancer patients by regulating MMP activity, lowering the risk of cancer recurrence and spread [44].

#### **4.4. Positive effects of exercise on mental health**

##### **4.4.1. Regulation of endorphins and neurotransmitters**

Exercise is widely identified for its ability to significantly mitigate anxiety and depression in cancer patients by regulating neurotransmitter and endorphin levels. Studies confirm that exercise increases endorphin, serotonin, and dopamine levels, chemicals closely associated with improved mood and well-being. The increase in endorphins offers a “feel-good” sensation that effectively decreases anxiety symptoms, while the rise in dopamine and serotonin helps alleviate depression and enhances the overall mental health of cancer patients [45,46]. Furthermore, exercise helps patients cope with the psychological stress of cancer by regulating the brain’s reward system, optimizing mood regulation, and enhancing life satisfaction [46]. Thus, exercise, as a non-pharmacological intervention, has significant positive effects on the mental health of cancer patients.

##### **4.4.2. Enhanced coping ability**

Exercise, as a non-pharmacological psychological intervention, helps enhance cancer patients’ coping abilities and mitigate cancer-related fatigue (CRF). Research confirmed that exercise helps patients decrease stress responses, increase their sense of control over the disease, and enhance self-efficacy. These psychological enhancements enable patients to better cope with the challenges of treatment, thereby strengthening treatment adherence and quality of life [47,48]. Furthermore, regular exercise interventions offer patients with social opportunities and emotional support, which help mitigate feelings of loneliness and helplessness. Through exercise, patients can build greater psychological resilience, better cope with the side effects of cancer and its treatments, and enhance both psychological and physical health outcomes [47].

##### **4.4.3. Immunity and exercise intensity**

Mild exercise, such as walking or stretching, exerts a moderate immunomodulatory effect that helps maintain immune homeostasis, but its ability to enhance antitumor immunity may be limited. For instance, although exercise can promote the mobilization of NK cells and CD8<sup>+</sup> T cells, its enhancing effect is primarily short-term following acute exercise, with minimal long-term impact [36].

Moderate-intensity exercise, such as brisk walking or cycling, has been identified as the optimal level for enhancing immune function. Research shows that it boosts immune surveillance by increasing the recruitment and activity of CD8<sup>+</sup> T cells and NK cells, while also reducing systemic inflammation and stress-related hormones such as cortisol [49].

Intense exercise, particularly high-intensity interval training (HIIT), temporarily elevates cortisol levels, potentially leading to a transient suppression of immune function [50]. However, long-term regular high-intensity exercise can improve immune function by enhancing recovery mechanisms, though overtraining without adequate recovery may result in immune suppression [50].

##### **4.4.4. Psychological stress and exercise intensity**

Mild exercise is particularly effective in alleviating mild anxiety and promoting relaxation, which is beneficial for patients suffering from severe fatigue or physical decline. Moderate-intensity exercise is widely recognized for its ability to reduce

psychological stress, alleviate symptoms of anxiety and depression, and improve overall mental health. Studies show that moderate aerobic exercise, such as running, swimming, and cycling, has significant benefits for mental health, especially in reducing symptoms of anxiety and depression [51]. This intensity of exercise appears to balance physiological activation and recovery, thus providing optimal psychological benefits.

#### **4.5. The role of different types of exercise in coping with psychological stress**

In modern society, psychological stress has become a prevalent issue. Research indicates that different types of exercise have significant effects in alleviating psychological stress. Aerobic exercise is widely considered an effective way to improve mental health. Studies show that aerobic exercises, such as Tai Chi, not only improve physical health but also effectively reduce anxiety and depressive symptoms [52]. One study found that after 8 weeks of aerobic training, participants showed significant improvements in mental state, and their cardiovascular recovery capacity was enhanced [53].

Additionally, Tai Chi, a traditional mind-body exercise, has received increasing attention in recent years. Tai Chi practice has been found to effectively lower stress levels and improve mental health. Research shows that participants in Tai Chi groups exhibited significantly greater improvements in anxiety and stress perception compared to the waitlist group [52]. Moreover, Tai Chi is considered a low-intensity exercise suitable for people of all ages, particularly the elderly [54].

Yoga is another effective form of exercise for coping with psychological stress. Studies have shown that yoga practice significantly enhances participants' self-esteem and quality of life, while reducing depressive symptoms [55]. In a comparison between yoga and resistance training, the yoga group showed greater improvements in fatigue, self-esteem, and quality of life [56].

In conclusion, various types of exercise have shown positive effects in managing psychological stress. Aerobic exercise, Tai Chi, yoga, and hiking each have their unique characteristics and can provide effective mental health support for different populations.

#### **4.6. Gender differences in exercise interventions**

In terms of exercise interventions, although the basic principles are similar between men and women, there may be differences in the choice of exercise type, intensity, and frequency. For example, research indicates that women rely less on carbohydrates during moderate-intensity endurance exercise compared to men, which may affect their performance and adaptation during exercise interventions [57]. Additionally, women show different physiological responses after high-intensity exercise compared to men, particularly in the changes of brain-derived neurotrophic factor (BDNF) levels in the blood, where women's responses may not be as pronounced as those in men [58]. These gender differences need to be considered in the design of exercise interventions to better meet the needs of both sexes.

Furthermore, for different types of exercise interventions, studies have found that

multi-component exercise programs (such as combining strength and aerobic exercises) have a more significant effect on improving cognitive function in elderly women [59]. In elderly men, combining resistance training and aquatic exercise has also shown positive effects on combating oxidative stress [52]. These findings suggest that the effectiveness of exercise interventions may vary by gender, so considering gender differences when designing personalized exercise plans is crucial.

The frequency and duration of exercise interventions may also influence health-related outcomes. Research shows that although long-duration and short-duration exercises are similar in terms of energy expenditure, their impact on health indicators may not show significant differences, which supports the flexibility of exercise interventions [60]. Therefore, when designing exercise interventions, it is important to adjust the type, intensity, and frequency of exercise according to the individual's specific needs and gender differences to achieve the best results.

## **5. Conclusion and future prospects**

### **5.1. Contributions of previous research in the field**

Exercise, as a low-cost and easy-to-implement intervention, has been confirmed to effectively mitigate the negative impact of stress on tumor progression through various molecular mechanisms, while also significantly optimizing the psychological health and quality of life of cancer patients. Future research should continue to delve into optimal strategies for implementing exercise interventions and integrating them with personalized treatments to support better physical and psychological recovery for cancer patients. Exercise interventions not only serve as an adjunct to cancer treatment but also hold broad clinical applications, offering patients enhanced treatment outcomes and long-term health benefits.

### **5.2. Personalized design of exercise interventions**

Given the variability in cancer types, stages, and patients' physical conditions, there are significant differences in the exercise intervention needs among patients. Future research should aim to develop personalized exercise prescriptions, tailoring exercise programs to the needs of each cancer patient. For instance, patients with limited physical function may benefit from low-intensity aerobic exercises or light resistance training, while those in better physical condition may engage in more challenging exercise programs. Moreover, patients at different stages of cancer may have varying tolerances to exercise: early-stage patients may handle higher-intensity exercise, while late-stage patients may require a greater focus on safety and rehabilitation exercises. By designing individualized interventions, exercise can better meet patients' specific needs, thereby optimizing their treatment outcomes and quality of life.

### **5.3. Synergistic effects of exercise and pharmacological therapies**

A growing body of researches confirm that exercise not only serves as an independent non-pharmacological intervention but can also work synergistically with traditional treatments such as chemotherapy, radiotherapy, and immunotherapy.

Exercise can enhance the tumor microenvironment, improve immune cell function, inhibit inflammation and angiogenesis, and thereby increase the efficacy of drug therapies. For example, exercise can enhance the penetration of chemotherapy drugs, boost the cytotoxic effects of radiotherapy, and even optimize the outcomes of immunotherapy. Future research should further investigate the interaction mechanisms between exercise and pharmacological treatments, particularly the potential synergistic effects in regulating the tumor immune microenvironment, to determine the best combined exercise and drug therapy protocols.

#### 5.4. Integrated application of exercise in psychological interventions

Exercise has a significant positive impact on the mental health of cancer patients, and future efforts should delve into combining exercise with psychological support therapies to form more comprehensive stress management strategies. By integrating exercise with psychological interventions, not only can anxiety and depression among cancer patients be alleviated, but their coping abilities can also be strengthened, optimizing treatment adherence and life satisfaction. This integrated approach can enhance patients' quality of life from both physiological and psychological perspectives. Future interventions should develop more combined models, incorporating exercise with psychological counseling, cognitive-behavioral therapy, and other psychological support methods to offer holistic treatment support for cancer patients.

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## References

1. Oh HM, Son CG. The Risk of Psychological Stress on Cancer Recurrence: A Systematic Review. *Cancers*. 2021; 13(22): 5816. doi: 10.3390/cancers13225816
2. Falcinelli M, Thaker PH, Lutgendorf SK, et al. The Role of Psychologic Stress in Cancer Initiation: Clinical Relevance and Potential Molecular Mechanisms. *Cancer Research*. 2021; 81(20): 5131-5140. doi: 10.1158/0008-5472.can-21-0684
3. Pitman A, Suleman S, Hyde N, et al. Depression and anxiety in patients with cancer. *BMJ*. Published online April 25, 2018: k1415. doi: 10.1136/bmj.k1415

4. Giles GE, Mahoney CR, Bruny  TT, et al. Stress Effects on Mood, HPA Axis, and Autonomic Response: Comparison of Three Psychosocial Stress Paradigms. Kavushansky A, ed. PLoS ONE. 2014; 9(12): e113618. doi: 10.1371/journal.pone.0113618
5. Segerstrom SC, Miller GE. Psychological Stress and the Human Immune System: A Meta-Analytic Study of 30 Years of Inquiry. Psychological Bulletin. 2004; 130(4): 601-630. doi: 10.1037/0033-2909.130.4.601
6. Sitlinger A, Brander DM, Bartlett DB. Impact of exercise on the immune system and outcomes in hematologic malignancies. Blood Advances. 2020; 4(8): 1801-1811. doi: 10.1182/bloodadvances.2019001317
7. Gustafson MP, Wheatley-Guy CM, Rosenthal AC, et al. Exercise and the immune system: taking steps to improve responses to cancer immunotherapy. Journal for ImmunoTherapy of Cancer. 2021; 9(7): e001872. doi: 10.1136/jitc-2020-001872
8. Kulchyski M, Halder HR, Askin N, et al. Aerobic Physical Activity and Depression Among Patients With Cancer. JAMA Network Open. 2024; 7(10): e2437964. doi: 10.1001/jamanetworkopen.2024.37964
9. Shalata W, Gothelf I, Bernstine T, et al. Mental Health Challenges in Cancer Patients: A Cross-Sectional Analysis of Depression and Anxiety. Cancers. 2024; 16(16): 2827. doi: 10.3390/cancers16162827
10. Dai S, Mo Y, Wang Y, et al. Chronic Stress Promotes Cancer Development. Frontiers in Oncology. 2020; 10. doi: 10.3389/fonc.2020.01492
11. Vignjevi  Petrinovi  S, Milo evi  MS, Markovi  D, et al. Interplay between stress and cancer—A focus on inflammation. Frontiers in Physiology. 2023; 14. doi: 10.3389/fphys.2023.1119095
12. Lewis C, Darnell D, Kerns S, et al. Advancing efficient methodologies through community partnerships and team science. In: Proceedings of the 3rd Biennial Conference of the Society for Implementation Research Collaboration (SIRC) 2015; 24-26 September 2015; Seattle, WA, USA.
13. Liu Y, Tian S, Ning B, et al. Stress and cancer: The mechanisms of immune dysregulation and management. Frontiers in Immunology. 2022; 13. doi: 10.3389/fimmu.2022.1032294
14. Baritaki S, de Bree E, Chatzaki E, et al. Chronic Stress, Inflammation, and Colon Cancer: A CRH System-Driven Molecular Crosstalk. Journal of Clinical Medicine. 2019; 8(10): 1669. doi: 10.3390/jcm8101669
15. Lei Y, Liao F, Tian Y, et al. Investigating the crosstalk between chronic stress and immune cells: implications for enhanced cancer therapy. Frontiers in Neuroscience. 2023; 17. doi: 10.3389/fnins.2023.1321176
16. Hong Y, Zhang L, Liu N, et al. The Central Nervous Mechanism of Stress-Promoting Cancer Progression. International Journal of Molecular Sciences. 2022; 23(20): 12653. doi: 10.3390/ijms232012653
17. Tian W, Liu Y, Cao C, et al. Chronic Stress: Impacts on Tumor Microenvironment and Implications for Anti-Cancer Treatments. Frontiers in Cell and Developmental Biology. 2021; 9. doi: 10.3389/fcell.2021.777018
18. Bernab  DG. Catecholamines Mediate Psychologic Stress-Induced Cancer Progression. Cancer Research. 2021; 81(20): 5144-5146. doi: 10.1158/0008-5472.can-21-3077
19. Cole SW, Sood AK. Molecular Pathways: Beta-Adrenergic Signaling in Cancer. Clinical Cancer Research. 2012; 18(5): 1201-1206. doi: 10.1158/1078-0432.ccr-11-0641
20. Chen G, Qiu L, Gao J, et al. Stress Hormones: Emerging Targets in Gynecological Cancers. Frontiers in Cell and Developmental Biology. 2021; 9. doi: 10.3389/fcell.2021.699487
21. Jeong JH, Park HJ, Park SH, et al.  $\beta$ 2-Adrenergic Receptor Signaling Pathway Stimulates the Migration and Invasion of Cancer Cells via Src Activation. Molecules. 2022; 27(18): 5940. doi: 10.3390/molecules27185940
22. Qiao G, Chen M, Mohammadpour H, et al. Chronic Adrenergic Stress Contributes to Metabolic Dysfunction and an Exhausted Phenotype in T Cells in the Tumor Microenvironment. Cancer Immunology Research. 2021; 9(6): 651-664. doi: 10.1158/2326-6066.cir-20-0445
23. Hong H, Ji M, Lai D. Chronic Stress Effects on Tumor: Pathway and Mechanism. Frontiers in Oncology. 2021; 11. doi: 10.3389/fonc.2021.738252
24. Chen H, Liu D, Yang Z, et al. Adrenergic signaling promotes angiogenesis through endothelial cell-tumor cell crosstalk. Endocrine Related Cancer. 2014; 21(5): 783-795. doi: 10.1530/erc-14-0236
25. Sternlicht MD, Werb Z. How Matrix Metalloproteinases Regulate Cell Behavior. Annual Review of Cell and Developmental Biology. 2001; 17(1): 463-516. doi: 10.1146/annurev.cellbio.17.1.463
26. Quintero-Fabi n S, Arreola R, Becerril-Villanueva E, et al. Role of Matrix Metalloproteinases in Angiogenesis and Cancer. Frontiers in Oncology. 2019; 9. doi: 10.3389/fonc.2019.01370
27. James KA, Stromin JI, Steenkamp N, et al. Understanding the relationships between physiological and psychosocial stress,

- cortisol and cognition. *Frontiers in Endocrinology*. 2023; 14. doi: 10.3389/fendo.2023.1085950
28. Anderson E, Shivakumar G. Effects of Exercise and Physical Activity on Anxiety. *Frontiers in Psychiatry*. 2013; 4. doi: 10.3389/fpsyt.2013.00027
29. Belvederi Murri M, Ekkekakis P, Magagnoli M, et al. Physical Exercise in Major Depression: Reducing the Mortality Gap While Improving Clinical Outcomes. *Frontiers in Psychiatry*. 2019; 9. doi: 10.3389/fpsyt.2018.00762
30. Qiao G, Chen M, Bucsek MJ, et al. Adrenergic Signaling: A Targetable Checkpoint Limiting Development of the Antitumor Immune Response. *Frontiers in Immunology*. 2018; 9. doi: 10.3389/fimmu.2018.00164
31. Manoleras AV, Sloan EK, Chang A. The sympathetic nervous system shapes the tumor microenvironment to impair chemotherapy response. *Frontiers in Oncology*. 2024; 14. doi: 10.3389/fonc.2024.1460493
32. Colon-Echevarria CB, Lamboy-Caraballo R, Aquino-Acevedo AN, et al. Neuroendocrine Regulation of Tumor-Associated Immune Cells. *Frontiers in Oncology*. 2019; 9. doi: 10.3389/fonc.2019.01077
33. Lavín-Pérez AM, Collado-Mateo D, Mayo X, et al. Can Exercise Reduce the Autonomic Dysfunction of Patients With Cancer and Its Survivors? A Systematic Review and Meta-Analysis. *Frontiers in Psychology*. 2021; 12. doi: 10.3389/fpsyg.2021.712823
34. Casanova-Lizón A, Manresa-Rocamora A, Flatt AA, et al. Does Exercise Training Improve Cardiac-Parasympathetic Nervous System Activity in Sedentary People? A Systematic Review with Meta-Analysis. *International Journal of Environmental Research and Public Health*. 2022; 19(21): 13899. doi: 10.3390/ijerph192113899
35. Shao T, Verma HK, Pande B, et al. Physical Activity and Nutritional Influence on Immune Function: An Important Strategy to Improve Immunity and Health Status. *Frontiers in Physiology*. 2021; 12. doi: 10.3389/fphys.2021.751374
36. Koivula T, Lempiäinen S, Rinne P, et al. Acute exercise mobilizes CD8+ cytotoxic T cells and NK cells in lymphoma patients. *Frontiers in Physiology*. 2023; 13. doi: 10.3389/fphys.2022.1078512
37. Rundqvist H, Veliça P, Barbieri L, et al. Cytotoxic T-cells mediate exercise-induced reductions in tumor growth. *eLife*. 2020; 9. doi: 10.7554/elife.59996
38. Soler MF, Abaurrea A, Azcoaga P, et al. New perspectives in cancer immunotherapy: targeting IL-6 cytokine family. *Journal for ImmunoTherapy of Cancer*. 2023; 11(11): e007530. doi: 10.1136/jitc-2023-007530
39. Hirano T. IL-6 in inflammation, autoimmunity and cancer. *International Immunology*. 2020; 33(3): 127-148. doi: 10.1093/intimm/dxaa078
40. Qi C, Song X, Wang H, et al. The role of exercise-induced myokines in promoting angiogenesis. *Frontiers in Physiology*. 2022; 13. doi: 10.3389/fphys.2022.981577
41. Li S, Li S, Wang L, et al. The Effect of Blood Flow Restriction Exercise on Angiogenesis-Related Factors in Skeletal Muscle Among Healthy Adults: A Systematic Review and Meta-Analysis. *Frontiers in Physiology*. 2022; 13. doi: 10.3389/fphys.2022.814965
42. Brenner DR, Ruan Y, Adams SC, et al. The impact of exercise on growth factors (VEGF and FGF2): results from a 12-month randomized intervention trial. *European Review of Aging and Physical Activity*. 2019; 16(1). doi: 10.1186/s11556-019-0215-4
43. Huang H. Matrix Metalloproteinase-9 (MMP-9) as a Cancer Biomarker and MMP-9 Biosensors: Recent Advances. *Sensors*. 2018; 18(10): 3249. doi: 10.3390/s18103249
44. Giganti MG, Tresoldi I, Sorge R, et al. Physical exercise modulates the level of serum MMP-2 and MMP-9 in patients with breast cancer. *Oncology Letters*. 2016; 12(3): 2119-2126. doi: 10.3892/ol.2016.4887
45. Marconcin P, Marques A, Ferrari G, et al. Impact of Exercise Training on Depressive Symptoms in Cancer Patients: A Critical Analysis. *Biology*. 2022; 11(4): 614. doi: 10.3390/biology11040614
46. Craft LL, VanIterson EH, Helenowski IB, et al. Exercise Effects on Depressive Symptoms in Cancer Survivors: A Systematic Review and Meta-analysis. *Cancer Epidemiology, Biomarkers & Prevention*. 2012; 21(1): 3-19. doi: 10.1158/1055-9965.epi-11-0634
47. Rashwan ZI, Shaheen SR, Rasoul ASAEFAE, et al. Empowering mind-body wellness: effect of bundling seated exercises and psychoeducational rehabilitation using the teach-back approach on fatigue and coping of women postmastectomy. *BMC Women's Health*. 2024; 24(1). doi: 10.1186/s12905-024-03242-5
48. Mustian KM, Alfano CM, Heckler C, et al. Comparison of Pharmaceutical, Psychological, and Exercise Treatments for Cancer-Related Fatigue. *JAMA Oncology*. 2017; 3(7): 961. doi: 10.1001/jamaoncol.2016.6914
49. Suzuki K, Hayashida H. Effect of Exercise Intensity on Cell-Mediated Immunity. *Sports*. 2021; 9(1): 8. doi:

- 10.3390/sports9010008
50. Cerqueira É, Marinho DA, Neiva HP, et al. Inflammatory Effects of High and Moderate Intensity Exercise—A Systematic Review. *Frontiers in Physiology*. 2020; 10. doi: 10.3389/fphys.2019.01550
51. Herbert C, Meixner F, Wiebking C, et al. Regular Physical Activity, Short-Term Exercise, Mental Health, and Well-Being Among University Students: The Results of an Online and a Laboratory Study. *Frontiers in Psychology*. 2020; 11. doi: 10.3389/fpsyg.2020.00509
52. Zheng S, Kim C, Lal S, et al. The Effects of Twelve Weeks of Tai Chi Practice on Anxiety in Stressed But Healthy People Compared to Exercise and Wait-List Groups—A Randomized Controlled Trial. *Journal of Clinical Psychology*. 2017; 74(1): 83-92. doi: 10.1002/jclp.22482
53. Chovanec L, Gröpel P. Effects of 8-week endurance and resistance training programmes on cardiovascular stress responses, life stress and coping. *Journal of Sports Sciences*. 2020; 38(15): 1699-1707. doi: 10.1080/02640414.2020.1756672
54. Wang D, Wang P, Lan K, et al. Effectiveness of Tai chi exercise on overall quality of life and its physical and psychological components among older adults: a systematic review and meta-analysis. *Brazilian Journal of Medical and Biological Research*. 2020; 53(10). doi: 10.1590/1414-431x202010196
55. Taspinar B, Aslan UB, Agbuga B, et al. A comparison of the effects of hatha yoga and resistance exercise on mental health and well-being in sedentary adults: A pilot study. *Complementary Therapies in Medicine*. 2014; 22(3): 433-440. doi: 10.1016/j.ctim.2014.03.007
56. Gammage KL, Drouin B, Lamarche L. Comparing a Yoga Class with a Resistance Exercise Class: Effects on Body Satisfaction and Social Physique Anxiety in University Women. *Journal of Physical Activity and Health*. 2016; 13(11): 1202-1209. doi: 10.1123/jpah.2015-0642
57. Devries MC. Sex-based differences in endurance exercise muscle metabolism: impact on exercise and nutritional strategies to optimize health and performance in women. *Experimental Physiology*. 2015; 101(2): 243-249. doi: 10.1113/ep085369
58. Schmidt-Kassow M, Schädle S, Otterbein S, et al. Kinetics of serum brain-derived neurotrophic factor following low-intensity versus high-intensity exercise in men and women. *NeuroReport*. 2012; 23(15): 889-893. doi: 10.1097/wnr.0b013e32835946ca
59. Yang J, Dong Y, Yan S, et al. Which Specific Exercise Models Are Most Effective on Global Cognition in Patients with Cognitive Impairment? A Network Meta-Analysis. *International Journal of Environmental Research and Public Health*. 2023; 20(4): 2790. doi: 10.3390/ijerph20042790
60. Manthou E, Gill JMR, Malkova D. Effect of Exercise Programs With Aerobic Exercise Sessions of Similar Intensity but Different Frequency and Duration on Health-Related Measures in Overweight Women. *Journal of Physical Activity and Health*. 2015; 12(1): 80-86. doi: 10.1123/jpah.2013-0047

## Article

# Mindfulness interventions in post-cervical cancer: Sexual, psychological, and quality of life impact

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**Abstract: Background:** The incidence of cervical cancer has been steadily increasing in recent years. Surgical resection is an effective treatment option, but there remains a risk of recurrence and numerous complications. In the wake of surgery, patients often experience vaginal elasticity loss, narrowing, and lowered estrogen levels, which leads to dyspareunia. The loss of physiological functions in females is also followed by uncomfortable emotions such as anxiety, depression, low self-esteem, and panic, which not only affect treatment outcomes but also disrupt patients' daily lives. This experiment intends to observe the effects of a comprehensive mindfulness-based cognitive behavioral intervention approach on patients' sexual function, psychological state, and quality of life following surgery, hoping to provide more feasible care options for such patients. **Objective:** This research aims to investigate the impact of comprehensive mindfulness-based cognitive behavioral interventions on patients' sexual function, psychological state, and quality of life after early cervical cancer resection surgery. **Methods:** This study included 206 patients who underwent cervical cancer resection at Capital Medical University electric power teaching Hospital (State Grid Corporation of China Beijing electric power hospital) between June 2022 and December 2023. The 96 patients who had surgery between June 2022 and February 2023 were assigned to the control group, while the 110 patients who underwent surgery between March 2023 and December 2023 were allocated to the intervention group. The control group was subjected to standard nursing care, whereas the intervention group received mindfulness-based cognitive behavioral interventions. Care was given to both groups for 8 weeks. Comparisons were made for the sexual function levels of both groups one-year post-surgery. Health knowledge and nursing satisfaction were also compared, and psychological states [via the self-rating anxiety scale (SAS) and self-rating depression scale (SDS)], mindfulness cognition levels [using the mindful attention awareness scale (MAAS)], and quality of life were evaluated before and after the 8-week intervention. **Results:** Following the implementation of different nursing interventions, the intervention group exhibited remarkably heightened levels of health knowledge acquisition and nursing satisfaction compared with the control group ( $P < 0.05$ ). Prior to the intervention, there were no statistically significant variances between the two cohorts in terms of sexual desire, sexual arousal, orgasm, vaginal lubrication, dyspareunia and sexual intercourse satisfaction, SAS scores, SDS scores, MAAS scores, physiological status scores, social/family status scores, emotional well-being scores, and functional status scores ( $P > 0.05$ ). Post-intervention, the intervention group scored higher in terms of sexual function, had lower SAS and SDS scores, and displayed higher MAAS scores compared with the control group. Moreover, the intervention group demonstrated significantly better scores in physiological status, emotional well-being, and functional status compared to the control group ( $P < 0.05$ ), with these differences being statistically significant ( $P < 0.05$ ). **Conclusion:** Implementing mindfulness-based cognitive behavioral interventions in patients undergoing cervical cancer resection can enhance their health knowledge and nursing satisfaction, maintain sexual function, improve postoperative psychological state, and elevate quality of life. This approach holds remarkable

clinical value.

**Keywords:** cervical cancer; mindfulness; cognitive behavioral intervention; resection surgery; sexual function; psychological state; quality of life

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## 1. Introduction

Cervical cancer ranks as the most common malignant tumor in the female reproductive system, represents a significant concern in gynecological health, and is the fourth most frequently diagnosed cancer worldwide [1]. With the acceleration of life pace and changes in dietary habits, the incidence of cervical cancer has been rising yearly, with approximately 18.1 million new cancer cases reported in 2018 [2]. Cervical cancer is particularly prevalent in low- and middle-income countries and stands as a leading cause of cancer-related mortality among women globally, making it a significant global public health issue [3]. Surgery plays a crucial part in the treatment of early-stage cervical cancer. For women with stage IA(2) and IB(1) cervical cancer and specific patients with stage II endometrial cancer, open radical hysterectomy and bilateral pelvic lymph node dissection are standard surgical procedures that can notably extend survival and yield excellent survival rates. Nevertheless, these benefits come with the cost of treatment-correlated short- and long-term complications, necessitating adjuvant chemoradiotherapy to abate the incidence of these complications [4–6]. Previous studies have revealed that cervical cancer surgery and chemoradiotherapy can adversely affect sexual function, giving way to vaginal shortening, reduced elasticity and lubrication of the vaginal wall, as well as dyspareunia [7,8]. These postoperative adverse effects substantially impact patients, leading to sexual dysfunction, anxiety, and depression, culminating in decreased postoperative well-being and quality of life [9,10]. Therefore, perioperative care for cervical cancer surgery patients should pay special attention to issues pertaining to sexual function and psychological state to improve postoperative quality of life.

The term “mindfulness” originates from ancient Eastern Buddhist meditation practices, focusing on maintaining continuous attention and alertness to the present task, concentrating one’s mind on ongoing activities, and emphasizing non-judgmental and non-controlling self-regulation of awareness [11]. Currently, mindfulness-based interventions have been adopted clinically as adjunctive treatments for chronic conditions such as cancer, chronic pain, insomnia, and asthma, displaying positive outcomes [12,13]. Mindfulness therapy is a collective term for various psychological therapies centered around mindfulness. More established mindfulness therapies include Mindfulness-based Stress Reduction (MBSR), Mindfulness-based Cognitive Therapy (MBCT), Dialectical Behavioral Therapy (DBT), and Acceptance and Commitment Therapy (ACT). Currently, mindfulness-based interventions have been clinically implemented as an adjunct treatment for chronic patients suffering from conditions such as cancer, chronic pain, insomnia, and asthma, showing some positive effects [14,15]. MBCT is a multimodal intervention that combines mindfulness meditation training with the cognitive theory of emotional disorders. This integrative feature may provide advantages in the prevention domain, addressing the critical need to improve the health of patients with recurrent mood disorders. There is

substantial evidence suggesting that psychotherapy is as effective as antidepressant medication in treating depression. Additionally, new studies indicate that psychotherapy is also very effective in preventing the recurrence of depression, with effects comparable to those of antidepressant medications [16,17]. However, current research on the effects of comprehensive mindfulness-based cognitive-behavioral interventions on patients following cervical cancer surgery is also scarce. Given the prevalence of postoperative depression among cancer patients [18], it is particularly important to explore the role of MBCT in this population. Therefore, our study investigates the impact of implementing mindfulness-based cognitive behavioral interventions on sexual function, psychological state, and quality of life in patients after cervical cancer resection, with findings reported as follows.

## 2. Materials and methods

### 2.1. General data

This investigation engaged a cohort of 206 individuals with early-stage cervical cancer, all of whom underwent radical hysterectomy at Capital Medical University electric power teaching Hospital (State Grid Corporation of China Beijing electric power hospital) from June 2022 to December 2023.

Inclusion criteria: women diagnosed with cervical cancer via biopsy or rapid intraoperative pathological diagnosis; cervical cancer stages OGTT IA1-IIA2; meeting the indications for radical hysterectomy; aged 18 years or older; undergoing treatment for more than 3 months and having resumed sexual activity; no severe gynecological, urological, or endocrinological diseases affecting sexual function; clinical and laboratory examinations show no severe cardiac, liver, or kidney dysfunction; no history of severe mental illness (such as schizophrenia or major depression) or cognitive disorders (such as dementia or post-stroke sequelae), and no acute psychological crisis or risk of suicide; postoperatively clear consciousness, normal language expression and comprehension abilities, and being able to complete the scales independently; Willing and able to participate in all mindfulness-based behavioral intervention sessions, have a stable living environment, and be able to attend regular follow-ups; voluntarily participating in the study and signing the informed consent form.

Exclusion criteria: patients with other severe diseases affecting sexual life; Patients with a history of or currently having other cancers, as well as those undergoing treatment for disease recurrence; postoperative cognitive dysfunction; and those who withdrew midway.

The present study is a retrospective analysis, with time distribution as the grouping criterion. The 96 patients who went through surgery between June 2022 and February 2023 were designated as the control group, while the 110 patients who experienced surgery between March 2023 and December 2023 were assigned to the control group. Baseline data such as age, disease course, education level, marital status, occupation, tumor stage, and presence of metastasis were compared between the two groups, showing no statistically significant ( $P > 0.05$ ). See **Table 1**.

**Table 1.** Comparison of general data between the two groups.

| Baseline data           |                                | Control group (n = 96) | Intervention group (n = 110) | $\chi^2/t$ | P      |
|-------------------------|--------------------------------|------------------------|------------------------------|------------|--------|
| Age (years)             | -                              | 43.95 ± 0.62           | 44.03 ± 0.58                 | 1.614      | 0.108  |
| Disease course (months) | -                              | 2.81 ± 0.23            | 2.77 ± 0.25                  | 1.189      | 0.3236 |
| Education level         | Primary school                 | 25 (26.04)             | 29 (26.36)                   | 0.510      | 0.775  |
|                         | Junior high school             | 38 (39.58)             | 48 (43.64)                   |            |        |
|                         | Senior high school and college | 33 (34.38)             | 33 (30.00)                   |            |        |
| Marital status          | Married                        | 61 (63.54)             | 78 (70.91)                   | 1.268      | 0.260  |
|                         | Unmarried                      | 35 (36.46)             | 32 (29.09)                   |            |        |
| Occupation              | Farmer                         | 15 (15.63)             | 21 (19.09)                   | 1.733      | 0.630  |
|                         | Administration/technology      | 33 (34.38)             | 36 (32.73)                   |            |        |
|                         | Business/service               | 28 (29.17)             | 30 (27.27)                   |            |        |
|                         | Housewife/unemployed           | 20 (20.83)             | 23 (20.91)                   |            |        |
| Tumor stages            | Stage I                        | 26 (27.08)             | 31 (28.18)                   | 5.424      | 0.143  |
|                         | Stage II                       | 34 (35.42)             | 29 (26.36)                   |            |        |
|                         | Stage III                      | 20 (20.83)             | 23 (20.91)                   |            |        |
|                         | Stage IV                       | 16 (16.67)             | 27 (24.55)                   |            |        |
| Metastasis              | Presence                       | 61 (63.54)             | 64 (58.18)                   | 0.617      | 0.432  |
|                         | Absence                        | 35 (36.46)             | 46 (41.82)                   |            |        |

## 2.2. Nursing care methods

The control group received standard nursing care, which included routine health education, explaining surgical-related knowledge to the patients, guiding them on proper nursing methods, maintaining perineal cleanliness, and providing medication and nursing interventions as per the doctor's advice. When patients experience psychological issues, specialized psychological counseling can be arranged to help them cope with the psychological stress and anxiety arising from surgery and recovery. Additionally, training family members to participate in care, particularly those who can provide extra support and supervision, should be professionally guided. Prior to discharge, patients were given standard discharge instructions, provided with hospital contact cards, instructed to strictly follow medical advice, and advised to promptly contact healthcare professionals or seek hospital care if any issues arose at home. Establish regular phone or video follow-ups to continuously monitor the patient's recovery progress and check for any complications or under-treatment issues.

The intervention group was subjected to mindfulness-based cognitive behavioral interventions: (1) Establishing a mindfulness-based cognitive behavioral intervention relationship: The nursing team is composed of professional caregivers who have received training in mindfulness cognitive behavioral interventions and have successfully passed assessments. Before surgery, nurses explained the methods, purposes, and precautions of mindfulness cognitive behavioral training to patients and their families, helping them understand and become familiar with the "self-direction" state. Positive cases of cervical cancer resection were shared with patients, and mindfulness lectures were given to help patients accept the reality of the disease and treatment, enhancing their psychological acceptance. Patients were encouraged to

adopt mindfulness concepts, repeatedly meditate on the significant effects obtained after treatment, boost their motivation for treatment, and build confidence in facing and overcoming the disease. (2) Implementing comprehensive mindfulness-based cognitive behavioral interventions: Nurses assisted patients in learning the relevant theories and training methods of mindfulness-based cognitive therapy (MBCT) and learning to objectively observe the relationships among thoughts, events, and feelings and identify habitual reaction patterns. Patients were taught to break unfavorable thought patterns, establish realistic thinking modes, accept their emotions and thoughts, and apply the learned knowledge and methods in real life to appropriately handle emotions and psychological states during disease treatment. During the implementation process, nurses utilize recorded audio along with live guidance to reduce the time burden on nurses while ensuring that patients receive adequate support and guidance. The nurses or therapists implementing MBCT have received training in MBCT and have obtained the corresponding certification.

Comprehensive mindfulness-based cognitive behavioral nursing interventions were carried out daily from 9:00 to 11:00 AM, and MBCT audio was played for practice (2.5-3 h/session, once a week, for 8 weeks, totaling approximately 20 to 25 h). Patients were instructed to experience their inner activities, such as perception, sensation, and thoughts, maintaining an open attitude towards emotions and feelings during practice. Weekly interventions were as follows: 1) Helping patients familiarize themselves with fellow patients, establishing good interpersonal relationships, playing the “eating an orange” exercise audio, and guiding patients to share experiences and thoughts with each other. 2) Playing body scan, mindfulness meditation, and stretching breathing audios, followed by discussion and summary. 3) Playing mindfulness movement, mindfulness stretching breathing, and regular breathing audios, guiding patients to learn. 4) Playing mindfulness walking and mindfulness meditation audios, guiding patients to practice. 5) Guiding patients in 3-min responsive breathing space and meditation to explore difficulty with audio accompaniment. 6) Guiding patients in 10-min mindfulness meditation, mindfulness stretching breathing, and 20-min mindfulness meditation practices with audio accompaniment, and guiding patients to view their thoughts as psychological time, with a primary focus on the present moment. 7) Repeating 3-min responsive breathing space training and continuous mindfulness practice. 8) Guiding patients in formal and informal mindfulness practices, and helping them conduct 3-min responsive breathing space practices in an alternative way. After the comprehensive mindfulness-based cognitive behavioral intervention practice, patients were organized for mutual communication, sharing their gains and thoughts, followed by a final summary by the nursing staff. A WeChat group for comprehensive mindfulness-based cognitive behavioral interventions was created, where practice videos were posted, and patients were assigned relevant tasks. Professional nurses were arranged in the group to answer questions, provide guidance, and supervise continuous practice, enhancing patients’ understanding of mindfulness cognitive learning and integrating it into their daily lives. In addition, to guard against the effects of transference and countertransference, healthcare professionals should: 1) Regularly assess their own emotional states and identify emotional reactions that might affect professional judgment. Emphasize the management of patients’ emotions and the maintenance of professional boundaries to avoid interfering with the intervention

process and to prevent transference and countertransference effects. 2) Enhance their understanding of transference and countertransference through training, and learn how to manage these emotional phenomena in their actual work. 3) Promptly seek professional supervision or consultation when faced with complex situations to better handle their own emotional reactions. By effectively managing transference and countertransference, healthcare professionals can improve their work efficiency and ensure the provision of high-quality care to patients. If participants experience a significant exacerbation of their condition during the study, such as marked worsening of depression or anxiety symptoms, the research team needs to conduct an appropriate assessment of these participants and make referrals for more specialized care when necessary.

Both cohorts of patients underwent an assessment of nursing effects subsequent to an 8-week period of care.

### **2.3. Outcome evaluation**

(1) Health knowledge mastery and nursing satisfaction: On the day of discharge, the responsible nurse distributed questionnaires to patients to assess their grasp of health knowledge and satisfaction with nursing care. The health knowledge questionnaire covered topics such as cervical cancer, the purpose and significance of cervical cancer resection surgery, and postoperative precautions. Each question was worth 5 points, with 20 questions in total, for a maximum score of 100. Satisfaction was measured by surveying patients' opinions on the professional skills and service attitudes of the nursing staff. Satisfaction was categorized as very satisfied, basically satisfied, and dissatisfied, with the satisfaction rate calculated as  $[\text{number of very satisfied cases} + \text{number of basically satisfied cases}] / \text{total number of patients} \times 100\%$ . (2) Psychological state: Patients' anxiety and depression levels were assessed using the self-rating anxiety scale (SAS) [19] and the self-rating depression scale (SDS) [20] before (at enrollment) and after the intervention (8 weeks). Both scales contain 20 items, with a total score of 80. A total SAS score of less than 50 indicates normal anxiety levels, and a total SDS score of less than 53 suggests normal depression levels. Higher total scores on these scales denote more severe anxiety and depression. (3) Sexual function level: One year following surgery, patients' sexual function levels were evaluated using the female sexual function index (FSFI) [21]. This scale encompasses 4 dimensions and 19 items, covering sexual desire, sexual arousal and orgasm, vaginal lubrication and dyspareunia, as well as sexual satisfaction. The total score is set at 95, with higher scores denoting better sexual function. (4) Average Sentence Length: refers to the average number of words contained in each sentence of a given text or document. This metric can help analyze the overall structure and readability of the text. By calculating the average sentence length, researchers can assess the complexity of sentences and the fluency of writing. Average sentence length is related to several psychological factors, such as cognitive processing ability, attention span, language proficiency, and emotional state. Longer sentences may indicate more complex thought processes, while shorter sentences may be associated with lower cognitive load or a reduced amount of information conveyed [22]. (5) Language Content: Language content pertains to what we express, specifically the

meaning or theme of our statements. It is widely known that individuals with depressive symptoms often use an excessive amount of vocabulary to convey negative emotions, particularly negative adjectives and adverbs such as “lonely,” “sad,” or “tragic.” Interestingly, the use of pronouns reveals more about their emotional state. Patients with depression tend to use first-person singular pronouns more frequently, such as “me,” “myself,” and “I,” while second-person and third-person pronouns are used much less often—such as “they,” “them,” or “she.” This pattern of pronoun usage suggests that individuals with depression are more focused on themselves and have less connection with others. (6) Mindfulness cognition level: The mindful attention awareness scale (MAAS) [23] was employed to evaluate patients’ mindfulness cognition levels preceding and following the intervention, assessing their awareness of autopilot responses (namely habitual reactions) and attention to current events. This single-dimension scale includes 15 items, scored on a 6-point scale, with total scores ranging from 15 to 90. Scores of 66 to 90 represent good mindfulness cognition, 41 to 65 mean moderate levels, and 40 or below indicate poor levels. Higher total scores signify higher levels of mindfulness. (7) Quality of life: The functional assessment of the cancer therapy-generic scale (FACT-G) [24] was taken to evaluate patients’ quality of life before and after the intervention. This scale contains 4 dimensions and 27 items, covering physiological status, social/family status, emotional well-being, and functional status. Each item is rated on a 5-point scale, with forward items scoring 0 to 4 and reverse items scoring 4 to 0. The total score for each dimension is calculated by aggregating the scores of all items within that dimension, while the overall score is derived by summing the scores across all dimensions. Higher scores represent better quality of life.

## 2.4. Statistical analysis

The SPSS22.0 software was introduced for the processing and analysis of all data in this study. Measurement data were expressed as ( $\bar{x} \pm s$ ). Comparisons between the two groups were conducted via an independent samples *t*-test, while within-group pre- and post-intervention comparisons were performed through a paired samples *t*-test. Enumeration data were represented as percentages and analyzed using the chi-square test. A *P*-value of less than 0.05 was considered to signify statistically significant variances.

## 3. Results

### 3.1. Comparison of health knowledge mastery and nursing satisfaction between the two groups

Following the intervention with different nursing care plans, the control group achieved a health knowledge mastery score of ( $71.45 \pm 8.96$ ) and reported a nursing satisfaction rate of 87.50%. In contrast, the intervention group scored ( $87.23 \pm 9.37$ ) on health knowledge mastery and displayed a nursing satisfaction rate of 95.45%. The intervention group notably outperformed the control group in both health knowledge mastery and nursing satisfaction, with the disparities being statistically significant ( $P < 0.05$ ), as exhibited in **Table 2** and **Figure 1**. This demonstrated that implementing

comprehensive mindfulness-based cognitive behavioral intervention evidently enhanced the level of health knowledge and satisfaction with nursing care in patients subsequent to cervical cancer resection.

**Table 2.** Comparison of health knowledge mastery and nursing satisfaction between the two groups.

| Items                       |                      | Control group (n = 96) | Intervention group (n = 110) | $\chi^2/t$ | P       |
|-----------------------------|----------------------|------------------------|------------------------------|------------|---------|
| Knowledge mastery (points)  | -                    | 71.45 ± 8.96           | 87.23 ± 9.37                 | 102.305    | < 0.001 |
| Nursing satisfaction [n(%)] | Very satisfied       | 38 (39.58)             | 63 (57.27)                   | 54.284     | 0.038   |
|                             | Basically satisfied  | 46 (47.92)             | 42 (38.18)                   |            |         |
|                             | Dissatisfied         | 12 (12.50)             | 5 (4.55)                     |            |         |
|                             | Overall satisfaction | 84 (87.50)             | 105 (95.45)                  |            |         |

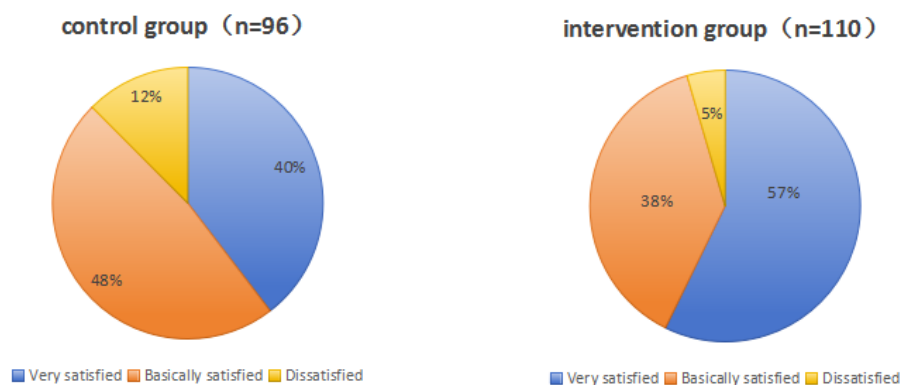


**Figure 1.** Nursing satisfaction in both groups.

### 3.2. Comparison of psychological state between the two groups

Prior to the intervention, there were no statistically significant variances in SAS and SDS scores between the two groups ( $P > 0.05$ ). After 8 weeks of intervention with different nursing care plans, the psychological states of both groups improved compared to their pre-intervention states. The intervention group exhibited SAS and SDS scores of ( $42.65 \pm 4.61$ ) and ( $44.93 \pm 6.22$ ), respectively, which were lower than those of the control group at the same time point, with the variances containing statistical significance ( $P < 0.05$ ). Refer to **Table 3**. This confirmed that, vis-à-vis conventional nursing measures, comprehensive mindfulness-based cognitive behavioral interventions were more effective in mitigating postoperative anxiety and depression and alleviating poor psychological states.

**Table 3.** Comparison of psychological states pre- and post-intervention between the two groups (points,  $\bar{x} \pm s$ ).

| Psychological states |                   | Control group (n = 96) | Intervention group (n = 110) | t      | P       |
|----------------------|-------------------|------------------------|------------------------------|--------|---------|
| SAS                  | Pre-intervention  | 59.46 ± 5.11           | 60.11 ± 5.94                 | 0.836  | 0.404   |
|                      | Post-intervention | 49.88 ± 5.02*          | 42.65 ± 4.61*                | 10.773 | < 0.001 |
| SDS                  | Pre-intervention  | 61.77 ± 6.38           | 61.38 ± 5.73                 | 0.462  | 0.644   |
|                      | Post-intervention | 47.65 ± 6.19*          | 44.93 ± 6.22*                | 3.138  | 0.002   |

Note: Compared with pre-intervention levels within the same group, \*:  $P < 0.05$ .

### 3.3. Comparison of sentence lengths between two groups of patients

In our study, we examined the average sentence length and language content of two groups of patients. As shown in **Table 4**, there was no significant difference in the average sentence length between the two groups before the intervention. After the intervention, the average sentence length for both groups increased compared to before the intervention. In the control group, the increase in average sentence length was not significant, but in the intervention group, the sentence length increased more significantly compared to the control group, with a notable difference ( $P < 0.05$ ). Furthermore, regarding the language content of the patients, we found that the control group tended to use more negative adjectives and first-person pronouns, whereas the intervention group used such language content less frequently.

**Table 4.** Comparison of average sentence length before and after intervention in two groups.

|                   | Control group ( $n = 96$ ) | Intervention group ( $n = 110$ ) | $t$    | $P$       |
|-------------------|----------------------------|----------------------------------|--------|-----------|
| Pre-intervention  | $2.46 \pm 0.91$            | $2.51 \pm 0.94$                  | 0.387  | 0.699     |
| Post-intervention | $2.54 \pm 0.56$            | $3.89 \pm 1.01^*$                | 11.627 | $< 0.001$ |

Note: Compared with pre-intervention levels within the same group, \*:  $P < 0.05$ .

### 3.4. Comparison of sexual function levels between the two groups

Preceding the intervention, no statistically significant variances were discovered in scores for sexual desire, sexual arousal and orgasm, vaginal lubrication and dyspareunia, and sexual satisfaction between the two cohorts ( $P > 0.05$ ). Following the intervention, scores for various sexual functions in both groups vigorously decreased. The intervention group displayed scores of ( $6.98 \pm 0.61$ ), ( $27.15 \pm 2.02$ ), ( $28.79 \pm 2.05$ ), and ( $11.94 \pm 1.01$ ), respectively, which were conspicuously higher than those within the control group, and the differences contained statistical significance ( $P < 0.05$ ), as displayed in **Table 5**. This demonstrated that the use of a comprehensive mindfulness-based cognitive behavioral intervention nursing plan was more efficacious in elevating postoperative sexual function levels compared with conventional nursing plans.

**Table 5.** Comparison of sexual function levels between the two groups (points,  $\bar{x} \pm s$ ).

| Psychological states                |                   | Control group ( $n = 96$ ) | Intervention group ( $n = 110$ ) | $t$    | $P$       |
|-------------------------------------|-------------------|----------------------------|----------------------------------|--------|-----------|
| Sexual desire                       | Pre-intervention  | $7.88 \pm 0.62$            | $7.85 \pm 0.73$                  | 0.315  | 0.753     |
|                                     | Post-intervention | $5.41 \pm 0.55^*$          | $6.98 \pm 0.61^*$                | 19.287 | $< 0.001$ |
| sexual arousal and orgasm           | Pre-intervention  | $29.45 \pm 2.41$           | $29.66 \pm 1.86$                 | 0.705  | 0.482     |
|                                     | Post-intervention | $22.03 \pm 2.16^*$         | $27.15 \pm 2.02^*$               | 17.570 | $< 0.001$ |
| Vaginal lubrication and dyspareunia | Pre-intervention  | $29.33 \pm 1.85$           | $29.36 \pm 1.94$                 | 0.113  | 0.910     |
|                                     | Post-intervention | $25.14 \pm 2.26^*$         | $28.79 \pm 2.05^*$               | 12.153 | $< 0.001$ |
| Sexual satisfaction                 | Pre-intervention  | $13.62 \pm 1.03$           | $13.55 \pm 1.21$                 | 0.444  | 0.658     |
|                                     | Post-intervention | $9.38 \pm 0.84^*$          | $11.94 \pm 1.01^*$               | 19.610 | $< 0.001$ |

Note: Compared with pre-intervention levels within the same group, \*:  $P < 0.05$ .

### 3.5. Comparison of mindfulness cognition levels between the two groups

Prior to the intervention, no noticeable difference was determined in MAAS scores between the two groups ( $P > 0.05$ ). Subsequent to the intervention, the control group scored ( $51.33 \pm 6.03$ ) on the MAAS, whereas the intervention group scored ( $67.38 \pm 6.47$ ). The intervention group displayed dramatically heightened scores compared to the control group, with the variance being statistically significant ( $P < 0.05$ ). Refer to **Figure 2**. Our outcomes suggested that comprehensive mindfulness-based cognitive behavioral interventions vigorously drove up patients' mindfulness cognition levels.

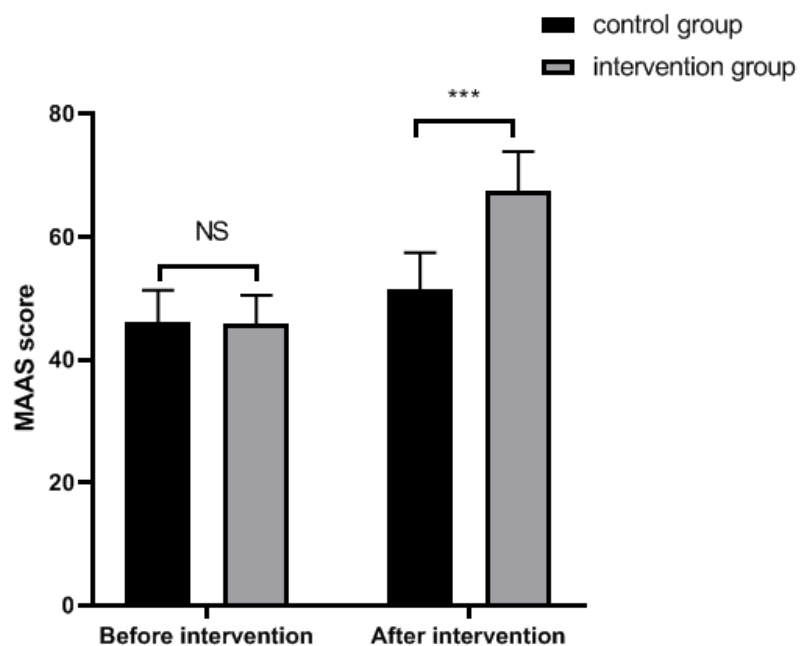


**Figure 2.** Comparison of mindfulness cognition levels between the two groups.

### 3.6. Comparison of quality of life between the two groups

Prior to the intervention, there were no statistically significant differences observed between the two groups in terms of physiological status, social and family dynamics, emotional well-being, and functional status ( $P > 0.05$ ). Subsequent to the intervention, both groups showed improvements in quality of life compared to pre-intervention levels ( $P < 0.05$ ). No statistically significant variance was identified in social/family status scores between the two patient cohorts ( $P > 0.05$ ). The intervention group had scores of ( $16.42 \pm 2.11$ ) for physiological status, ( $18.56 \pm 1.89$ ) for social/family status, ( $14.88 \pm 1.23$ ) for emotional well-being, and ( $18.92 \pm 1.55$ ) for functional status, all notably higher than those within the control group, with differences holding statistical significance ( $P < 0.05$ ), as exhibited in **Table 6**. This denoted that comprehensive mindfulness-based cognitive behavioral interventions, versus conventional nursing interventions, displayed a more pronounced effect on enhancing patients' quality of life.

**Table 6.** Comparison of quality of life between the two groups (points,  $\bar{x} \pm s$ ).

| Quality of life      |                   | Control group (n = 69) | Intervention group (n = 77) | t      | P       |
|----------------------|-------------------|------------------------|-----------------------------|--------|---------|
| Physiological status | Pre-intervention  | 12.55 ± 1.68           | 12.59 ± 1.95                | 0.132  | 0.895   |
|                      | Post-intervention | 13.13 ± 1.57*          | 16.42 ± 2.11*               | 10.588 | < 0.001 |
| Social/family status | Pre-intervention  | 19.58 ± 1.92           | 20.22 ± 3.05                | 1.497  | 0.137   |
|                      | Post-intervention | 18.14 ± 1.65*          | 18.56 ± 1.89*               | 1.423  | 0.157   |
| Emotional well-being | Pre-intervention  | 11.76 ± 1.23           | 12.03 ± 1.16                | 1.365  | 0.175   |
|                      | Post-intervention | 12.45 ± 1.05*          | 14.88 ± 1.23*               | 12.763 | < 0.001 |
| Functional status    | Pre-intervention  | 11.67 ± 2.29           | 12.08 ± 1.07                | 1.409  | 0.161   |
|                      | Post-intervention | 16.05 ± 1.37*          | 18.92 ± 1.55*               | 11.796 | < 0.001 |

Note: Compared with pre-intervention levels within the same group, \*:  $P < 0.05$ .

#### 4. Discussion

Currently, the standard treatments for cervical cancer encompass radical hysterectomy, radiotherapy, chemotherapy, or a combination of various methods, especially for early-stage cervical cancer patients [25]. Nevertheless, a substantial number of patients experience severe gastrointestinal, bladder, and sexual function disorders following treatment and surgery, accompanied by inhibited sexual desire, vaginal dryness, dyspareunia, anxiety, and depression [26,27]. Since many cervical cancer patients are relatively young and still have sexual needs, these issues exert a considerable impact on their normal lives. Postoperative quality of life for cervical cancer patients has become increasingly important, and treatment outcomes are not the sole clinical evaluation criteria; helping patients restore ideal sexual function is also pivotal [28]. Generally, cervical cancer patients seldom seek advice from doctors or nurses about sexual issues, rarely resort to the internet or other resources to learn about related knowledge, or discuss postoperative sexual problems with partners or spouses, particularly in relatively conservative countries like China. In such cases, healthcare providers should place greater emphasis on sexual and psychological issues for cervical cancer patients and offer psychological counseling on sexual health to boost patients' postoperative quality of life [10]. Cognitive Behavioral Therapy (CBT), Mindfulness-Based Stress Reduction (MBSR), and Psychodynamic Therapy, among others, are widely used as adjunctive treatments for various diseases. These therapies not only help patients better cope with the psychological stress that diseases bring, but also improve their quality of life. In our study, we specifically focused on the application of Mindfulness-Integrated Cognitive Behavioral Intervention (MICBI) in patients who have undergone early-stage cervical cancer surgery.

In routine nursing care, staff typically provide health guidance only on the physiological symptoms and dietary and medication knowledge occurring during the perioperative period, often neglecting changes in the patient's psychological state and failing to implement timely and effective psychological interventions for uncomfortable emotions. Mindfulness emphasizes maintaining a focus on the present moment without judgment of the current state or undue concern about one's illness [29]. It guides patients how to cope with stress and pain while maintaining an open and accepting attitude. Through mindfulness practices, patients can regulate their

emotions, thereby strengthening their emotional regulation abilities and cognitive [30]. Cognitive behavioral interventions involve replacing irrational beliefs with rational ones after individuals recognize them, helping them reconstruct their cognitive structures to eliminate uncomfortable emotions [31]. Clinical trials have validated that MBCT is efficacious in treating mental disorders such as depression, insomnia, and anxiety [32].

The findings of this study confirmed that following nurse-led MBCT interventions, patients in the intervention cohort exhibited dramatically higher levels of health knowledge and greater satisfaction with care compared with the control group ( $P < 0.05$ ). Their sexual function significantly improved, and their anxiety and depression were notably alleviated, as evidenced by lowered SAS and SDS scores, heightened MAAS scores, and an overall enhancement in quality of life. This demonstrated that, vis-à-vis conventional nursing methods, comprehensive mindfulness-based cognitive behavioral interventions conspicuously improved health knowledge, nursing satisfaction, sexual function, postoperative psychological state, and quality of life for patients undergoing cervical cancer resection surgery. The reasons for these improvements may be that comprehensive mindfulness-based cognitive behavioral interventions combine positive psychological theories with sexual health knowledge to provide targeted interventions. This approach changes patients' perception of emotions, pain, and thoughts, augments their understanding of sexual health, and strengthens their resilience and ability to handle stimuli. It also helps patients and their partners adapt to and manage sexual dysfunction post-cancer treatment [33], encouraging them to view uncomfortable events with a more objective attitude and less subjective emotional bias. This fundamentally changes patients' thinking patterns and the uncomfortable emotions associated with them, thereby ameliorating psychological stress, improving regulating abilities, achieving a harmonious sexual life, increasing care satisfaction, and enhancing postoperative quality of life and overall well-being [34].

Furthermore, mindfulness training helps patients eliminate uncomfortable psychological states, foster a mindfulness-based thinking mode, further mitigate adverse psychological effects, boost immune function, promote postoperative recovery, and attenuate physical pain and mental burden [35]. These results align with findings from earlier research. Brotto et al. [36] have discovered that intermittent mindfulness-based cognitive behavioral interventions can effectively improve sexual function, and sexual response, and abate sexual distress in survivors of endometrial or cervical cancer, dramatically alleviating sexual-related suffering. Additionally, Gorman et al. [37] have pointed out that mindfulness interventions for breast cancer and cervical cancer survivors can evidently ameliorate sexual dysfunction and enhance sexual health, with both qualitative and quantitative outcomes supporting the feasibility, acceptability, and appropriateness of mindfulness interventions. Yang et al. [38] have also reported in a meta-analysis of randomized controlled trials that mindfulness-based stress reduction alleviates anxiety and depression in postoperative cervical cancer patients, providing reliable evidence for non-pharmacological interventions for cervical cancer survivors. These studies, along with our findings, demonstrate that comprehensive mindfulness-based cognitive behavioral interventions may become an important perioperative management strategy for

cervical cancer surgical patients.

In summary, through systematic intervention, we evaluated the impact of Mindfulness-Integrated Cognitive Behavioral Intervention (MICBI) on the sexual function, psychological state, and quality of life of patients who underwent cervical cancer surgery. The results indicate that MICBI not only significantly improved the psychological state of the patients but also contributed to enhancing their quality of life and restoring sexual function. Overall, the importance of physical and mental health is increasingly emphasized in modern healthcare, and the role of psychological therapies in disease management is gaining more recognition. Our research further confirms the significant role of psychological interventions in improving the overall health status of patients and provides new insights and methods for clinical practice. However, our study also has limitations. Being a single-center study, only selected survivors could participate, which restricts the generalizability of the findings. Future research should focus on developing a multi-center online treatment management model to address this limitation.

## 5. Conclusion

To sum up, implementing comprehensive mindfulness-based cognitive behavioral interventions for patients undergoing cervical cancer resection can assist patients in cultivating mindfulness, alleviating uncomfortable emotions, enhancing their grasp of health knowledge, sustaining postoperative sexual function, and boosting nursing satisfaction. Additionally, it can remarkably improve postoperative psychological status and quality of life, demonstrating considerable clinical efficacy and warranting promotion in clinical practice.

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**Ethical approval:** The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Capital Medical University Electric Power Teaching Hospital (protocol code: 2024033010201; date of approval: March 2024). All participants have signed the informed consent forms.

**Availability of data and materials:** The datasets used during the current study are available from the corresponding author upon reasonable request.

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## References

1. Buskwofie A, David-West G, Clare CA. A Review of Cervical Cancer: Incidence and Disparities. *J Natl Med Assoc.* 2020; 112(2): 229-232.
2. Sharma S, Deep A, Sharma AK. Current Treatment for Cervical Cancer: An Update. *Anticancer Agents Med Chem.* 2020;

- 20(15): 1768-1779.
3. Pimple SA, Mishra GA. Global strategies for cervical cancer prevention and screening. *Minerva Ginecol.* 2019; 71(4): 313-320.
4. Poddar P, Maheshwari A. Surgery for cervical cancer: consensus & controversies. *Indian J Med Res.* 2021; 154(2): 284-292.
5. Ware RA, van Nagell JR. Radical hysterectomy with pelvic lymphadenectomy: indications, technique, and complications. *Obstet Gynecol Int.* 2010; 2010:587610.
6. Lykke R, Blaakær J, Ottesen B, et al. Incidence of pelvic organ prolapse repair subsequent to hysterectomy: a comparison between radical hysterectomy and total abdominal hysterectomy. *Int Urogynecol J.* 2017; 28(5): 745-749.
7. Palaia I, Santangelo G, Caruso G, et al. Long-term Quality of Life and Sexual Function After Neoadjuvant Chemotherapy and Radical Surgery for Locally Advanced Cervical Cancer. *J Sex Med.* 2022; 19(4): 613-619.
8. Mishra N, Singh N, Sachdeva M, et al. Sexual Dysfunction in Cervical Cancer Survivors: A Scoping Review. *Womens Health Rep (New Rochelle).* 2021; 2(1): 594-607.
9. de Morais Siqueira T, Derchain S, Juliato CRT, et al. Vaginal stenosis in women with cervical or endometrial cancer after pelvic radiotherapy: a cross-sectional study of vaginal measurements, risk for sexual dysfunction and quality of life. *Int Urogynecol J.* 2022; 33(3): 637-649.
10. Shi Y, Cai J, Wu Z, et al. Effects of a nurse-led positive psychology intervention on sexual function, depression and subjective well-being in postoperative patients with early-stage cervical cancer: A randomized controlled trial. *Int J Nurs Stud.* 2020; 111: 103768.
11. Dunne JD, Thompson E, Schooler J. Mindful meta-awareness: sustained and non-propositional. *Curr Opin Psychol.* 2019; 28: 307-311.
12. Nissen ER, O'Connor M, Kaldo V, et al. Internet-delivered mindfulness-based cognitive therapy for anxiety and depression in cancer survivors: A randomized controlled trial. *Psychooncology.* 2020; 29(1): 68-75.
13. Li Y, Nazari N, Sadeghi M. Internet delivered, non-inferiority, two-arm, assessor-blinded intervention comparing mindfulness-based stress reduction and cognitive-behavioral treatment for insomnia: a protocol study for a randomized controlled trial for nursing staff with insomnia. *Trials.* 2022; 23(1): 1020.
14. McCloy K, Hughes C, Dunwoody L, et al. Evaluating the effectiveness of mindfulness alone compared to exercise and mindfulness on fatigue in women with gynaecology cancer (GEMS): Protocol for a randomised feasibility trial. *PLoS One.* 2023; 18(10): e0278252.
15. Zhou B, Gek Mui L, Li J, et al. The impact of mindfulness-based interventions on the experiences of cancer patients: A qualitative meta-synthesis. *Patient Educ Couns.* 2024; 127: 108353.
16. Lee SH, Cho SJ. Cognitive Behavioral Therapy and Mindfulness-Based Cognitive Therapy for Depressive Disorders. *Adv Exp Med Biol.* 2021; 1305: 295-310.
17. Mo Y, Lei Z, Chen M, et al. Effects of self-help mindfulness-based cognitive therapy on mindfulness, symptom change, and suicidal ideation in patients with depression: a randomized controlled study. *Front Psychol.* 2023; 14: 1287891.
18. Nie X. Effects of Network-based Positive Psychological Nursing Model on Negative Emotions, Cancer-related Fatigue, and Quality of Life in Cervical Cancer Patients with Post-operative Chemotherapy. *Ann Ital Chir.* 2024; 95(4): 542-551.
19. Zung WW. A rating instrument for anxiety disorders. *Psychosomatics.* 1971; 12(6): 371-379.
20. Zung WW. A Self-Rating Depression Scale. *Arch Gen Psychiatry.* 1965; 12: 63-70.
21. Rosen R, Brown C, Heiman J, et al. The Female Sexual Function Index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function. *J Sex Marital Ther.* 2000 Apr-Jun; 26(2): 191-208.
22. Uludag K. Exploring the Association Between Textual Parameters and Psychological and Cognitive Factors. *Psychol Res Behav Manag.* 2024; 17: 1139-1150.
23. Brown KW, Ryan RM. The benefits of being present: mindfulness and its role in psychological well-being. *J Pers Soc Psychol.* 2003; 84(4): 822-848.
24. Brucker PS, Yost K, Cashy J, et al. General population and cancer patient norms for the Functional Assessment of Cancer Therapy-General (FACT-G) [published correction appears in *Eval Health Prof.* 2005; 28(3): 370.
25. Monk BJ, Enomoto T, Kast WM, et al. González-Martín A. Integration of immunotherapy into treatment of cervical cancer: Recent data and ongoing trials. *Cancer Treat Rev.* 2022; 106: 102385.
26. Sakuragi N, Murakami G, Konno Y, et al. Nerve-sparing radical hysterectomy in the precision surgery for cervical cancer. *J Gynecol Oncol.* 2020; 31(3): e49.

27. Zullo MA, Mancini N, Angioli R, et al. Vesical dysfunctions after radical hysterectomy for cervical cancer: a critical review. *Crit Rev Oncol Hematol*. 2003; 48(3): 287-93.
28. Cianci S, Tarascio M, Arcieri M, et al. Post Treatment Sexual Function and Quality of Life of Patients Affected by Cervical Cancer: A Systematic Review. *Medicina (Kaunas)*. 2023; 59(4): 704.
29. Zollars I, Poirier TI, Pailden J. Effects of mindfulness meditation on mindfulness, mental well-being, and perceived stress. *Curr Pharm Teach Learn*. 2019; 11(10): 1022-1028.
30. Lenze EJ, Voegtle M, Miller JP, et al. Effects of Mindfulness Training and Exercise on Cognitive Function in Older Adults: A Randomized Clinical Trial. *JAMA*. 2022; 328(22): 2218-2229.
31. Reynolds GO, Willment K, Gale SA. Mindfulness and Cognitive Training Interventions in Mild Cognitive Impairment: Impact on Cognition and Mood. *Am J Med*. 2021; 134(4): 444-455.
32. van der Velden AM, Scholl J, Elmholt EM, et al. Mindfulness Training Changes Brain Dynamics During Depressive Rumination: A Randomized Controlled Trial. *Biol Psychiatry*. 2023; 93(3): 233-242.
33. Li LP, Rao DF, Chen XX, et al. The impact of hospital-family integrated continuation nursing based on information technology on patients' unhealthy mood, family function and sexual function after cervical cancer surgery. *Medicine (Baltimore)*. 2023; 102(16): e33504.
34. Knoerl R, Mazzola E, Woods H, et al. Exploring the Feasibility of a Mindfulness-Music Therapy Intervention to Improve Anxiety and Stress in Adolescents and Young Adults with Cancer. *J Pain Symptom Manage*. 2022 Apr;63(4): e357-e363.
35. Liu W, Liu J, Ma L, et al. Effect of mindfulness yoga on anxiety and depression in early breast cancer patients received adjuvant chemotherapy: a randomized clinical trial. *J Cancer Res Clin Oncol*. 2022; 148(9): 2549-2560.
36. Brotto LA, Erskine Y, Carey M, et al. A brief mindfulness-based cognitive behavioral intervention improves sexual functioning versus wait-list control in women treated for gynecologic cancer. *Gynecol Oncol*. 2012; 125(2): 320-5.
37. Gorman JR, Drizin JH, Al-Ghadban FA, et al. Adaptation and feasibility of a multimodal mindfulness-based intervention to promote sexual health in cancer survivorship. *Transl Behav Med*. 2021; 11(10): 1885-1895.
38. Yang X, Huang L, Li C, et al. The effectiveness of mindfulness-based stress reduction intervention on alleviating anxiety and depression in postoperative patients with cervical cancer: A protocol for systematic review and meta-analysis. *Medicine (Baltimore)*. 20224; 101(5): e28706.

Article

# Leveraging nature-based tourism for cancer recovery: Enhancing psychological well-being and sustainable wellness tourism in Yunnan, China

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**Abstract:** This research explores the role of nature-based tourism as an innovative approach in tourism management for enhancing the psychological well-being of cancer survivors and their families in Yunnan, China. Given the increasing need for holistic and sustainable tourism products, this study investigates how Yunnan's unique natural landscapes and rich cultural heritage can contribute to emotional recovery and well-being. Utilizing a combination of in-depth interviews, surveys, and participant observation, the study provides insights into how nature-based tourism helps reduce stress, promotes emotional rejuvenation, and strengthens family bonds for cancer survivors. Findings highlight that culturally integrated wellness experiences, including traditional healing practices and family-inclusive tourism activities, have significant potential for promoting holistic recovery. The research also identifies key barriers such as financial constraints, physical limitations, and accessibility issues, providing recommendations to address these challenges and enhance the inclusivity of tourism offerings. This study contributes to the field of tourism management by demonstrating how wellness tourism can evolve to serve vulnerable populations while promoting sustainable and community-centered tourism practices. Ultimately, it aims to position Yunnan as a leading destination for therapeutic tourism, combining health, culture, and sustainability.

**Keywords:** wellness tourism; tourism management; nature-based tourism; cancer recovery; psychological well-being; sustainable tourism; family bonding; traditional Chinese medicine; cultural tourism; Yunnan

## 1. Introduction

### 1.1. Background and context

Cancer remains one of the most significant global health challenges of the 21st century, impacting millions of individuals and their families worldwide. According to the World Health Organization (WHO), cancer is responsible for nearly 10 million deaths annually, accounting for approximately one in six deaths globally. While advancements in medical treatments such as chemotherapy, radiation, and immunotherapy have greatly improved life expectancy and recovery rates, the psychosocial and emotional burden of cancer remains profound. Cancer patients often face immense psychological stress, manifesting as anxiety, depression, fear of recurrence, and emotional exhaustion. This burden extends beyond the patients themselves, affecting their families, who may also experience helplessness, emotional fatigue, and financial strain [1].

In recent years, healthcare professionals have increasingly recognized the importance of addressing the psychosocial dimensions of cancer. It is now widely acknowledged that holistic cancer care must encompass not only the biological and medical aspects of treatment but also the mental, emotional, and social needs of patients. This paradigm shift has led to the exploration of innovative interventions that support the mental well-being of cancer patients, alongside their physical health. Among these interventions, nature-based tourism has emerged as a promising therapeutic approach to enhance psychological well-being [2].

Nature-based tourism, often referred to as eco-tourism or wellness tourism, emphasizes the therapeutic use of natural landscapes and environments as spaces for relaxation, healing, and rejuvenation. Research has shown that exposure to natural settings—such as mountains, forests, lakes, and rivers—can significantly reduce stress levels, promote emotional recovery, and foster a sense of peace. For cancer patients facing physical and emotional challenges, nature-based tourism offers a respite from the clinical environment of hospitals and treatment centers, providing a more holistic healing experience. Additionally, nature-based tourism allows families to reconnect in tranquil settings, strengthening emotional bonds and providing much-needed psychological support [3].

In China, the province of Yunnan stands out as an ideal location to explore the therapeutic potential of nature-based tourism for cancer patients and their families. Yunnan is known for its diverse landscapes, including snow-capped mountains, verdant forests, serene lakes, and a rich cultural heritage. The natural beauty and cultural richness of the province make it a popular destination for tourists seeking both adventure and peace. Moreover, Yunnan has a long-standing tradition of integrating nature with wellness practices, such as traditional Chinese medicine, herbal therapies, and mindfulness techniques. These factors position Yunnan as a uniquely suitable environment for exploring how nature-based tourism can contribute to the psychological well-being of cancer survivors and their families [4].

## **1.2. Purpose of the study**

The primary purpose of this study is to explore how nature-based tourism in Yunnan can provide therapeutic benefits for cancer survivors and their families. Nature-based tourism offers cancer survivors an opportunity for psychological recovery by immersing them in restorative natural environments. Studies indicate that nature-based tourism can enhance self-identity and self-esteem, contributing to emotional resilience and mental recovery in cancer patients. This highlights the role of inclusive tourism that acknowledges the unique needs of cancer survivors and facilitates their recovery by providing normalizing travel experiences [5].

In addition, the study aims to examine how family engagement in nature-based tourism can alleviate emotional stress among caregivers and family members. The effects of nature-based tourism extend beyond the individual, with research demonstrating that families dealing with the emotional burden of cancer can benefit from shared experiences in nature. By providing a “mental sanctuary”, these environments offer relief from the emotional exhaustion and stress associated with caregiving [6].

The objectives of the study include investigating how nature-based tourism in Yunnan contributes to the psychological well-being of cancer survivors, exploring the role of family involvement, and examining the potential integration of nature-based tourism into holistic cancer care practices. Nature-based tourism has been shown to have transformative wellness outcomes, which can foster emotional recovery for both cancer survivors and their caregivers [7]. This interdisciplinary approach aims to open new pathways for improving the quality of life for cancer patients while promoting sustainable tourism practices in Yunnan [8].

### **1.3. Significance of the study**

This study is particularly significant for Chinese communities and the broader East Asian cultural context, where health and well-being are traditionally viewed holistically, emphasizing the interconnectedness of the body, mind, and environment. Nature has long been considered a powerful healing force, a principle deeply embedded in traditional Chinese medicine and philosophies such as Taoism and Confucianism. In these traditions, harmony between humans and nature is crucial for maintaining good health. Therefore, the integration of nature into healing practices aligns with these cultural values, making nature-based tourism an appealing option for cancer patients and their families in China. In particular, the natural environments of regions like Yunnan, with its rich biodiversity and cultural heritage, offer therapeutic potential by providing peaceful spaces for physical and emotional recovery. For cancer survivors, these natural settings offer more than just scenic beauty—they serve as healing environments that facilitate mental restoration and emotional resilience. Nature-based tourism can thus be seen as not only a recreational activity but a holistic form of therapy that supports the mental, emotional, and social aspects of cancer recovery [9].

Furthermore, the significance of this study extends to the field of tourism management by demonstrating how tourism can transcend its conventional role as an economic driver and evolve into a tool for health and well-being. In recent years, wellness tourism has emerged as a niche market within the broader tourism industry, particularly in China. Studies show that wellness tourism, which emphasizes health and well-being through engagement with natural and cultural resources, can provide therapeutic benefits to vulnerable populations such as cancer survivors. The integration of wellness practices into tourism experiences, such as mindfulness, healthy diets, and physical activity, has been shown to improve the mental and physical well-being of participants. This research contributes to the growing body of literature on wellness tourism by examining how tailored tourism experiences can cater to the unique psychological needs of cancer survivors and their caregivers [10]. By focusing on the recovery process through tourism, this study offers practical insights for tourism operators, healthcare providers, and policymakers, encouraging them to collaborate in developing wellness-oriented tourism products that promote mental health recovery. This can lead to the creation of tourism programs specifically designed for individuals undergoing cancer recovery, which could set new standards for wellness tourism in the country.

## **Research gap**

Despite the growing body of research on wellness tourism and its role in health promotion, particularly for mental well-being, there remains a significant gap in understanding how nature-based tourism can be specifically integrated into cancer recovery frameworks. Existing international studies have predominantly focused on the general benefits of nature exposure for stress relief and mental health recovery, but few have examined the unique needs of cancer survivors, especially in the context of family-centered recovery and community-based tourism interventions [11]. Moreover, much of the current literature is centered on Western countries, where cultural practices and beliefs about health and nature differ substantially from those in East Asia. There is a lack of research that considers the influence of traditional Chinese values, such as the holistic integration of body, mind, and nature, on cancer recovery through nature-based tourism.

This study aims to fill this gap by exploring how nature-based tourism in Yunnan can be tailored to support the psychological well-being of cancer survivors and their families within the Chinese cultural context. By investigating the therapeutic potential of natural environments in China and their alignment with traditional health practices, this research offers a culturally relevant approach to cancer recovery. Furthermore, the study's focus on family involvement in nature-based tourism as part of the recovery process provides a new perspective that addresses the psychosocial needs of not only patients but also caregivers, which has been underexplored in previous research [12].

The broader implications of this study for cancer care are also noteworthy. It highlights the importance of addressing the psychosocial aspects of cancer recovery, which are often overlooked in traditional medical treatments. By demonstrating the potential therapeutic benefits of nature-based tourism, this research encourages healthcare institutions to integrate non-traditional interventions into cancer treatment plans. Nature-based tourism, with its focus on relaxation and emotional rejuvenation, offers a complementary approach to medical treatment, helping patients cope with the psychological stress and emotional fatigue associated with cancer. For instance, wellness tourism destinations like Bama in China have been recognized for their ability to foster recovery through sociability and engagement with natural landscapes, offering cancer patients and their families a chance to regain a sense of normalcy and emotional balance [13].

Additionally, this study's findings have implications for promoting healthy lifestyles among cancer survivors. Research shows that engagement in wellness tourism can lead to positive lifestyle changes, such as improved dietary habits and increased physical activity, both of which are critical for cancer recovery and prevention. Programs like Be Well Communities™, which focus on mobilizing communities to promote wellness, have demonstrated the effectiveness of evidence-based interventions in improving health outcomes, particularly in preventing cancer and supporting recovery [14]. By integrating similar wellness-oriented approaches into tourism, this study provides a framework for enhancing the quality of life for cancer survivors, while also promoting sustainable tourism practices in regions like

Yunnan, where nature-based tourism can play a dual role in health promotion and environmental conservation.

In conclusion, this study is both timely and relevant, as it addresses the growing need for holistic approaches to cancer care in China. By exploring the intersection of tourism and healthcare, this research contributes to a deeper understanding of how nature-based tourism can enhance the psychological well-being of cancer survivors and their families, while also promoting sustainable tourism practices. The findings of this study could inspire future research on the role of natural environments in improving the quality of life for individuals facing chronic illnesses, potentially expanding the scope of wellness tourism to include more diverse and vulnerable populations.

## **2. Literature review**

### **2.1. Tourism and mental health**

Tourism, especially in natural environments, has been widely recognized for its restorative effects on mental health. Restorative environments, which are often found in nature, promote recovery from mental fatigue, reduce stress, and foster a sense of well-being. Studies show that nature tourism contributes to the improvement of cognitive function, emotional resilience, and mood, making it particularly beneficial for individuals undergoing recovery from serious health conditions like cancer [15]. Additionally, multisensory experiences in tourism, particularly those in historical and cultural contexts, have been found to enhance mental restoration by fostering place attachment and providing a perceived restorative environment [16].

A significant aspect of nature-based tourism is its ability to foster mindfulness and emotional recovery. Mindfulness, when practiced in natural settings, enhances the therapeutic effects of the environment, leading to improvements in mood, reduced symptoms of depression and anxiety, and greater overall psychological resilience [9]. For cancer survivors, who often face emotional and cognitive challenges during recovery, the benefits of nature tourism are substantial. It offers an escape from the stressors of daily life and provides a conducive environment for healing and reflection.

Ecotherapy, a practice that combines nature exposure with therapeutic activities, has also demonstrated positive outcomes for mental health. Engaging with nature through hiking, forest bathing, or simply spending time outdoors has been shown to lower cortisol levels, decrease symptoms of stress, and elevate feelings of calmness and happiness [10]. This practice is especially valuable for individuals recovering from cancer, who may be dealing with chronic anxiety and stress. By participating in nature-based tourism, these individuals can experience both physical and psychological benefits.

### **2.2. Cancer and psychosocial well-being**

Cancer patients and their families face numerous psychosocial challenges throughout the treatment and recovery process. Anxiety, depression, fear of recurrence, and emotional exhaustion are common among cancer patients, often

persisting even after treatment has concluded. These psychological burdens extend to family members and caregivers, who experience significant stress as they provide emotional and practical support [17].

Interventions aimed at improving the psychosocial well-being of cancer patients have traditionally focused on counseling, cognitive-behavioral therapy, and support groups. However, there is a growing interest in complementary therapies, including nature-based interventions, that address the emotional and psychological impacts of cancer. Nature-based activities, such as eco-therapy, have been shown to reduce anxiety, improve mood, and enhance the overall quality of life for cancer survivors [18].

Family involvement in the recovery process is essential, and nature-based tourism offers a unique opportunity to strengthen familial bonds while addressing emotional fatigue. Research suggests that cancer survivors benefit from shared experiences in natural environments, which provide not only emotional relief but also a sense of normalcy and connection [19]. Programs that integrate family-centered approaches in natural settings, such as retreats or group therapy in nature, can significantly improve the mental health of both patients and caregivers.

### **2.3. East Asian cultural perspectives on healing**

In East Asian cultures, particularly in China, health is traditionally viewed as a holistic concept, with the body, mind, and spirit seen as interconnected. This belief is rooted in traditional Chinese medicine (TCM), which emphasizes the importance of balance and harmony between individuals and their environment. Nature plays a central role in TCM practices, with natural settings such as mountains, rivers, and forests viewed as essential for promoting health and well-being. Practices like qi gong and tai chi, which are often performed outdoors, align with this cultural understanding of health by enhancing the flow of energy (qi) and promoting mental clarity [20].

Family is another core element of East Asian approaches to health. In Chinese culture, caregiving is often viewed as a family responsibility, and the well-being of the individual is closely tied to the well-being of the family. Cancer treatment, in particular, involves the active participation of family members in caregiving roles. This family-centered approach to health care is evident in the ways that healing practices often involve the entire family unit [21].

The integration of nature-based tourism into cancer recovery is particularly relevant in this cultural context. By participating in tourism that incorporates elements of mindfulness, traditional Chinese healing practices, and nature, cancer survivors can experience a form of therapy that resonates with their cultural values. This approach not only supports mental and emotional recovery but also aligns with traditional beliefs about the role of nature in health and healing.

### **2.4. Yunnan's potential as a healing destination**

Yunnan Province, located in southwestern China, is well known for its stunning natural landscapes, cultural diversity, and rich biodiversity. The province's mountains, forests, lakes, and ethnic cultures make it a prime location for eco-

tourism and wellness tourism. Yunnan has long been a popular destination for tourists seeking adventure and relaxation, but in recent years, it has also gained recognition as a hub for wellness tourism [22].

Yunnan's potential as a healing destination lies in its combination of natural beauty and traditional healing practices. The province is home to a variety of traditional Chinese medicine practices, including herbal medicine and acupuncture, which can be integrated into wellness tourism experiences. These healing traditions, combined with the restorative effects of Yunnan's natural environments, offer a unique opportunity for cancer survivors to engage in tourism that supports both their physical and mental well-being [23]. The region's natural resources are not only valuable for their scenic beauty but also for their role in promoting health and well-being.

Previous research on eco-tourism in China has highlighted the socio-economic benefits of tourism in regions like Yunnan, where tourism has contributed to poverty alleviation and environmental conservation [12]. However, there is growing recognition of the potential for tourism to also play a role in health promotion. By positioning Yunnan as a destination for nature-based wellness tourism, the province can attract visitors seeking therapeutic experiences that promote healing and recovery [24].

In conclusion, Yunnan's natural and cultural resources make it an ideal location for exploring the potential of nature-based tourism to enhance the psychological well-being of cancer survivors and their families. The integration of eco-tourism with traditional healing practices offers a comprehensive approach to wellness that aligns with both cultural values and modern health needs [25].

### **3. Methodology**

#### **3.1. Research design**

This study adopts a qualitative research design to explore the perceptions of cancer survivors and their families regarding nature-based tourism in Yunnan. The qualitative approach is particularly well-suited for this research because it allows for a deep understanding of the subjective experiences, emotions, and attitudes of the participants. Through qualitative methods, the research can uncover nuanced insights into how nature-based tourism affects the psychological well-being of cancer survivors and their families.

The research will employ a combination of in-depth interviews, surveys, and observational data to gather comprehensive information from participants. In-depth interviews provide the flexibility to probe deeper into the personal experiences of cancer survivors and their families, allowing them to express their feelings and thoughts about their healing process in natural environments. Surveys will supplement the interviews by providing structured data on the broader perceptions and experiences of the participants, offering quantitative insights that can support the qualitative findings. Observational data will be gathered through direct observation of interactions between participants and natural settings during their visits to nature-based tourism sites in Yunnan, enabling the researcher to contextualize the interview and survey data within real-life experiences.

### **3.2. Data collection methods**

To gain a holistic understanding of the impact of nature-based tourism on the psychological well-being of cancer survivors and their families, the data collection will be multi-faceted, incorporating both primary and secondary data sources.

The primary data will be collected through in-depth interviews with three groups of participants: Cancer survivors, their families, and healthcare professionals. The interviews will focus on personal experiences, challenges, and perceptions of nature-based tourism as a therapeutic tool. Participants will be asked open-ended questions, allowing them to share detailed accounts of their emotional and psychological journeys. The interview process will be semi-structured to ensure that key themes are explored while allowing for flexibility in participants' responses.

Additionally, secondary data will be incorporated into the study, sourced from academic journals, research reports, and governmental tourism data. These sources will provide contextual information, such as the broader impacts of wellness tourism in China, tourism development in Yunnan, and relevant cancer care practices. By combining primary and secondary data, the research will have a strong foundation for comprehensive analysis, ensuring that the findings are not only based on personal accounts but also informed by existing literature and empirical data.

Interviews will take place in multiple locations in Yunnan, including popular nature-based tourism destinations. This location-specific data will help contextualize the therapeutic potential of Yunnan's natural settings, enabling the researcher to draw connections between the local environment and participant experiences.

In addition to qualitative interviews, surveys, and observational data, the study incorporated quantitative measures to assess psychological variables such as stress, anxiety, and depression. Standardized psychological assessments were administered to participants before and after their engagement in nature-based tourism activities.

#### **3.2.1. Quantitative assessments**

Perceived Stress Scale (PSS) [26]: A widely used instrument to measure the perception of stress. It assesses the degree to which situations in one's life are appraised as stressful.

Hospital Anxiety and Depression Scale (HADS) [27]: A validated tool used to detect states of anxiety and depression in patients, consisting of two subscales: HADS-Anxiety and HADS-Depression.

#### **3.2.2. Justification for use of scales**

The PSS and HADS were chosen for their reliability and validity in assessing psychological distress. Both scales have been translated into Chinese and validated in Chinese populations, ensuring cultural relevance and accuracy in measurement [28,29]. Utilizing these standardized instruments allowed for a quantitative evaluation of the psychological benefits of nature-based tourism, complementing the qualitative insights from interviews and surveys.

#### **3.2.3. Procedure**

Participants completed the PSS and HADS assessments at two time points:

Before engagement in nature-based tourism: Baseline measurements were taken to assess initial stress, anxiety, and depression levels.

After engagement in nature-based tourism: Follow-up assessments were conducted immediately after the tourism activities to measure any changes in psychological well-being

### **3.3. Study participants**

The study participants will be selected based on their relevance to the research questions. The primary group of participants will be cancer survivors who have engaged in nature-based tourism in Yunnan. In addition, the study will include their family members, who often play a crucial role in the emotional recovery process, and healthcare professionals involved in cancer treatment and recovery.

To ensure that the findings are representative, the participant selection will aim for diversity in terms of age, gender, and cancer stages. This approach ensures that the study captures a wide range of perspectives, reflecting the varying needs and experiences of cancer survivors at different points in their recovery journeys. Participants will be recruited through cancer support organizations, wellness tourism operators, and healthcare institutions in Yunnan.

For inclusion in the study, cancer survivors must meet specific criteria:

- **Experience with nature-based tourism:** Participants must have engaged in nature-based tourism activities during their cancer recovery process.
- **Geographical focus:** Participants must have participated in these activities in Yunnan, ensuring that the study is regionally relevant.
- **Diverse demographics:** The study will aim for a diverse group, including survivors from different age groups, genders, and cancer stages to capture varied experiences.

Additionally, tourism operators and healthcare providers involved in cancer care and wellness tourism will be interviewed to gather their perspectives on the role of nature-based tourism in supporting cancer recovery. This will help provide a more comprehensive view of how tourism and healthcare sectors can collaborate to offer holistic care.

### **3.4. Data analysis techniques**

Once the data is collected, the research will use thematic analysis as the primary method for analyzing the qualitative data. Thematic analysis is ideal for identifying common themes and patterns in participant responses, allowing the researcher to understand the shared experiences of cancer survivors and their families in relation to nature-based tourism. This method will help to pinpoint key themes such as psychological well-being, emotional resilience, the benefits of nature-based tourism, and the challenges associated with engaging in these activities during recovery.

Thematic analysis will follow a structured approach:

- 1) **Familiarization with the data:** The researcher will transcribe the interviews and survey responses and review the observational notes, ensuring a deep understanding of the data.
- 2) **Coding:** The data will be systematically coded to identify recurring themes and patterns. The codes will represent meaningful units of information related to the

study's objectives, such as stress reduction, emotional bonding within families, and the perceived restorative qualities of natural settings.

- 3) Theme development: Based on the codes, the researcher will group related data points into themes that reflect the broader concepts emerging from the data.
- 4) Reviewing and refining themes: The themes will be reviewed to ensure they accurately represent the data and are relevant to the research questions. Any redundant or overlapping themes will be merged or refined.

To assist with this process, NVivo, a qualitative data analysis software, will be used to manage and organize the large volume of data collected from interviews, surveys, and observations. NVivo will facilitate the coding process by allowing the researcher to categorize data efficiently, track connections between themes, and visualize relationships within the data.

The use of NVivo will help ensure a rigorous and systematic approach to data analysis, improving the validity and reliability of the findings. Additionally, the software's ability to manage and analyze large datasets will be critical in synthesizing insights from diverse participant groups, ensuring that the analysis reflects a comprehensive view of the role of nature-based tourism in cancer recovery.

### **3.5. Ethical considerations**

Participants provided written informed consent prior to their involvement in the study, acknowledging their voluntary participation and understanding of the research purpose. They were informed of their right to withdraw from the study at any time without any consequences. Since the research involved collecting personal experiences and opinions on nature-based tourism and psychological well-being—without any invasive procedures or medical interventions—formal ethical approval from a medical ethics board was not required. No sensitive health data, personal medical records, or work with vulnerable populations were involved.

To maintain confidentiality, all personal identifiers were removed from interview transcripts and reports. Participants' privacy was ensured throughout the data collection and analysis process, adhering to established ethical standards in qualitative research.

## **4. Results**

This chapter presents the findings of the study, incorporating data collected from interviews and surveys conducted with local cancer survivors, their families, and members of anti-cancer support groups in the community. Given that the data was gathered outside of hospital settings and with informed consent from participants, ethical considerations were duly observed in line with community research practices. The results are organized according to the thematic areas outlined: Participant demographics and sample analysis, psychological benefits of nature-based tourism, cultural and spiritual significance, challenges and barriers, and comparisons with other regions.

#### 4.1. Participant demographics and sample analysis

Understanding the demographic characteristics of the participants is fundamental to effectively contextualize the results of this study. Primary data collection was conducted through in-depth interviews and surveys targeting community-based cancer survivors, their family members, and individuals associated with local anti-cancer support groups in Yunnan.

##### 4.1.1. Sample composition

A total of 50 participants were included in the study, categorized into three main groups: Cancer survivors, family members of survivors, and active members of anti-cancer support groups. The demographic details of the participants are presented in **Table 1**. This table illustrates the breakdown of participants according to their roles, gender, age group, cultural/ethnic background, cancer stage, and educational level, which helps to provide a comprehensive understanding of the diverse population involved in the research.

**Table 1.** Demographic characteristics of participants.

| Characteristic             | Subcategory                             | Number of Participants | Percentage (%) |
|----------------------------|-----------------------------------------|------------------------|----------------|
| Role                       | Cancer Survivors                        | 30                     | 60%            |
|                            | Family Members                          | 15                     | 30%            |
|                            | Support Group Members                   | 5                      | 10%            |
| Gender                     | Male                                    | 22                     | 44%            |
|                            | Female                                  | 28                     | 56%            |
| Age Group                  | 18–30                                   | 8                      | 16%            |
|                            | 31–45                                   | 18                     | 36%            |
|                            | 46–60                                   | 16                     | 32%            |
|                            | 61 and above                            | 8                      | 16%            |
| Cultural/Ethnic Background | Han Chinese                             | 32                     | 64%            |
|                            | Ethnic Minorities (Yi, Bai, Naxi, etc.) | 18                     | 36%            |
| Cancer Stage               | Early Stage                             | 12                     | 24%            |
|                            | Mid Stage                               | 20                     | 40%            |
|                            | Late Stage                              | 18                     | 36%            |
| Education Level            | Primary Education                       | 10                     | 20%            |
|                            | Secondary Education                     | 20                     | 40%            |
|                            | Higher Education                        | 20                     | 40%            |

Source: Field data, 2024.

##### 4.1.2. Analysis of demographics

The majority of participants were cancer survivors (60%), followed by family members (30%) and support group members (10%). The presence of support group members offered valuable insights into community perspectives on cancer recovery. Female participants (56%) slightly outnumbered males (44%), possibly indicating greater involvement by women in community wellness and support activities. The most represented age groups were 31–45 years (36%) and 46–60 years (32%),

suggesting that middle-aged individuals are the most engaged in nature-based therapeutic tourism, balancing family, work, and health. A significant proportion (36%) of participants were from Yunnan's ethnic minority groups (e.g., Yi, Bai, Naxi), highlighting their deep-rooted connections to natural and cultural healing practices. Most participants were in the mid-stage (40%) or late-stage (36%) of cancer, with a smaller portion in the early stage (24%), allowing for an understanding of different needs across the stages of cancer recovery. Participants had balanced education levels, with 40% having secondary education, 40% higher education, and 20% primary education, which may correspond to greater openness to nature-based therapies. These demographic insights provide essential context for understanding how nature-based tourism can benefit cancer survivors and their families in Yunnan, considering cultural, social, and health-related factors.

#### 4.1.3. Cultural perspectives

The inclusion of participants from different cultural backgrounds enriched the study, offering diverse insights into their relationships with nature and healing practices.

**Table 2** provides a detailed breakdown of the cultural backgrounds of the study participants, highlighting the diversity within the sample. The majority of participants were Han Chinese (64%), followed by individuals from the Yi (16%), Bai (12%), and Naxi (8%) ethnic groups. This distribution reflects the cultural richness of Yunnan province, where a variety of ethnic groups coexist, each with distinct traditions and healing practices. The significant representation of ethnic minorities is crucial, as it brings in diverse cultural insights, particularly regarding traditional relationships with nature and community-based healing practices. These varied cultural backgrounds offered unique perspectives that enriched the understanding of how nature-based tourism can serve as a therapeutic tool for cancer recovery.

**Table 2.** Cultural background of participants.

| Ethnic Group | Number of Participants | Percentage (%) |
|--------------|------------------------|----------------|
| Han Chinese  | 32                     | 64%            |
| Yi           | 8                      | 16%            |
| Bai          | 6                      | 12%            |
| Naxi         | 4                      | 8%             |

Source: Field data, 2024.

Participants from ethnic minority groups often shared unique perspectives on the healing properties of nature, influenced by their traditional beliefs and practices. For example, Yi participants frequently emphasized the role of ancestral lands and natural rituals in their well-being, while Bai and Naxi individuals highlighted the importance of natural elements like water and mountains as integral to their cultural identity and healing processes. Such contributions underscored the holistic role of nature in promoting both physical and mental health across different cultural settings.

#### 4.1.4. Gender perspectives

Understanding the differing perspectives between female and male participants is essential for tailoring nature-based tourism experiences to meet their diverse needs. The key themes reported by each group are summarized in **Table 3**.

**Table 3.** Gender-based perspectives on nature-based tourism.

| Gender              | Percentage (%) | Key Emphases                                                   |
|---------------------|----------------|----------------------------------------------------------------|
| Female Participants | 56%            | Emotional Healing, Family Relationships, Spiritual Experiences |
| Male Participants   | 44%            | Physical Improvements, Stress Relief, Personal Reflection      |

These differences in gender perspectives highlight the need to offer a range of nature-based tourism options that cater to both emotional and physical aspects of healing. For example, programs for female participants might include more guided meditation or family-oriented activities, while those for male participants could feature more physically engaging or solitary reflective experiences. Recognizing and respecting these differences allows for the creation of more personalized and effective tourism programs that support diverse pathways to well-being.

#### 4.2. Psychological benefits of nature-based tourism

The psychological benefits of nature-based tourism were significant for the participants of this study. Engaging with the natural environment helped foster a sense of tranquility and provided respite from the daily stressors associated with living with cancer. The interaction with natural landscapes—such as forests, lakes, and mountains—not only helped participants improve their physical health but also promoted emotional and psychological well-being. This section delves into the psychological advantages reported by participants, supported by qualitative data from interviews that highlight their personal experiences and sentiments.

##### 4.2.1. Enhancement of psychological well-being

**Table 4.** Psychological benefits reported by participants.

| Psychological Benefit          | Number of Participants Reporting | Percentage (%) |
|--------------------------------|----------------------------------|----------------|
| Stress Reduction               | 43                               | 86%            |
| Improved Mood                  | 40                               | 80%            |
| Increased Emotional Resilience | 35                               | 70%            |
| Enhanced Self-esteem           | 32                               | 64%            |
| Reduction in Anxiety Symptoms  | 38                               | 76%            |
| Better Sleep Quality           | 30                               | 60%            |

Source: Field data, 2024.

A significant majority of participants experienced improvements in their psychological health as a result of nature-based tourism. Many participants highlighted the direct impact that Yunnan's natural landscapes had on their emotional well-being, describing feelings of stress relief, emotional rejuvenation, and overall improvements in mental health. These improvements are quantitatively

represented in **Table 4**, which summarizes the key psychological benefits reported by participants.

Participants from all age groups and cultural backgrounds noted these benefits, demonstrating the universal appeal of nature-based tourism for psychological recovery. The testimonials collected during interviews further emphasize the profound impact of nature on participants' mental well-being.

Participant testimonials:

- *"Being in the mountains allowed me to breathe freely, both physically and emotionally."* (Female, 45, Han Chinese)
- *"Nature helped me find peace amidst the chaos of my illness."* (Male, 52, Yi ethnicity)
- *"The forests and rivers were like a refuge to me. I felt like I was reconnecting with myself and leaving behind the constant worry of my treatments."* (Female, 38, Bai ethnicity)
- *"I never realized how much I needed this until I was standing by the lake, feeling completely calm for the first time in months."* (Male, 61, Naxi ethnicity)

These testimonials highlight the diverse ways in which nature-based tourism contributed to participants' well-being. Stress reduction was one of the most frequently mentioned benefits, with participants describing how the natural surroundings helped alleviate their constant anxiety. A middle-aged participant explained: "The sounds of the forest and the fresh air made me forget my struggles, even if only for a short while. It was like a reset for my mind." (Male, 47, Han Chinese).

Improved mood and increased emotional resilience were also key outcomes. One participant shared how spending time outdoors brought unexpected moments of joy: "Watching the sunset from the hilltop, I felt happy for the first time in a long while. It reminded me that there's still beauty in the world, despite everything." (Female, 54, Yi ethnicity).

Enhanced self-esteem and a reduction in anxiety symptoms were closely tied to participants' sense of achievement during nature-based activities. Whether it was completing a hike or simply walking along a riverbank, these activities provided a sense of accomplishment. "I felt proud of myself for completing the trail. It made me realize that I'm still capable of so much, even with my illness." (Male, 50, Bai ethnicity).

Lastly, several participants noted that exposure to natural settings helped them achieve better sleep quality. One participant reflected: "I slept soundly after our trip to the mountains. It was the first time in a long time that I didn't wake up with my mind racing." (Female, 42, Han Chinese).

These personal stories, combined with the data in **Table 3**, demonstrate the significant psychological benefits of engaging in nature-based tourism for cancer survivors and their families. The experience provided participants with not only a physical escape from their daily routines but also a profound emotional and mental reprieve, contributing to an overall sense of well-being.

#### **4.2.2. Stress reduction and emotional healing**

Nature-based tourism emerged as a powerful tool for stress reduction and emotional healing among participants. Many participants described how the serene environments of Yunnan's natural landscapes helped alleviate their anxiety and gave them a sense of peace that they had not experienced during their medical treatments. Participants consistently reported that being immersed in nature—surrounded by lush greenery, fresh air, and the sounds of water—created an environment that was conducive to relaxation and mental rejuvenation.

One participant, a cancer survivor in the mid-stage of recovery, expressed: “When I was in the forest, I could finally breathe freely. It felt as though the weight of my diagnosis had lifted, even if just for a while. The sound of the river and the wind through the trees made me feel alive again”. This reflection captures the essence of how the natural environment played a critical role in providing emotional relief.

Another participant, a family member, described the effect of nature on her emotional state: “Seeing my husband smile and relax while we walked through the mountains was incredibly meaningful. It was one of the first times I saw him truly let go of his stress since his diagnosis. It gave me hope that we could still have these moments of joy together”. This demonstrates how nature-based tourism not only aids in the emotional recovery of cancer survivors but also positively impacts their caregivers, who also bear a significant emotional burden.

Several participants highlighted that the sense of connection with nature made them feel more grounded and helped shift their focus away from their illness. A participant from the Yi ethnic group mentioned: “In our culture, we believe that the mountains and rivers have spirits. When I walked among them, I felt protected and watched over. It was like I was receiving strength from nature itself”. This perspective underscores the cultural dimension of emotional healing, where nature is seen not just as a physical place but as a source of spiritual comfort and resilience.

The emotional healing facilitated by nature also helped participants find a renewed sense of purpose. One participant in the late stage of cancer said: “After spending time by the lake, I started to think less about my illness and more about what I could still do—how I could still enjoy life. It gave me a new perspective that I hadn't had in a long time”. This illustrates the transformative potential of nature-based experiences, which can foster a sense of hope and reframe participants' outlook on their journey with cancer.

The psychological benefits of nature-based tourism are further amplified when considering the communal aspects of these experiences. Participants often engaged in activities such as hiking, group meditation, and traditional rituals together, which helped strengthen bonds with their families and fellow survivors. A family member shared: “We did a small prayer by the river, just as our ancestors did. It was such a powerful moment, not just for my mother but for all of us. It brought us closer together, and we left feeling united in her fight against cancer”. This highlights how communal experiences in natural settings can foster emotional resilience and enhance the overall well-being of both patients and their families.

These personal narratives emphasize the profound impact that nature-based tourism can have on the psychological health of cancer survivors and their families. The natural settings of Yunnan, with their rich biodiversity and cultural heritage, offer a unique environment that supports stress relief, emotional recovery, and a renewed sense of purpose.

#### **4.2.3. Sense of peace and mindfulness**

Participants frequently reported that the natural settings in Yunnan significantly facilitated mindfulness and provided them with a profound sense of inner peace. Being immersed in nature allowed them to disconnect from daily worries and focus on the present, which played a crucial role in enhancing their mental well-being.

**Mindfulness practices:** Participants found that activities such as meditation and mindful breathing were greatly enhanced by the serene and natural surroundings. The sounds of flowing water, rustling leaves, and the fresh air created an environment conducive to practicing mindfulness, which helped them achieve a deeper state of relaxation and focus. One participant described the experience of meditating in nature as deeply restorative: *“Meditating by the lake made me feel connected to something larger than myself, which was comforting.”* (Female, 38, Bai ethnicity).

**Spiritual connection:** Many participants also expressed feeling a deeper spiritual connection to the natural world, which fostered a sense of acceptance and helped them cope with their illness. For some, the landscapes of Yunnan were not only a physical setting but also held spiritual significance, providing emotional strength and comfort. A participant from the Naxi ethnicity shared: *“Being surrounded by the mountains felt like being embraced by a protective force. It helped me accept my condition and gave me the strength to keep going.”* (Male, 55, Naxi ethnicity).

The testimonials highlight that the sense of peace derived from these natural settings was both emotional and spiritual. Participants from various cultural backgrounds emphasized that being in nature helped them reconnect with themselves and the world around them. This deep connection to nature served as a powerful tool for fostering mindfulness, enhancing their ability to remain present, and supporting emotional healing.

#### **4.2.4. Role of family involvement and bonding**

Family involvement significantly amplified the psychological benefits of nature-based tourism for participants. The presence of family members provided emotional support, facilitated shared coping strategies, and enhanced the overall experience of engaging with natural environments. **Table 5** summarizes the impact of family involvement on various psychological outcomes, comparing participants who experienced nature-based tourism with their families versus those who participated alone.

**Table 5.** Impact of family involvement on psychological outcomes.

| Outcome                         | Participants with Family (N = 35) | Participants Alone (N = 15) |
|---------------------------------|-----------------------------------|-----------------------------|
| Increased Emotional Support     | 32 (91%)                          | 10 (67%)                    |
| Enhanced Communication          | 28 (80%)                          | 8 (53%)                     |
| Shared Coping Strategies        | 26 (74%)                          | 7 (47%)                     |
| Greater Enjoyment of Activities | 30 (86%)                          | 9 (60%)                     |

Source: Field data, 2024.

Families reported that shared experiences in natural settings significantly strengthened relationships, provided mutual emotional support, and helped in developing shared coping mechanisms. These collective experiences in nature not only enhanced individual well-being but also fostered a sense of unity and resilience within families.

Participant testimonials:

- *“Sharing these moments with my family reminded us of our strength together.”* (Male, 50, Han Chinese)
- *“Walking through the forest with my children made me realize how much we could still enjoy life together, despite the challenges we face.”* (Female, 45, Han Chinese)

These testimonials emphasize that nature-based tourism experiences are more impactful when shared with loved ones. Family involvement played a key role in reducing the emotional burden of illness, as the presence of supportive companions provided comfort and joy. Participants also highlighted how these shared moments helped them reconnect on a deeper level, reinforcing bonds that may have been strained during periods of medical treatment and stress. The natural environment thus served not only as a setting for individual recovery but also as a catalyst for family cohesion and mutual support.

### 4.3. Cultural and spiritual significance

Yunnan’s cultural and spiritual heritage enriched the healing experience for participants, providing a deeper, more meaningful context for their psychological and emotional recovery. The natural landscapes, combined with cultural practices and spiritual landmarks, played a significant role in fostering well-being.

#### 4.3.1. Influence of Yunnan’s cultural heritage

The influence of Yunnan’s rich cultural heritage on participants’ well-being was profound, as they engaged with the traditions and practices of local ethnic groups. The integration of cultural experiences during nature-based tourism helped to provide participants with a sense of enrichment and belonging.

As shown in **Table 6**, learning about the different traditions of Yunnan’s ethnic minorities, such as the Yi, Bai, and Naxi, broadened participants’ perspectives. These cultural experiences allowed participants to see the deep connection between health, nature, and community, which enhanced their overall sense of well-being. **Table 6** also illustrates how the opportunity to interact with local people and participate in cultural activities fostered a feeling of belonging among participants. One participant expressed: “The warmth of the local people and their stories inspired

me.” (Female, 40, Naxi ethnicity). These interactions helped participants feel welcomed and connected, contributing to emotional healing by reducing feelings of isolation and building a sense of solidarity. Moreover, participants reported that these cultural engagements broadened their perspectives, providing new insights into the importance of community in personal well-being and deepening their appreciation of Yunnan’s cultural richness.

**Table 6.** Impact of cultural engagement on participants.

| Cultural Impact        | Number of Participants Reporting | Percentage (%) |
|------------------------|----------------------------------|----------------|
| Cultural Enrichment    | 36                               | 72%            |
| Sense of Community     | 30                               | 60%            |
| Broadened Perspectives | 32                               | 64%            |

Source: Field data, 2024.

#### 4.3.2. Buddhist temples and spiritual healing

Visits to Buddhist temples in Yunnan were profoundly impactful for many participants, as summarized in **Table 7**. The temples provided a space for spiritual reflection and emotional release, which were crucial for participants coping with the stress and uncertainty of their illness.

**Table 7.** Activities enhancing spiritual well-being.

| Activity                           | Number of Participants Engaged | Percentage (%) |
|------------------------------------|--------------------------------|----------------|
| Temple Visits                      | 38                             | 76%            |
| Participation in Religious Rituals | 25                             | 50%            |
| Spiritual Reflection               | 33                             | 66%            |

Source: Field data, 2024.

As shown in **Table 7**, participants engaged in temple visits, participation in religious rituals, and spiritual reflection, which significantly enhanced their spiritual well-being. The tranquil atmosphere of the temples provided participants with an opportunity to reflect on their lives and health, offering a sense of peace away from medical treatments and daily pressures. Many participants found solace in this environment, which allowed them to meditate and find emotional relief. Additionally, participation in Buddhist rituals, such as lighting incense and offering prayers, helped participants feel spiritually uplifted, offering an outlet for their hopes and fears. One participant mentioned: “The simple act of lighting incense and offering prayers gave me a sense of hope and a connection to something greater than myself.” (Male, 48, Han Chinese). These activities collectively fostered a deep spiritual connection, providing comfort and enhancing participants’ ability to cope with their illness.

#### 4.3.3. Integration of traditional Chinese medicine

The integration of Traditional Chinese Medicine (TCM) practices into nature-based tourism experiences was highly valued by participants, as shown in **Table 8**. TCM practices such as herbal treatments, acupuncture, Tai Chi, and mindfulness

meditation were seen as complementary to participants' medical treatments and enhanced their overall sense of well-being.

**Table 8.** Traditional Chinese medicine practices utilized.

| TCM Practice           | Number of Participants Utilizing | Percentage (%) | Perceived Effectiveness |
|------------------------|----------------------------------|----------------|-------------------------|
| Herbal Treatments      | 28                               | 56%            | High                    |
| Acupuncture            | 22                               | 44%            | Moderate                |
| Tai Chi/Qi Gong        | 30                               | 60%            | High                    |
| Mindfulness Meditation | 35                               | 70%            | High                    |

Source: Field data, 2024.

As illustrated in **Table 8**, participants reported that TCM practices complemented their ongoing medical treatments by providing both physical and emotional relief. Herbal treatments were often used to alleviate symptoms such as nausea and fatigue, while acupuncture was particularly helpful in reducing pain. Additionally, engaging in TCM practices provided participants with a greater sense of control over their own healing journey. Tai Chi and Qi Gong, in particular, were described as empowering practices that allowed participants to actively contribute to their recovery. One participant shared: "Practicing Tai Chi every morning made me feel like I was taking control of my health. It gave me strength and energy." (Female, 50, Yi ethnicity). The use of TCM also aligned with participants' cultural beliefs about health and nature. Many participants expressed comfort in engaging with healing practices that were deeply rooted in their cultural heritage, which enhanced the emotional and psychological benefits of their overall recovery process.

#### 4.4. Challenges and barriers

Despite the numerous psychological, physical, and social benefits associated with nature-based tourism, participants faced several significant challenges that hindered their ability to fully engage in these experiences. These challenges can be broadly categorized into financial constraints, physical limitations, lack of awareness and accessibility, and sustainable development concerns. Understanding these barriers is crucial for developing comprehensive strategies to make nature-based tourism more inclusive and accessible for all cancer survivors and their families.

##### 4.4.1. Financial constraints

**Table 9.** Financial barriers to participation.

| Financial Constraint | Number of Participants Affected | Percentage (%) |
|----------------------|---------------------------------|----------------|
| Medical Expenses     | 30                              | 60%            |
| Travel Costs         | 25                              | 50%            |

Source: Field data, 2024.

Economic barriers were a major limitation that prevented some participants from accessing the full benefits of nature-based tourism. Many participants highlighted that the costs associated with both medical treatment and tourism experiences were significant hurdles to participation. As shown in **Table 9**, financial

barriers such as medical expenses and travel costs significantly impacted participants' ability to engage in such activities.

The ongoing costs of cancer treatment, including medications, hospital visits, and follow-up care, consumed much of the disposable income that participants could otherwise have used for engaging in therapeutic travel experiences. As noted by one participant, "I wish such healing experiences were more affordable." (Female, 55, Han Chinese). Travel costs, including accommodation and transportation, were similarly prohibitive for many participants, who expressed a desire for subsidized programs or more affordable options to make these experiences feasible. For many, the financial burden created a stark choice between essential medical care and potentially beneficial activities like nature-based tourism.

#### 4.4.2. Physical limitations

Physical health conditions were another significant barrier that restricted participants' engagement with nature-based tourism. Many cancer survivors faced various physical limitations, ranging from fatigue and pain to more severe mobility issues and immunocompromised conditions, which made participation in physically demanding activities challenging. As shown in **Table 10**, these physical barriers significantly impacted participants' ability to engage in nature-based tourism.

**Table 10.** Physical barriers to participation.

| Physical Limitation          | Number of Participants Affected | Percentage (%) |
|------------------------------|---------------------------------|----------------|
| Fatigue                      | 34                              | 68%            |
| Mobility Issues              | 20                              | 40%            |
| Immunocompromised Conditions | 15                              | 30%            |
| Pain and Discomfort          | 28                              | 56%            |

Source: Field data, 2024.

Fatigue was the most frequently reported issue, with 68% of participants citing it as a primary limitation. This highlights the importance of designing tailored activities that take into account the varying physical abilities of participants. Participants expressed the need for options such as shorter trails, resting areas, and activities that could be adjusted according to their physical capacities. One participant suggested, "If there were more activities designed for people with limited mobility, it would have been easier for me to join." (Male, 61, Han Chinese). Furthermore, many participants stressed the importance of having medical support available during tourism activities, such as ensuring the presence of medical professionals or adequate first-aid facilities, to alleviate concerns about safety during travel.

#### 4.4.3. Lack of awareness and accessibility

Another key barrier identified was the lack of awareness and accessibility of nature-based tourism opportunities for cancer survivors. Information gaps regarding available programs and accessibility issues further hindered participants from taking advantage of these beneficial experiences. As shown in **Table 11**, awareness and accessibility issues significantly impacted participants' ability to engage in these programs.

**Table 11.** Awareness and accessibility issues.

| Barrier              | Number of Participants Affected | Percentage (%) |
|----------------------|---------------------------------|----------------|
| Limited Promotion    | 22                              | 44%            |
| Accessibility Issues | 18                              | 36%            |

Source: Field data, 2024.

Nearly half of the participants (44%) reported that they were simply unaware of the programs available. “I didn’t know such programs existed until a friend told me.” remarked one participant (Male, 60, Yi ethnicity), emphasizing the need for better outreach and targeted promotion. Accessibility was also a challenge for participants with disabilities or mobility issues, with 36% indicating that the sites lacked adequate facilities such as wheelchair ramps or accessible pathways. Ensuring that sites are accessible for individuals with different physical abilities is crucial for promoting inclusive tourism experiences. Participants emphasized that increased visibility of these programs through healthcare providers and local community centers could enhance awareness and participation.

#### 4.4.4. Sustainable development challenges

Lastly, sustainable development challenges were highlighted as concerns by participants and local community members alike. The increase in tourism has raised issues of environmental degradation and cultural commodification, posing risks to the very environments that participants find healing. As shown in **Table 12**, these sustainable development challenges were significant.

**Table 12.** Sustainable development challenges.

| Challenge       | Number of Participants Affected | Percentage (%) |
|-----------------|---------------------------------|----------------|
| Over-tourism    | 18                              | 36%            |
| Cultural Impact | 15                              | 30%            |

Source: Field data, 2024.

Over-tourism was a concern for 36% of participants, who noted that the influx of visitors could potentially harm the pristine natural landscapes they sought to enjoy. This sentiment was reflected in comments such as, “If too many people visit, the environment won’t be as peaceful or clean.” (Female, 45, Bai ethnicity). Additionally, 30% of participants expressed concerns about the cultural impacts of tourism, particularly the risk of cultural commodification. They noted that an increase in tourism could lead to the commercialization of local traditions, thereby diminishing their authenticity and meaning.

To address these challenges, participants suggested implementing eco-friendly practices, such as limiting the number of visitors to certain areas, ensuring waste management, and promoting environmentally responsible behavior among tourists. They also emphasized the importance of involving local communities in tourism planning to foster responsible tourism development that benefits both the environment and local cultures. One participant suggested, “Local communities should have a say in how tourism develops here, so that it doesn’t damage our culture or environment.” (Male, 50, Naxi ethnicity).

In summary, while nature-based tourism presents significant opportunities for enhancing the well-being of cancer survivors and their families, several barriers must be addressed to maximize its accessibility and sustainability. Financial constraints, physical limitations, lack of awareness, and concerns regarding sustainable development are all challenges that require collaborative solutions involving healthcare providers, local authorities, and tourism operators. By addressing these issues, the potential for nature-based tourism as a therapeutic intervention can be fully realized, providing a holistic approach to healing for cancer survivors and their families.

#### 4.5. Comparison with Himachal Pradesh

Comparing Yunnan's approach with other regions provides valuable insights into how wellness tourism can be expanded and improved. By analyzing the practices in Himachal Pradesh, India, we can identify both strengths and areas for development in Yunnan's wellness tourism model.

Himachal Pradesh, India, presents an interesting comparison with Yunnan due to their shared natural beauty and cultural depth. Both regions possess mountainous landscapes that create serene environments ideal for healing and relaxation, and both offer a rich tapestry of cultural traditions that greatly enhance the tourism experience. The natural landscapes of these regions are not only visually appealing but also serve as therapeutic spaces, which is a common theme in wellness tourism. Additionally, both Yunnan and Himachal Pradesh integrate their diverse cultural traditions and spiritual sites into the wellness experience, making cultural richness a core component of their tourism offerings. This shared focus on leveraging natural and cultural resources makes Himachal Pradesh an ideal benchmark for evaluating and enhancing Yunnan's wellness tourism initiatives. **Table 13** provides a comparative analysis of the key aspects of wellness tourism between these two regions.

**Table 13.** Comparative analysis of wellness tourism.

| Aspect               | Yunnan, China                          | Himachal Pradesh, India               |
|----------------------|----------------------------------------|---------------------------------------|
| Natural Landscapes   | Mountains, forests, lakes              | Himalayas, rivers, valleys            |
| Cultural Elements    | Ethnic minorities, Buddhism, TCM       | Hinduism, Buddhism, Ayurveda          |
| Wellness Practices   | Herbal treatments, Tai Chi, meditation | Yoga, meditation, Ayurvedic therapies |
| Accessibility        | Developing infrastructure              | Established tourist facilities        |
| Marketing Strategies | Domestic focus                         | International outreach                |

Sources: Comparative tourism studies, 2023.

##### Lessons for Yunnan:

To enhance the competitiveness of Yunnan's wellness tourism, several lessons can be drawn from the comparative analysis with Himachal Pradesh:

- **Infrastructure Improvement:** It is essential for Yunnan to enhance its facilities to cater to a broader and more diverse audience. By developing accessible routes, improving accommodation options, and upgrading general infrastructure, Yunnan can make wellness tourism more inclusive and convenient. Himachal Pradesh's well-established tourist facilities serve as an exemplary model of how

infrastructure improvements can position a destination as a more accessible wellness hub [29].

- **Marketing Enhancement:** Expanding promotional activities to target an international audience is crucial for increasing tourism inflow. Himachal Pradesh has successfully leveraged diverse marketing campaigns that focus on cultural richness and wellness practices, effectively attracting global tourists. By adopting similar marketing strategies, Yunnan can enhance its visibility on the international stage and appeal particularly to Western tourists seeking both cultural and nature-based wellness experiences [29].

Sharma and Singh highlighted that the success of Himachal Pradesh in increasing tourism is largely attributed to its well-developed infrastructure and extensive international marketing efforts [29]. These approaches have enabled the region to attract significant tourism inflows, which Yunnan could replicate to achieve comparable growth. Specifically, targeting Western countries that have a growing interest in both cultural and wellness tourism could provide Yunnan with a substantial opportunity to expand its international appeal.

The comparisons with Himachal Pradesh highlight several opportunities for Yunnan to evolve its wellness tourism model. Himachal Pradesh serves as a model of how robust infrastructure and targeted international marketing can lead to significant tourism growth. Addressing existing infrastructure gaps and enhancing international marketing strategies could help Yunnan position itself as a premier wellness tourism destination in East Asia.

Moreover, a multi-dimensional approach that involves local community collaboration, partnerships with research institutions, and strategic international outreach is essential for achieving sustainable and inclusive growth in Yunnan's wellness tourism sector. This comprehensive approach can ensure that Yunnan's wellness tourism offerings are both culturally resonant and globally competitive, fostering a sustainable model that benefits local communities and international visitors alike.

#### 4.6. Quantitative analysis of psychological benefits

**Table 14.** Mean scores of psychological scales before and after nature-based tourism.

| Scale                        | Pre-Intervention Mean ± SD | Post-Intervention Mean ± SD | Mean Difference | t-value | p-value |
|------------------------------|----------------------------|-----------------------------|-----------------|---------|---------|
| Perceived Stress Scale (PSS) | 25.6 ± 5.2                 | 18.3 ± 4.7                  | −7.3            | −12.45  | < 0.001 |
| HADS-Anxiety                 | 12.4 ± 3.1                 | 8.7 ± 2.9                   | −3.7            | −9.87   | < 0.001 |
| HADS-Depression              | 13.0 ± 3.5                 | 9.2 ± 3.0                   | −3.8            | −10.23  | < 0.001 |

Source: Statistical analysis.

To quantitatively assess the psychological benefits of nature-based tourism, participants completed standardized psychological assessments before and after their engagement in the tourism activities. The instruments used were the Perceived Stress Scale (PSS) and the Hospital Anxiety and Depression Scale (HADS). The quantitative data were analyzed to determine any significant changes in stress, anxiety, and depression levels among participants. As shown in **Table 14**,

significant improvements were observed in the psychological well-being of participants.

The results indicate significant reductions in perceived stress, anxiety, and depression levels among participants following the nature-based tourism activities:

Perceived Stress Scale (PSS): There was a substantial decrease in perceived stress levels, with the mean score reducing by 7.3 points from 25.6 before the intervention to 18.3 after the intervention. The paired sample t-test confirmed that this reduction is statistically significant ( $t = -12.45, p < 0.001$ ).

Hospital Anxiety and Depression Scale (HADS):

- Anxiety subscale: Participants experienced a significant decrease in anxiety symptoms, with the mean score dropping by 3.7 points from 12.4 to 8.7 post-intervention ( $t = -9.87, p < 0.001$ ).
- Depression subscale: There was also a significant reduction in depression symptoms, as evidenced by a 3.8-point decrease in the mean score from 13.0 to 9.2 ( $t = -10.23, p < 0.001$ ).

The statistical analyses confirm that these reductions are not due to chance but are associated with the nature-based tourism intervention. The significant  $p$ -values (all  $< 0.001$ ) across the PSS and both HADS subscales provide strong empirical evidence of the psychological benefits.

These quantitative findings corroborate the qualitative data presented earlier, where participants reported experiencing stress reduction, emotional healing, and enhanced well-being after engaging in nature-based tourism. The alignment between the quantitative and qualitative results strengthens the validity of the study's conclusions, demonstrating that nature-based tourism has a positive impact on the psychological well-being of cancer survivors and their families.

In summary, the integration of quantitative assessments with qualitative insights offers a comprehensive understanding of the therapeutic effects of nature-based tourism. The significant improvements in stress, anxiety, and depression levels highlight the potential of such interventions as complementary therapies in cancer recovery programs.

## 5. Discussion and recommendation

### 5.1. Implications of findings

This study investigated the role of nature-based tourism in enhancing the psychological well-being of cancer survivors and their families in Yunnan, China. The findings underscore the significant therapeutic benefits of engaging with natural environments, cultural heritage, and traditional healing practices. Participants reported substantial psychological improvements, including stress reduction, emotional healing, and enhanced family bonds. Quantitative data showed significant decreases in perceived stress, anxiety, and depression levels after participation in nature-based tourism activities. Specifically, the Perceived Stress Scale (PSS) scores decreased by an average of 7.3 points ( $p < 0.001$ ), while the Hospital Anxiety and Depression Scale (HADS) indicated mean reductions of 3.7 points in anxiety ( $p < 0.001$ ) and 3.8 points in depression ( $p < 0.001$ ). These results align with previous

research indicating the restorative effects of natural environments on mental health [15].

Moreover, the cultural and spiritual significance of Yunnan's heritage enhanced the healing experience. Engagement with local traditions and spiritual practices, such as visits to Buddhist temples and participation in Traditional Chinese Medicine (TCM), provided participants with a deeper sense of peace and belonging. Family involvement amplified these benefits, strengthening emotional support networks and fostering shared coping strategies. However, several challenges were identified that limit the accessibility and sustainability of these benefits. Financial constraints, physical limitations, lack of awareness, and sustainable development concerns were significant barriers. These findings highlight the need for targeted interventions to address these obstacles.

## **5.2. Recommendations**

Based on the findings, several recommendations are proposed to enhance the psychological well-being of cancer survivors through nature-based tourism, directly addressing the challenges identified in the results.

Firstly, enhancing financial accessibility is crucial. Developing partnerships between government agencies, healthcare providers, and tourism operators can facilitate subsidized nature-based tourism programs specifically for cancer survivors and their families. This approach can alleviate financial burdens and make therapeutic experiences more accessible. Implementing flexible pricing models, such as tiered pricing or sliding scale fees based on participants' income levels, can further reduce costs. Additionally, encouraging businesses to sponsor wellness tourism programs as part of their corporate social responsibility efforts can provide financial support for participants in need.

Secondly, accommodating physical limitations is essential to make nature-based tourism inclusive. Investing in the development of accessible facilities, such as wheelchair-friendly trails, resting areas, and transportation options suitable for individuals with mobility challenges, can greatly enhance participation. Designing nature-based activities that cater to varying physical abilities, including low-impact options like guided nature walks, meditation sessions, and interactive cultural experiences, can also make these programs more accessible. Ensuring the availability of medical personnel or first-aid facilities at tourism sites addresses health concerns promptly, providing reassurance to participants with health vulnerabilities.

Thirdly, increasing awareness and accessibility is vital for wider participation. Collaborations with hospitals and cancer support organizations can disseminate information about nature-based tourism programs, integrating them into cancer care plans as complementary therapies. Organizing informational sessions and workshops in local communities raises awareness of the benefits and availability of nature-based tourism for cancer recovery. Developing user-friendly websites and mobile applications that provide detailed information about wellness tourism options, booking processes, and accessibility features can further enhance visibility and engagement.

### **Promoting sustainable tourism practices**

A critical aspect of enhancing nature-based tourism for cancer recovery involves addressing the environmental and cultural challenges identified in Section 4.4 through the promotion of sustainable tourism practices.

Firstly, implementing environmental conservation initiatives is essential to mitigate the negative impacts of increased tourism on Yunnan's natural landscapes. This includes adopting eco-friendly practices such as limiting visitor numbers in sensitive areas to prevent over-tourism and environmental degradation. Establishing guidelines for responsible tourist behavior, such as promoting "leave no trace" principles, can minimize the ecological footprint of tourism activities. Supporting conservation projects and involving tourists in environmental stewardship programs can foster a sense of responsibility and connection to the natural environment.

Secondly, cultural preservation efforts are necessary to protect Yunnan's rich cultural heritage from the risks of commodification and cultural dilution due to tourism. Promoting respectful engagement with local cultures by providing education on cultural sensitivities ensures that interactions between tourists and local communities are mutually beneficial and culturally appropriate. Encouraging authentic cultural experiences, rather than staged or commercialized representations, helps maintain the integrity of local traditions. Involving local communities in the development and management of tourism programs empowers them to control how their culture is presented and shared.

Thirdly, sustainable infrastructure development supports both environmental conservation and cultural preservation. Investing in sustainable infrastructure, such as eco-friendly accommodations, renewable energy sources, and efficient waste management systems, minimizes the environmental impact of tourism facilities. Utilizing sustainable building materials and designs that harmonize with the local environment reduces ecological disruption. Sustainable infrastructure also includes the development of accessible facilities that consider both environmental sustainability and the needs of visitors with physical limitations.

Moreover, fostering community involvement and empowerment is key to sustainable tourism development. Involving local residents in tourism planning and decision-making processes ensures that development aligns with community values and priorities. This participatory approach promotes social sustainability by providing economic benefits to local communities through job creation and revenue sharing. It also encourages the preservation of cultural heritage, as communities have a vested interest in maintaining their traditions and environments.

Establishing sustainability certifications and standards for tourism operators can incentivize responsible practices. Recognizing and rewarding businesses that adhere to environmental and cultural preservation guidelines encourages the adoption of sustainable practices across the industry. Certifications can guide tourists in choosing operators committed to sustainability, thereby promoting a market-driven approach to environmental and cultural stewardship.

Finally, promoting sustainable tourism practices aligns with global efforts to support sustainable development goals (SDGs), particularly those related to good health and well-being (SDG 3), sustainable cities and communities (SDG 11), and

responsible consumption and production (SDG 12). By integrating sustainability into nature-based tourism for cancer recovery, Yunnan can contribute to these broader objectives while enhancing the therapeutic experiences of participants.

### **5.3. Addressing challenges and limitations**

Addressing the challenges requires mitigating financial and physical barriers. Expanding insurance coverage to include nature-based therapy programs can reduce out-of-pocket expenses for participants. Developing volunteer programs where community members assist participants with physical limitations during tourism activities enhances safety and inclusivity. Enhancing awareness and cultural sensitivity is also important. Designing culturally tailored tourism experiences that consider the cultural backgrounds of participants, incorporating multilingual guides and culturally appropriate activities, can make programs more effective. Providing training for tourism staff on cultural competency and the specific needs of cancer survivors ensures respectful and supportive interactions.

Promoting sustainable development addresses environmental and cultural challenges. Investing in sustainable infrastructure, such as renewable energy sources, waste management systems, and sustainable building materials for tourism facilities, minimizes environmental impact. Facilitating cultural exchange programs that promote mutual learning between tourists and local communities fosters respect and understanding.

### **5.4. Integrating lessons from other regions**

Comparing Yunnan's approach with regions like Himachal Pradesh, India, offers valuable insights. Improving transportation networks, accommodation options, and healthcare facilities in tourism areas can accommodate a broader range of visitors, including international tourists. Developing targeted marketing campaigns that highlight Yunnan's unique blend of natural beauty, cultural richness, and wellness opportunities can attract global audiences. Engaging in international collaborations allows for knowledge exchange and adaptation of successful wellness tourism strategies to fit the local context.

Implementing sustainable tourism practices observed in other regions can enhance Yunnan's approach. For instance, adopting community-based tourism models that involve local residents in decision-making processes has been successful in promoting sustainability and cultural preservation in other destinations. Learning from regions that have effectively balanced tourism development with environmental conservation can guide Yunnan in addressing its own sustainability challenges.

### **5.5. Recommendations for future research**

Building upon the findings and addressing limitations, future research should consider conducting long-term studies to assess the sustained impact of nature-based tourism on psychological well-being and cancer recovery outcomes. Expanding research to include diverse populations across different regions and cultural backgrounds can enhance generalizability. Incorporating a broader range of validated psychological and physiological assessments can capture the multifaceted benefits of

nature-based tourism. Implementing standardized protocols for interventions and data collection improves consistency and reliability.

Exploring the integration of virtual reality technologies to provide nature-based experiences for those unable to travel due to physical or financial constraints is another area for future research. Conducting policy impact studies to evaluate the effectiveness of integrating nature-based tourism into healthcare systems and developing guidelines for implementation can further advance the field.

Additionally, investigating the long-term environmental and cultural impacts of increased tourism in Yunnan is crucial. Research should assess the effectiveness of sustainable tourism practices and identify areas for improvement. Engaging in interdisciplinary studies that involve environmental scientists, cultural anthropologists, and tourism experts can provide a comprehensive understanding of sustainability challenges and solutions.

## **5.6. Conclusion**

By aligning recommendations with the findings, this study provides a coherent and actionable framework for leveraging nature-based tourism to enhance the psychological well-being of cancer survivors and their families, while emphasizing sustainable tourism practices. Addressing the identified challenges through targeted strategies can make wellness tourism more accessible, inclusive, and environmentally and culturally sustainable.

Implementing environmentally friendly initiatives and involving local communities are essential for preserving the natural and cultural resources integral to these therapeutic experiences. These efforts not only enhance the quality of the tourism experience but also contribute to the long-term viability of wellness tourism in the region. By integrating these recommendations, Yunnan has the potential to establish itself as a leading destination for therapeutic tourism, offering holistic healing experiences that are culturally rich, environmentally sustainable, and accessible to those in need.

## **6. Conclusion**

This study highlights the significant psychological benefits of nature-based tourism for cancer survivors and their families in Yunnan. By engaging with the natural environment, cultural heritage, and traditional healing practices, participants experienced enhanced well-being, greater emotional resilience, and improved family relationships. Addressing challenges related to financial accessibility, physical limitations, and awareness can further enhance these benefits. Furthermore, incorporating lessons from successful wellness tourism models in other regions, alongside a commitment to ethical research practices, will support the development of effective, sustainable wellness tourism programs that contribute meaningfully to holistic cancer care. Ultimately, these efforts can help establish Yunnan as a leading destination for nature-based wellness tourism, offering an inclusive, culturally rich, and therapeutic experience for those in need.

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## References

1. Xiong W, Wang T, Okumus B, et al. Beyond Experience: Uncovering the Travel Experience of Cancer Patients. *Journal of Hospitality & Tourism Research*. 2023; 47(10): 1563–1581. doi: 10.1177/10963480231212178
2. Butler G, Szili G, Hay I, et al. Searching for sanctuary during COVID-19: Exploring regional South Australians' nature-based tourism experiences. *Tourism Recreation Research*. 2022; 47(1): 85–97. doi: 10.1080/10371656.2022.2061142
3. Timko Olson ER, Olson AA, Driscoll M, et al. Nature-Based Interventions and Exposure among Cancer Survivors: A Scoping Review. *International Journal of Environmental Research and Public Health*. 2023; 20(3): 2376. doi: 10.3390/ijerph20032376
4. Zhang H, Zhang X, Yang Y, et al. From nature experience to visitors' pro-environmental behavior: The role of perceived restorativeness and well-being. *Journal of Sustainable Tourism*. 2023; 31(3): 512–528. doi: 10.1080/09669582.2023.2184314
5. Zhou L, Liu A, Wang L, et al. Perceived health benefits of nature-based tourism: The influences of tourists' involvement, restorative environment and health consciousness. *International Journal of Tourism Research*. 2023; 25(5): 672–687. doi: 10.1002/jtr.2597
6. Clissold R, Westoby R, McNamara K, et al. Wellbeing outcomes of nature tourism: Mt Barney Lodge. *Annals of Leisure Research*. 2022; 25(5): 700–721. doi: 10.1016/j.annale.2022.100077
7. Cvikl D, Avguštin C, Kreft S. The physiological and psychological effects of forest therapy (FT) on tourists in the Kranjska Gora destination. *Forests*. 2022; 13(10): 1670. doi: 10.3390/f13101670
8. Huang L, Xu H. Relational encounters: The therapeutic experiences of tourists with cancer in Bama, China. *Tourism Management Perspectives*. 2023; 46: 101131. doi: 10.1016/j.tmp.2023.101131
9. Liu L, Zhou Y, Sun X. The Impact of the Wellness Tourism Experience on Tourist Well-Being: The Mediating Role of Tourist Satisfaction. *Sustainability*. 2023; 15(3): 1872. doi: 10.3390/su15031872
10. Kim J, Kang S. Exploring the effects of therapeutic landscapes on psychological well-being: Evidence from forest therapy programs in South Korea. *Urban Forestry & Urban Greening*. 2022; 68: 127566. doi: 10.1016/j.ufug.2022.127566
11. Buettner D, Skemp S. Blue Zones: Lessons from the world's longest-lived. *American Journal of Lifestyle Medicine*. 2020; 14(5): 451–459. doi: 10.1177/1559827620917069
12. Ching S, Mok E. Adoption of healthy lifestyles among Chinese cancer survivors during the first five years after completion of treatment. *Ethnicity & Health*. 2019; 24(7): 763–779. doi: 10.1080/13557858.2019.1634182
13. Gonçalves AS, Maia RLF, Santos ACC, et al. Exploring the restorative benefits of nature-based activities in urban settings. *Journal of Environmental Psychology*. 2021; 76: 101655. doi: 10.1016/j.jenvp.2021.101655
14. Wang G, Ren L, Qiu H, et al. Salient health goal, salient restoration? A transformative model of wellness tourism. *Journal of Travel & Tourism Marketing*. 2023; 40(1): 33–48. doi: 10.1080/10548408.2023.2184443
15. Silva VCE, Bezerra DVS, Barbosa H, et al. Health Tourism: The practice of travel as a contributor to the restructuring process of elderly individuals with depression (Portuguese). *Revista de Administração Online e Inovação em Turismo*. 2021; 15(2): 6302. doi: 10.17648/raoit.v15n2.6302
16. Cooper M, Buckley R. Tourist Mental Health Drives Destination Choice, Marketing, and Matching. *Journal of Travel Research*. 2021; 61(2): 377–392. doi: 10.1177/00472875211011548
17. Song C, Ikei H, Miyazaki Y. Physiological effects of nature therapy: A review of the research in the last 5 years. *Environmental Health and Preventive Medicine*. 2020; 25(1): 29. doi: 10.1186/s12199-020-00884-3

18. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine*. 2020; 180(7): 1092–1099. doi: 10.1001/archinternmed.2020.1092
19. Buckley R, Westaway OAM. Women report that nature tourism provides recovery from psychological trauma. *Tourism Recreation Research*. 2021; 46(1): 25–37. doi: 10.1080/02508281.2021.1917892
20. Bjelland I, Dahl AA, Haug TT, et al. The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research*. 2022; 158: 110898. doi: 10.1016/j.jpsychores.2022.110898
21. Deng F, Chen D, Swartz M, et al. A Pilot Study of a Culturally Tailored Lifestyle Intervention for Chinese American Cancer Survivors. *Integrative Cancer Therapies*. 2019; 18: 1073274819895489. doi: 10.1177/1073274819895489
22. Rechis R, Oestman K, Caballero E, et al. Be Well Communities™: Mobilizing communities to promote wellness and stop cancer before it starts. *Cancer Causes & Control*. 2021; 32(4): 387–396. doi: 10.1007/s10552-021-01439-9
23. Hunter-Jones P, Flatt S, Crolley L, et al. *Mental health and social tourism: Exploring the provider landscape*. Edward Elgar Publishing; 2020.
24. Zhou J, Zhou Y, Li D. Exploring the complex mechanism of the influence of a multisensory tourism experience on tourists' mental restoration in the research context of historical and cultural blocks. *Current Issues in Tourism*. 2023; 26(10): 1285–1302. doi: 10.1080/13683500.2023.2267730
25. Li X, Zhang Y, He J. The role of nature exposure in reducing perceived stress: Evidence from urban green spaces in China. *Environmental Research*. 2022; 211: 113050. doi: 10.1016/j.envres.2022.113050
26. Wang Z, Chen J. Reliability and validity of the Chinese version of the Perceived Stress Scale. *J. Shanghai Jiaotong Univ. Med. Sci.* 2012; 32(4): 378–382. doi: 10.3969/j.issn.1674-8115.2012.04.015
27. Ye W, Xu Y, Chen W. Validation of the Chinese version of the Hospital Anxiety and Depression Scale in general hospital patients. *Chin. Ment. Health J.* 2019; 33(5): 368–372. doi: 10.3969/j.issn.1000-6729.2019.05.007
28. Leung CM, Ho S, Kan CS, et al. Evaluation of the Chinese version of the Hospital Anxiety and Depression Scale: A cross-cultural perspective. *Int. J. Psychosom.* 1993; 40(1–4): 29–34.
29. Sharma S, Singh R. Comparative Analysis of Wellness Tourism: Lessons from Himachal Pradesh. *J. Tour. Dev.* 2021; 15(3): 120–134.

## Article

# Effect of using photovoice based on health belief model on cancer awareness in disabled people

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**Abstract: Background:** Every year, 3 million patients are diagnosed with cancer worldwide, and the concept of “cancer” is thought to be important for disabled people. Within this scope, potential risk factors for cancer in people with disabilities include tobacco use, obesity, advanced age, and magnetic imaging procedures. **Aim:** The aim of the study was to assess the perceptions and awareness of cancer among disabled people using the photovoice method. **Method:** Photovoice method was used together with photographs and explanations to encourage disabled people to visualize the causes and consequences of cancer in society. In the photovoice method, participants were asked to take photographs while considering the sub-scales of the Health Belief Model: perception of susceptibility, perception of severity, perception of barrier, and perception of benefit. **Results:** According to the research, 15 disabled people with a mean age of 43 years participated in the study and 110 photographs describing their experiences were obtained. In 10 of them, they were gradually grouped according to the sub-scales of the Health Belief Model, considering the richness of interpretation and the maximum diversity of the photographs. **Conclusions:** In the analyses performed, it was found that disabled people have gained social awareness about cancer.

**Keywords:** photovoice; cancer; awareness; disabled; health belief model

## 1. Introduction

Cancer is the primary cause of morbidity and mortality across the globe [1]. It is estimated that there will be 35 million new cases of cancer by 2050 [2]. People with disabilities account for more than one billion people worldwide [3]. Some studies suggest that the prevalence of cancer is higher among people with disabilities than in the general population. For example, many people with disabilities have lifelong smoking habits, obesity, older age, such conditions are associated with cancer risk factors and may increase the risk of cancer [4,5]. It has been suggested that people with certain types of disability have significantly higher rates of certain types of cancer than people without disabilities [6,7]. People with disabilities have been reported to have higher cancer-related mortality rates [8].

It is emphasized that the participation of people with disabilities in health services, health services should be designed and implemented with a disability focus, and research aimed at maximizing the health of people with disabilities is very important [9]. Within this scope, raising cancer awareness among people with disabilities, who are disadvantaged in many ways, is one of the strategies for emphasizing the importance of health and implementing Preventive health programs. Cancer awareness helps people recognize behaviors that increase cancer risk [10]. Through cancer awareness, individuals can fill knowledge gaps, help recognize cancer

symptoms early, and seek timely medical care in the future. There is some evidence that community-based cancer education activities can increase awareness and the likelihood of earlier presentation, diagnosis, and treatment [11–13].

Developed in the early 1950s, the Health Belief Model (HBM) continues to be widely used in health education programs [10]. The model explains the beliefs and attitudes that influence an individual's behavior. The most basic components of the model are susceptibility perception, severity perception, benefit perception, barrier perception, self-efficacy perception, and health motivation. HBM recommends that if a person has a desire to prevent illness or a belief in recovery, they should take a specific health action as a positive behavior to prevent illness [14–16].

Photovoice is the process of identifying, representing, and developing a community through photographic methods. The photovoice approach is widely used in community-based research, enabling people to document societal issues, discuss them critically, and advocate for action by policymakers [14–16]. As a result, photovoice has taken its place as a participatory action research method and has been used to improve public health and influence policy [17]. Photovoice allows participants to work closely with researchers throughout the research process by expressing their ideas and experiences [18]. Several studies have used photovoice as a research method to explore thinking of the participants and to strengthen evaluation. The photovoice method used in this study will encourage people with disabilities to take part in the research and share their personal experiences [19,20]. Photovoice is both an innovative model and a dimension that develops insight in these disadvantaged people by raising awareness.

The study was conducted to assess disabled people's perceptions and awareness of cancer using the photovoice method. Investing in and working to prevent key risk factors for cancer can prevent millions of cases, diagnose future cancers and save many lives around the world, with huge economic and societal benefits for countries for years to come [2]. The aim of the current study is also to encourage people with disabilities to visualize the causes and consequences of cancer in society, to communicate the causes and consequences of cancer, and at the same time to raise both society's awareness of cancer and the visibility of people with disabilities in society.

## **2. Method**

In the research, photovoice method, one of the participatory action research methods, was used to raise cancer awareness. Photovoice, based on participatory action research, drives change in individuals and communities through discussions between participants and researchers about the participants' photos [21].

In contrast to traditional research, which focuses on experts, photovoice lets participants actively engage in the research process, sharing their thoughts and experiences while interacting with researchers. Paulo Freire, an educator and philosopher, claimed that education and knowledge are developed through collaboration, going beyond the traditional teacher-student hierarchy. Building on this theoretical foundation, photovoice focuses on equal participation between researchers and participants. It especially allows participants to share their life experiences

through the visual images they create [18,22].

Although it is known that people with disabilities often use photographs and visual elements to communicate their feelings and thoughts, it is believed that the photovoice method, which is a form of participatory action research, will serve this purpose [23]. Photovoice work, which involves the participation of individuals from the community being studied to create change, has begun to be conducted on important issues such as public health, discrimination, and stigma [24–26]. As a result, action to address stigma is important, and research through awareness raising, dissemination of evidence-based information and community education has played an important role [27]. The 1st author is a researcher who carries out qualitative and quantitative research processes with oncology patients and their relatives in addition to her psychiatric nursing expertise. Therefore, she has expertise in developing awareness and insight development strategies. With these characteristics, she took responsibility in this research. The 2nd author is a doctoral student in obstetrics and gynecology nursing and has training and skills in cancer screening in disabled women. In addition, this researcher has the ability to establish deep communication with her female patients and took part in this research with these characteristics. This study has the characteristics of an inter- and multidisciplinary research.

The sample size was not determined in the study and the interpretation of cancer awareness of the disabled people ( $n = 15$ , 5 study groups) who participated in XXXX Council of Disabled People and agreed to participate in the study was investigated using the photovoice method. In the study, only 10 out of 110 photographs from these groups were selected and analyzed [28,29]. These photographs were gradually eliminated and processed only on the basis of maximum diversity and richness of interpretation, including different interpretations and images. As a result, the photographs, each of which presents different interpretations and perspectives and at the same time produces different voices in the subjective worlds of the participants, were analyzed and the participants' own interpretations were examined. The pseudonyms given to the participants that took the photographs are listed below the photographs.

Prior to the study, approval was obtained from the ethics committee (IRB decision dated 16 March 2023, numbered 03/81). Participants were informed about the study, and their written consent was obtained. The consent form provides information that participants can join the study voluntarily, without any pressure or coercion, and that they have the right to refuse or withdraw from the study at any time. The authors declare no conflicts of interest. No funding was received for this research, and it did not receive any specific grants from public, commercial, or non-profit funding agencies.

## **2.1. Photovoice process**

The three-step photovoice process developed by Wang and Burris [28] was used to guide data collection and analysis: participants' selection of photographs and creation of a discussion section, participants' evaluation of cancer from their own perspectives and narration of the photographs, and coding of issues and themes emerging from the discussion according to the HBM model [28].

The researcher, first gave detailed training on what photovoice research is and its purpose. They received training in photography from a professional photographer in order to show the necessary sensitivity on ethical issues and to use their phones or cameras. During these trainings, they were specifically asked to explain the research before shooting. It was stated that they should not photograph human faces or themselves in order not to violate personal data and avoid ethical issues. The checklist shown below explained to the participants how the data collection phase would be conducted and how they could express their opinions about the photographs accordingly.

This instruction, abbreviated as SHOWED in English, consists of six questions:

- a) What do you see here?;
- b) What is really happening here?;
- c) How does this relate to our lives?;
- d) Why does this situation, concern or power exist?;
- e) How can this image educate others?;
- f) What can we do about it? [17].

Participants, were divided into 5 groups and asked, “How do you have cancer in your environment?” and 15 disabled people participated and 110 photographs describing their experiences were obtained. In 10 of them, they were gradually grouped according to the sub-scales of the Health Belief Model, considering the richness of interpretation and the maximum diversity of the photographs.

## 2.2. Data analysis

The data obtained as a result of the photographs taken by the participants; their interpretations were analyzed by content analysis method [29]. The photographs taken by the participants, were first analyzed together with their comments and the themes of the participants were identified. Photographs and participant comments that are related to each other are grouped. Then, coding was made in line with the purpose of the study and grouped according to the sub-scales of the Networking Belief Model. Then, 16 photographs were analyzed and interpreted by the researchers.

After analyzing the photographs the participants, were asked what kind of experience the study was, the skills they gained, their cancer awareness and their opinions about the study, and their answers were discussed. In the last step, they were asked to present the research as a seminar program to the people of XXXX.

## 3. Results

One hundred and ten photographs taken by the participants and their comments were analyzed one by one and a code list was created. Then, themes were formed by bringing together the codes that were related to each other. As a result of the analysis, 4 themes and 32 sub-themes were decided. These themes are addressed in 4 sub-scales of the HBM. **Figure 1** shows these sub-scales.

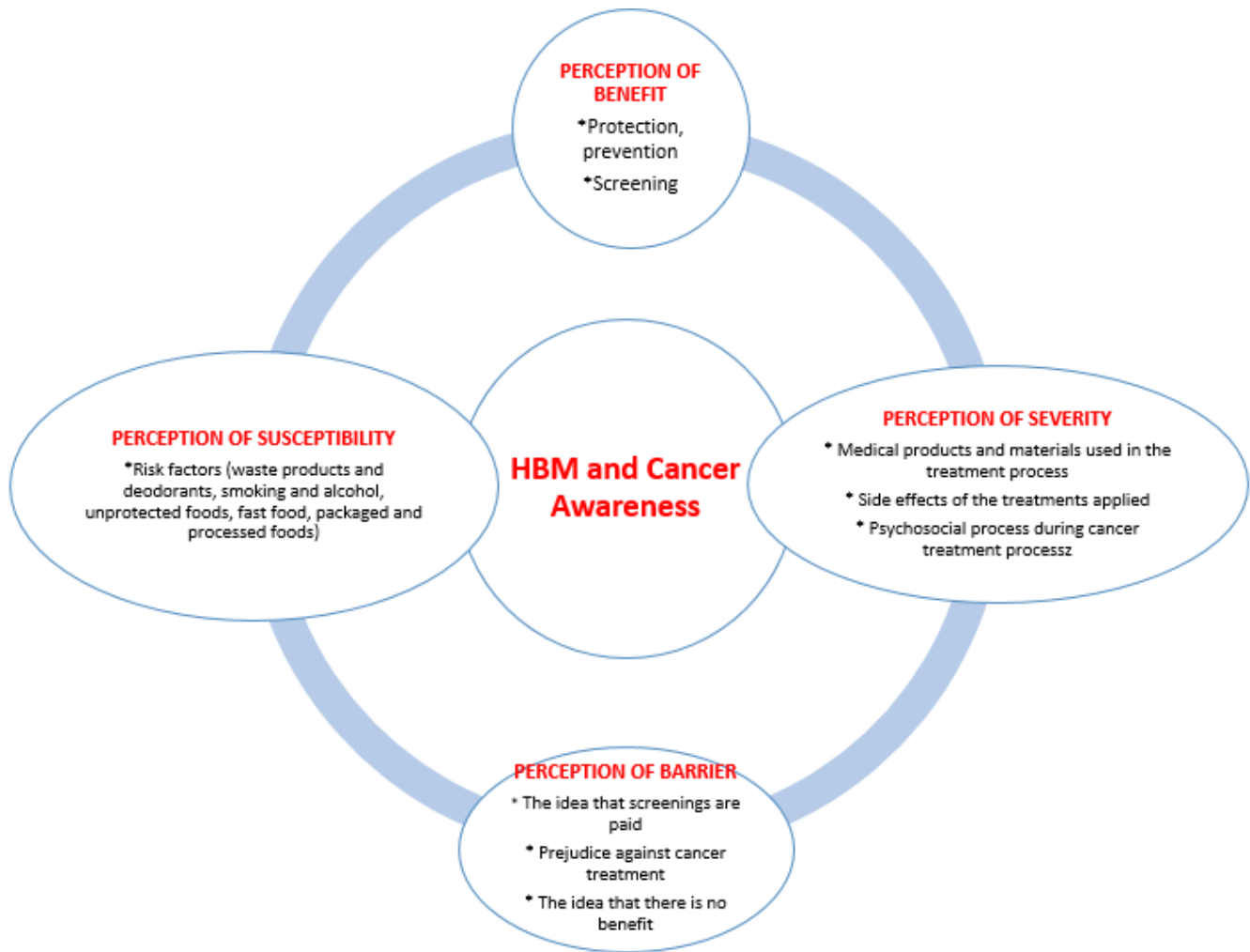


**Figure 1.** HBM and cancer awareness.

Fifteen people with disabilities individuals participated in the study. The median age of the participants, was 43 years. It was determined that 60% of the participants were male, 40% were female, 33% were graduates of primary-secondary education, 53.3% were single, 66.7% had a disability report of 70% or more, and 60% had a disability that occurred later (as a result of illness, accident, injury).

### 3.1. Perception of susceptibility and cancer awareness

Although not directly related participants, formed the sub-scale of “perception of susceptibility” of the health belief model that may increase susceptibility to cancer risk with the sub-theme “risk factors”. Smoking and alcohol, unprotected packaged and processed foods, fast food products were emphasized as “risk factors” by the participants.



**Figure 2.** Bad habits.

In these photos we see many cigarette packs, tobacco shops and alcohol aisles. People buy and drink these cigarettes, tobacco, and alcohol, and this damages our lungs, our liver, and eventually causes cancer. There are a lot of reasons why people smoke. Some people smoke and drink to show off, while others drink to relieve stress. Historically, these substances have been known to be the main causes of many diseases, but today hundreds of thousands of people are actively or passively affected by their carcinogenic effects (**Figure 2**).

The participant, stated that the monopoly products used with these visuals are the most common products that threaten human health and that users reduce their own quality of life and affect the quality of life of their environment. These photos show hamburgers and French fries, which are snacks eaten on the go. These foods are delicious and more convenient to keep up with the fast pace of life. This is because they are easily accessible, inexpensive, and quick to consume. Additives make these foods more palatable and encourage people to consume more. The fact that healthy and organic foods are more expensive and difficult to access also contributes to this situation (**Figure 3**).



**Figure 3.** Fast-food.

In this photo the participant, conveyed the main reasons why people turn to ready-to-eat foods. Intense work pressure, time constraints, difficulty in accessing organic

food, and working conditions have made fast food consumption more attractive. The participant, believes that the additives in these ready-to-eat and fast-consumed foods can cause cancer.

### 3.2. Perception of severity and cancer awareness

In the perception of severity sub-scale of the Health Belief Model; highlighting the different potential symptoms of cancer, the sub-heading “Medical products and materials used in the treatment process, side effects of the treatments applied, psychosocial process experienced in the cancer treatment process” was formed. Through the presentation of photographs such as chemotherapy room, lion and road, the participants mentioned the effect of problems experienced in the process after cancer diagnosis on the psychosocial life of cancer patients. With these photographs, the participants also emphasized the severity of cancer and the importance of early diagnosis of cancer and proper follow-up of symptoms experienced during the treatment process.



**Figure 4.** Door.

The photo shows the door leading to the room where chemotherapy will be administered. Every new door we encounter in our lives does not always open to beauty and hope, sometimes these doors express uncertainty, helplessness, fear, pain, dripping and hopelessness for cancer patients. As a society, we must do our part to ensure that cancer patients can resume their social lives after treatment (**Figure 4**).

The participant, notes that the doors that open in our lives do not always bring beauty, but sometimes have negative consequences. Some doors open to pain and despair. Finally, the patient should be supported in his or her struggle and helped to readjust to social life after the treatment process.

The lion in the photo was more stable than the other animals in the zoo, and his movements resembled those of a person with a behavioral disorder. His motionless

posture attracted attention, but zoo visitors did not notice the lion's abnormal behavior as they briefly looked around the other cages. As I watched him intently for a few minutes, I realized that his cage was a small quarantine area separated from the other cages. The lion in the cage was sick, and his illness had changed his behavior and made him lazy, which is not what is expected of a lion (**Figure 5**).



**Figure 5.** Alone and motionless.

In societies with low levels of awareness, cancer can cause people to isolate themselves from others and become withdrawn for fear of being stigmatized. This photo, will be a good example to explain that cancer is not the end and that one of the most important ways to get rid of it is to keep the morale high and to increase the level of social awareness.



**Figure 6.** The unknown.

The journey is more valuable and even more fun than the destination in terms of how it makes you feel. The sign in the photo shows a long road. Unfortunately, this long road is not more fun than the destination. As I tried to see the road through the eyes of a cancer patient, I felt that sometimes the road goes on forever and sometimes it ends in the blink of an eye. A journey of hundreds of thousands of miles to go for a test for suspected cancer can seem like a few hundred yards when you return home with a positive result. It is very important that we defeat this monster called cancer,

considering the possibility of leaving our loved ones unfinished at the end of this sometimes long and sometimes short road.

In this visual, the participant, conveyed the feelings of cancer patients on their way to treatment. Depending on the course of the disease, the path is sometimes longer and sometimes shorter. The patient must first fight for themselves, then for their loved ones, and reach the end of the road by defeating cancer (**Figure 6**).

### 3.3. Perception of benefit and cancer awareness

In the benefit perception sub-scale of the health belief model, the participants emphasized the importance of early diagnosis and treatment of cancer with PET-CT, fruit plate, Ketem Letter. Participants were aware of the different services offered by hospitals and their role in disease screening.

A fruit plate can be your sacrificial and saving friend, thanks to its vitamins and fiber. The presence of our devoted friends has always kept us alive, we cannot thank them enough (**Figure 7**).



**Figure 7.** Savior.

One of the most important methods of cancer prevention is a healthy lifestyle. In this visual the participant, emphasized the importance of a healthy diet as one of the most important steps in cancer prevention.

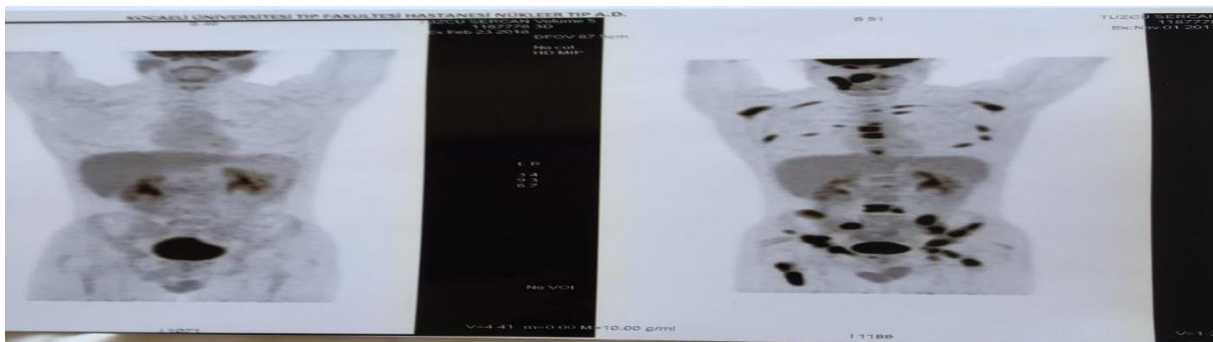


**Figure 8.** Victory.

The image on the right resembles a crumbling army at the height of the battle, while the moment of defeat on the left at the end of the battle suggests that a great victory celebration is well deserved. No matter how unjust the war, no matter how ruthless the enemy, resistance brings glorious victory (**Figure 8**).

In this image the participant, shared the joy he/she experienced at the end of a difficult process that was thought to be never-ending and unachievable in the PET-CT image taken after cancer treatment.

### 3.4. Perception of barrier and cancer awareness

In the Perception of Barrier sub-scale of the Health Belief Model, people with disabilities shared photos under the headings of “the idea that screening is paid for, stigma about cancer, perception of privacy, and fear” that may be barriers to cancer awareness and treatment. They touched on the facts underlying cancer screening or cancer diagnosis with photographs such as, free examinations, amulets, gynecological table.



**Figure 9.** Awareness.

In the 21st century, the diagnosis and diagnosis of cancer can be done free of charge and with very practical examinations in all health institutions, all the protocols to be applied in diagnosis and treatment are covered by the state, and all that is left for us to do is to run and hide well from this monster and not give it a chance, which seems quite easy (**Figure 9**).

In this visual the participant, emphasized that cancer screenings are free of charge, mentioned that the state conducts the necessary screenings and stated that our duty is only to participate in these screenings and take precautions.



**Figure 10.** Amulet.

The photograph was taken to emphasize that cancer is not a fate, or an inevitable end. Unfortunately, the proportion of patients who are late in starting treatment due to fatalistic thinking, who cannot benefit from the miracle of early diagnosis by saying “let the hodjas see before the doctor” is not insignificant at all. Cancer is not a fate, you have to fight it to get rid of it, it is an uphill battle, and it can only be won with the weapons of modern medicine (**Figure 10**).

In this photograph the participant, mentions that those who see cancer as a destiny delay in starting treatment. The importance of participating in cancer screenings, one of the weapons of modern medicine in the fight against cancer, is emphasized.



**Figure 11.** Fork.

The perception of privacy in patriarchal societies makes early diagnosis and treatment of cancer types related to sexual identity difficult and negatively affects the process (**Figure 11**).

In this visual the participant, emphasized one of the barriers to participation in cancer screening: women’s perception of privacy and their fear of it.

#### **4. Discussion**

The aim of the current study is to explain the perceptions and awareness of cancer among people with disabilities using the photovoice process. Visual and written expressions can personalize the inequalities experienced by people with disabilities,

rather than using numbers and statistics, and will allow for a deeper understanding of these communities' perceptions of cancer on an individual level. As far as it is known, the current study is the first to use photovoice to analyze the impact of cancer on people with disabilities. It explored how people with disabilities perceive cancer in their communities, highlighting risks, prevention, and barriers to health.

In the current study, people with disabilities identified and photographed various factors that increase the likelihood of developing cancer. In parallel to the present study, Poudel and Sumi [10] highlighted the importance of adopting the use of photovoice in determining cancer perceptions. To lower cancer risk, studies suggest reducing tobacco use, increasing physical activity, managing weight, improving diet, limiting alcohol intake, getting regular cancer screenings, and avoiding excessive sun exposure. In addition, public service announcements, posters, advertisements, and social media posts should be presented in a more appealing way to encourage people in society to adopt healthy habits [10].

Moise et al. [30] aimed to better understand the barriers to cervical cancer prevention and control among Haitian women using the photovoice method, highlighting fear of cancer and financial constraints as barriers to cancer prevention. In the present study, women's perception of privacy and their fear of it was photographed as a barrier to participation in screening

In a study by Adsul et al. [31], women expressed a deep sense of hopelessness regarding cervical cancer and talked about the deadly nature of cancer, emphasizing the belief that screening would not prevent death if a person developed cancer. In the same study, many participants felt shy or embarrassed about exposing their private parts during pelvic exams and feared pelvic exams because their peers often told them about their uncomfortable experiences. It has been found that women would prefer to die from cancer when the time comes, rather than undergo screening and face the stigma of being diagnosed and dealing with social judgment. In the present study, people with disabilities individual was criticized for having the belief that cancer is the will of the Creator in a person's life, a part of fate, and that there is no escape from cancer even if people have screenings, that it is an inevitable fate, and she defined and photographed the gynecological examination table as a "fork" to emphasize the perception of privacy of women, which is one of the barriers to participation in cancer screening, and the fear they experience about it.

To represent "loneliness" in the study of Woodgate and Busolo [32], They photographed the isolation of a lonely cat as a lonely person who is isolated from friends and family and is not free to do what he or she wants to do. The image of the lion standing still in the cage in the 5th photo, which was also taken in the current study, also expresses isolation in cancer [32].

Religion and spirituality are important factors in helping people cope with cancer [33]. In Woodgate and Busolo's [33] study, a grave described as "God's will" was photographed as they believed it was possible to get cancer as a punishment from God. In the study, participants mentioned that they delayed starting treatment because they saw cancer as a sign on their forehead in the "amulet" photo. Individuals who believe that it is fate and God's punishment for people to get cancer may blame or be unsupportive of people with cancer. It can also affect people's health-seeking attitudes and behaviors [32].

Situations represented in the “door” photo in the current study were identified in the study by Meiklejohn et al. [34]. They emphasized that cancer is not mentioned in society due to stigma and fear, and that other reasons for the silencing of cancer are the lack of information about cancer in health services and the lack of awareness of cancer in society [34].

## 5. Study limitations

The current study has several strengths and limitations. It offered a chance to better understand their concerns about cancer in their environment by involving people with disabilities in the research process. By empowering people with disabilities to participate in the work and by exhibiting their photographs in the community, they had the chance to contemplate their beliefs and concerns and propose action steps, not only with each other but also with the wider community. The exchange of ideas and discussion among people with disabilities encouraged them to think more critically, leading to a deeper understanding and a stronger sense of responsibility towards their communities. However, the photovoice method demands time, effort, and commitment from participants. Moreover, training sessions and group meetings should be conducted before the activities to discuss and deepen the understanding of the learning concept. Although participants were given individual and detailed training on photovoice and ethical issues before the study began, participants had great difficulty participating in the study at the beginning of the research process due to both their low level of education and their disabilities.

## 6. Conclusion

In the analyses performed, it was found that people with disabilities have gained social awareness about cancer. The findings from this study can guide future interventions and strategies to improve cancer screening in these communities. According to the study results, it is recommended that the study be conducted as a project or research in a larger sample group that will include researchers from multi-centered and related scientific fields.

## 7. Recommendations

The frequent use of photovoice in participatory action research around the world and in future social studies, awareness will be increased in all areas through photovoice studies in which participants are actively involved in the research process. People with disabilities do not only want to be on the agenda with their health or personal problems. For this reason, in the future, studies can be conducted on different subjects using the photovoice method, especially with people with disabilities individuals, and their visibility in society can be increased and their empowerment can be ensured. Community health workers should be trained to conduct community-based participatory work.

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review and editing, BÖ; visualization, YK and BÖ; supervision, YK and BÖ; project administration, YK and BÖ. All authors have read and agreed to the published version of the manuscript.

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**Ethical approval:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. For this type of study formal consent is required. Turkey of Ankara Yıldırım Beyazıt University Institute of Humanities and Social Sciences Ethics Committee approved the research Project (IRB decision dated 16 March 2023, numbered 03/81). All participants signed informed consent form before taking part in the study.

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

## References

1. World Cancer Research Fund International Worldwide Cancer Data. Available online: <https://www.wcrf.org/cancer-trends/worldwide-cancer> (accessed on 5 June 2024).
2. Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*. 2024; 74(3): 229–263. doi: 10.3322/caac.21834
3. Available online: <https://www.who.int/teams/noncommunicable-diseases/sensory-functions-disability-and-rehabilitation/world-report-on-disability> (accessed on 5 June 2024).
4. Iezzoni LI, Rao SR, Ressler J, et al. US Physicians' Knowledge About The Americans With Disabilities Act And Accommodation Of Patients With Disability. *Health Affairs*. 2022; 41(1): 96–104. doi: 10.1377/hlthaff.2021.01136
5. Shin DW, Park J, Yeob KE, et al. Disparities in prostate cancer diagnosis, treatment, and survival among men with disabilities: Retrospective cohort study in South Korea. *Disability and Health Journal*. 2021; 14(4): 101125. doi: 10.1016/j.dhjo.2021.101125
6. Iezzoni LI, Rao SR, Agaronnik ND, et al. Cross-Sectional Analysis of the Associations Between Four Common Cancers and Disability. *Journal of the National Comprehensive Cancer Network*. 2020; 18(8): 1031–1044. doi: 10.6004/jnccn.2020.7551
7. Kruse D, Park SR, van der Meulen Rodgers Y, et al. Disability and remote work during the pandemic with implications for cancer survivors. *Journal of Cancer Survivorship*. 2022; 16(1): 183–199. doi: 10.1007/s11764-021-01146-z
8. Iezzoni LI. Cancer detection, diagnosis, and treatment for adults with disabilities. *Lancet Oncol*. 2022; 23(4): e164–e173. doi: 10.1016/S1470-2045(22)00018-3
9. Swenor BK. Including disability in all health equity efforts: an urgent call to action. *Lancet Public Health*. 2021; 6(6): e359–e360. doi:10.1016/S2468-2667(21)00115-8
10. Poudel K, Sumi N. Engagement of Nepalese High-School Students in Cancer Awareness Using a Photovoice Based on the Health Belief Model. *Healthcare*. 2021; 9(10): 1283. doi: 10.3390/healthcare9101283
11. Kyle RG, Nicoll A, Forbat L, et al. Adolescents' awareness of cancer risk factors and associations with health-related behaviours. *Health Education Research*. 2013; 28(5): 816–827. doi: 10.1093/her/cyt055
12. Austoker J, Bankhead C, Forbes L, et al. Interventions to promote cancer awareness and early presentation: systematic review. *British Journal of Cancer*. 2009; 101(S2): S31–S39. doi: 10.1038/sj.bjc.6605388
13. World Health Organization. Cancer control knowledge into action: WHO guide for effective programmes. Geneva: World Health Organization; 2007.
14. Abraham C, ve Sheeran P. The Health Belief Model. Available online: [https://www.researchgate.net/publication/280963187\\_The\\_Health\\_Belief\\_Model](https://www.researchgate.net/publication/280963187_The_Health_Belief_Model) (accessed on 5 June 2024).
15. Rosenstock IM. Why People Use Health Services. *The Milbank Memorial Fund Quarterly*. 1966; 44(3): 94. doi:

- 10.2307/3348967
16. Mikhail B. The Health Belief Model: A Review and Critical Evaluation of The Model, Research And Practice. In: Chinn PL (editor). *Developing substance mid-range theory in nursing*, Advances in Nursing Science Series. An Aspen Publication, Maryland; 1994. pp. 74–92.
17. Wang C, Burris MA. Photovoice: Concept, Methodology, and Use for Participatory Needs Assessment. *Health Education & Behavior*. 1997; 24(3): 369–387. doi: 10.1177/109019819702400309
18. Park JS, Han JW, Choi JH, et al. Photovoice-Based Assessment of Weight Management Experiences of Breast Cancer Patients Treated with Tamoxifen. *International Journal of Environmental Research and Public Health*. 2020; 17(12): 4359. doi: 10.3390/ijerph17124359
19. Mmari K, Marshall B, Hsu T, et al. A mixed methods study to examine the influence of the neighborhood social context on adolescent health service utilization. *BMC Health Services Research*. 2016; 16(1). doi: 10.1186/s12913-016-1597-x
20. Nyambe S, Yamauchi T. Peri-urban water, sanitation and hygiene in Lusaka, Zambia: photovoice empowering local assessment via ecological theory. *Global Health Promotion*. 2021; 29(3): 66–76. doi: 10.1177/1757975921995713
21. Cordova D. *Accepting and Embracing My Disability-Describing the Life Experiences of Latinas/os with Physical Disabilities Who have Abused Substances*. Michigan State University; 2010.
22. Poudrier J, Mac-Lean RT. ‘We’ve fallen into the cracks’: Aboriginal women’s experiences with breast cancer through photovoice. *Nurs Inq*. 2009; 16(4): 306–137. doi: 10.1111/j.1440-1800.2008.00432.x
23. Wang CC, Cash JL, Powers LS. Who Knows the Streets as Well as the Homeless? Promoting Personal and Community Action through Photovoice. *Health Promotion Practice*. 2000; 1(1): 81–89. doi: 10.1177/152483990000100113
24. Catalani C, Minkler M. Photovoice: A Review of the Literature in Health and Public Health. *Health Education & Behavior*. 2009; 37(3): 424–451. doi: 10.1177/1090198109342084
25. Tanhan A, Strack RW. Online photovoice to explore and advocate for Muslim biopsychosocial spiritual wellbeing and issues: Ecological systems theory and ally development. *Current Psychology*. 2020; 39(6): 2010–2025. doi: 10.1007/s12144-020-00692-6
26. Russinova Z, Mizock L, Bloch P. Photovoice as a tool to understand the experience of stigma among individuals with serious mental illnesses. *Stigma and Health*. 2018; 3(3): 171–185. doi: 10.1037/sah0000080
27. Daher M. Cultural beliefs and values in cancer patients. *Annals of Oncology*. 2012; 23: iii66–iii69. doi: 10.1093/annonc/mds091
28. Wang C, Burris MA. Empowerment through Photo Novella: Portraits of Participation. *Health Education Quarterly*. 1994; 21(2): 171–186. doi: 10.1177/109019819402100204
29. Patton MQ. *Qualitative Research and Evaluation Methods*, 3rd ed. Thousand Oaks, CA: Sage Publications; 2022.
30. Moise RK, Jonas E, Campa EM, et al. Bayo Lapawol (Let Their Voices Be Heard): Haitian Women’s Barriers to and Facilitators of Cervical Cancer Prevention and Control. *Health Education & Behavior*. 2021; 48(6): 873–884. doi: 10.1177/1090198121990381
31. Adsul P, Nayaka S, Pramathesh R, et al. Using photovoice to understand the context of cervical cancer screening for underserved communities in rural India. *Global Health Promotion*. 2020; 27(4): 50–58. doi: 10.1177/1757975920915677
32. Woodgate RL, Busolo DS. Healthy Canadian adolescents’ perspectives of cancer using metaphors: a qualitative study. *BMJ Open*. 2017; 7(1): e013958. doi: 10.1136/bmjopen-2016-013958
33. Jim HSL, Pustejovsky JE, Park CL, et al. Religion, spirituality, and physical health in cancer patients: A meta-analysis. *Cancer*. 2015; 121(21): 3760–3768. doi: 10.1002/cncr.29353
34. Meiklejohn JA, Arley BD, Pratt G, et al. ‘We just don’t talk about it’: Aboriginal and Torres Strait Islander peoples’ perceptions of cancer in regional Queensland. *Rural Remote Health*. 2019; 19(2): 4789. doi: 10.22605/RRH4789

Article

# Clinical effects of surgical resection of osteosarcoma in proximal fibula and long-term follow-up of health status

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**Abstract: Purpose:** This study aimed to evaluate the health status and quality of life in patients with osteosarcoma of the proximal fibula following surgical treatment. The procedure necessarily involved resection of the peroneal nerve, resulting in iatrogenic footdrop. **Methods:** From January 2005 to 26 August 2020 patients with osteosarcoma in the proximal fibula were treated at the oncology department of Shanghai Jiao Tong University Affiliated Sixth People's Hospital. Clinical-pathological features as well as outcomes of these patients were investigated. Meanwhile, to clarify their health status, the SF-36 health survey questionnaire was administered at 12, 24, and 36 months post-diagnosis. **Results:** The outcomes for patients with osteosarcoma in the proximal fibula were encouraging. Both the three-year disease-free survival rate and the overall survival rate were recorded at 88.5% (23/26). Data from the SF-36 health survey questionnaire, completed by 20 patients who underwent limb-sparing surgery, revealed that at 24 months, patients perceived themselves as less healthy, both physically and emotionally, compared to their status at 12 months. Despite observing significant recovery at 36 months, the health status did not return to the levels reported at 12 months. The majority of patients (n = 17) identified “footdrop after surgery” as the primary factor affecting their quality of life. **Conclusions:** Osteosarcomas affecting the proximal fibula typically demonstrate a favorable prognosis following multi-modal treatment. However, patients' health status, including psychological well-being, requires improvement. Oncologists should strive to achieve an “equilibrium point” that minimizes the risk of recurrence while preserving peroneal nerve function.

**Keywords:** osteosarcoma; proximal fibula; SF-36; psychology

## 1. Background

Osteosarcoma represents the most prevalent malignant primary bone tumor in juvenile populations [1]. This condition predominantly affects the metaphyseal region of long bones, with the distal femur, proximal tibia, and proximal humerus being the most frequently affected sites. More than 70% of osteosarcomas originate around the knee joint. However, osteosarcoma in the proximal fibula, a bony structure near the knee joint, is an exceedingly rare occurrence. It is reported that the fibula is the site of 2.4% of primary bone tumors [2]. The proximal fibula presents a challenging surgical area due to the intricate interplay of adjacent neurovascular pathways. These structures are either preserved or resected based on their proximity to the tumorous growth. In slender tubular bones, such as the fibula, surgical margins

may extend more proximally or distally than indicated by MRI findings. Consequently, a comprehensive resection with wide margins is often necessary to ensure tumor-free surgical boundaries. This approach may occasionally necessitate the excision of the peroneal nerve to maintain adequate surgical margins, resulting in iatrogenic footdrop. As a result, a functional ankle-foot orthosis must be applied postoperatively to address this functional limitation.

Although osteosarcoma is the most common primary malignant bone tumor in children and young adults, several studies have reported encouraging outcomes for osteosarcoma in the proximal fibula [3–7]. The majority of patients affected are in their second decade of life [5–9]. As these adolescents recover from treatment, they reintegrate into society to varying degrees, participating in work or study. However, even if they survive, the footdrop caused by the removal of the common peroneal nerve can significantly impact their mental health, with physical disability or loss of function potentially leading to feelings of inferiority. In contrast to some other countries, China does not place as much emphasis on the mental health of adolescents, particularly among adolescent cancer patients. Therefore, the psychological effects of common peroneal nerve resection-induced footdrop on adolescents with peroneal osteosarcoma remain unclear. Post-treatment quality of life (QOL), also referred to as health status, has become a primary concern for patients. This has led many clinicians to investigate deliberate marginal resection of osteosarcoma located in the proximal fibula to preserve limb functionality [8,10,11]. However, despite the resulting footdrop, many researchers maintain that establishing tumor-free resection margins, which subsequently reduce the risk of recurrence and improve survival rates, is of greater importance [3,4].

Due to the rarity of cases, studies on the clinical characteristics and prognosis of osteosarcoma in the proximal fibula are limited. Moreover, there is a lack of research on the health status and long-term psychological effects on cancer survivors with unavoidable iatrogenic footdrop. This study aims to describe the clinical-pathological features and outcomes of osteosarcomas originating in the proximal fibula. To thoroughly examine the health state of these patients, we employed the SF-36 health survey questionnaire, a standardized instrument for assessing health status among cancer survivors [12–17]. Additionally, we sought to evaluate the long-term psychological effects on these patients during follow-up after treatment completion.

## **2. Methods**

### **2.1. Patients**

In this retrospective study, 26 patients with osteosarcoma of the proximal fibula were treated by the Department of Oncology at Shanghai Jiao Tong University Affiliated Sixth People's Hospital from January 2005 to August 2020 (see **Figure 1** for details on patient recruitment).

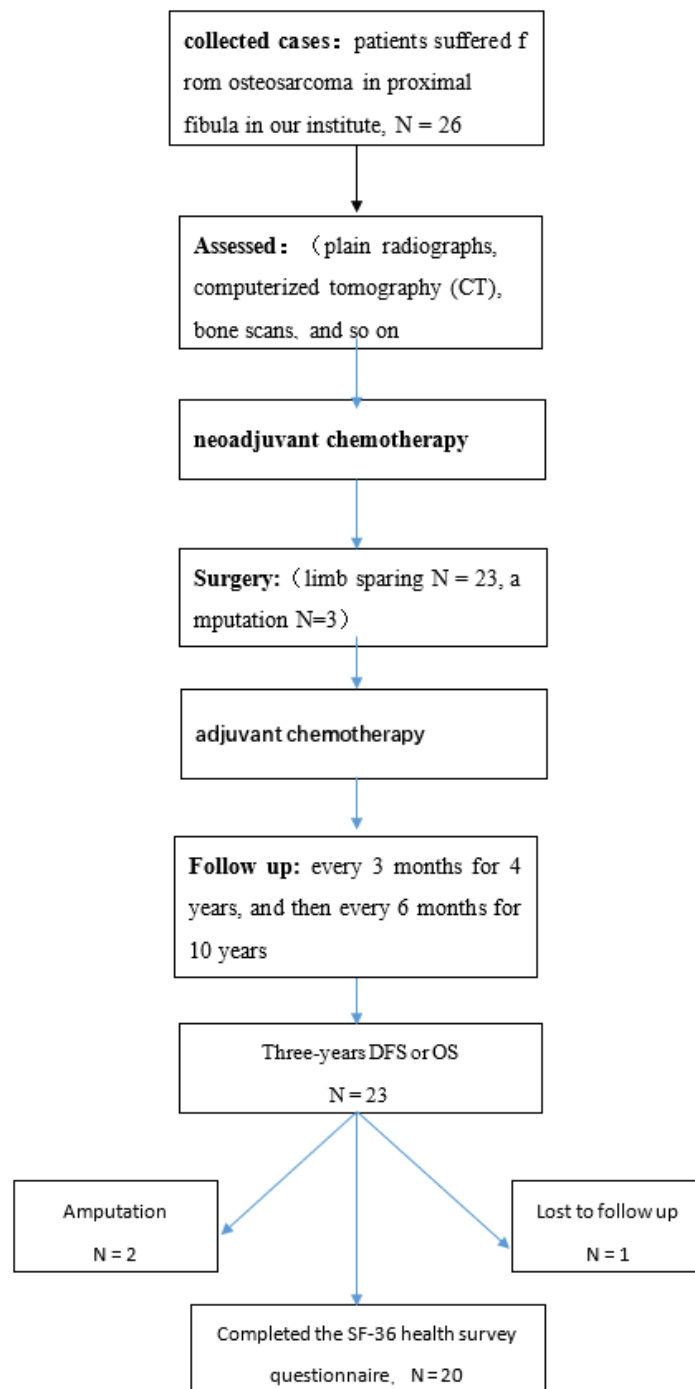


**Figure 1.** Flowchart of recruitment.

The inclusion criteria were as follows: (1) Histologically confirmed high-grade osteosarcoma according to the Enneking staging criteria at Shanghai Jiao Tong University Affiliated Sixth People's Hospital; (2) tumors located in the proximal fibula; (3) no antitumor therapy received before admission to the center; (4) magnetic resonance imaging (MRI) performed at initial presentation; (5) complete clinical and follow-up data available; and (6) limb-preserving surgery with Malawer Type II resection and two rounds of neoadjuvant chemotherapy carried out before surgery.

The exclusion criteria were as follows: (1) Evidence of distal metastasis at initial diagnosis; (2) failure to receive the standard treatment protocol at the center, including neoadjuvant therapy, surgery, and adjuvant chemotherapy; and (3) patients who underwent amputation.

Following the inclusion criteria, 26 patients with proximal fibular osteosarcoma were initially identified. Three cases were excluded due to amputation, resulting in the inclusion of 23 patients with proximal fibular osteosarcoma.

The cohort consisted of 26 individuals (17 men and 9 women) with a median age of 18 years (range: 11–43 years), all diagnosed with high-grade osteosarcoma according to the Enneking staging criteria. Comprehensive clinical data and treatment records were obtained through thorough medical chart reviews. Diagnostic methods included plain radiographs, computed tomography, bone scans, and magnetic resonance imaging. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All patients or their legal representatives provided informed written consent in accordance with committee rules.

## 2.2. Treatment

During initial surgery, limb-sparing surgery was performed on 23 patients, while three underwent amputation. All operations were conducted by Dr. Yang Qingcheng from the Department of Bone Oncology at Shanghai Sixth People's Hospital. Patients who underwent limb-preserving surgery received a Malawer Type II resection [6], which included extraarticular removal of the proximal fibula, approximately 5 cm of the unaffected diaphysis as determined by MRI, the anterior and lateral muscular compartments, the anterior tibial artery, and the common peroneal nerve. With the knee flexed at 20 degrees, non-absorbable sutures were used to reattach the lateral head of the biceps femoris and the lateral collateral ligament to the lateral tibial wall and surrounding knee capsule.

Four commonly used chemotherapeutic agents were administered according to the scheme presented in **Figure 2**, with a 2–3 week interval between chemotherapy rounds. Two rounds of neoadjuvant chemotherapy utilizing a combination of cisplatin (DDP), ifosfamide (IFO), methotrexate (MTX), and doxorubicin (ADM) were initiated preoperatively [18]. After surgery, patients received three to five cycles of postoperative adjuvant chemotherapy if no complications were noted.

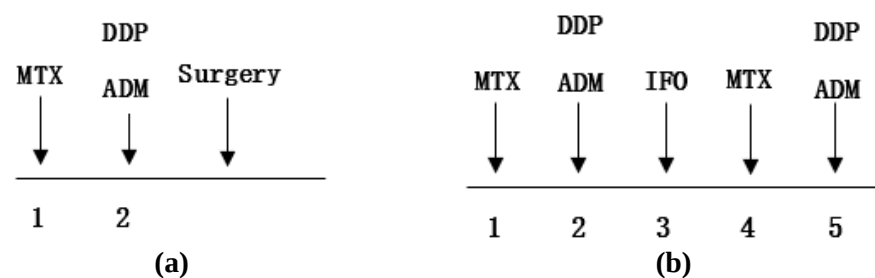


**Figure 2.** An example of chemotherapy protocol, (a) neo-adjuvant chemotherapy; (b) adjuvant chemotherapy.

### **2.3. Follow-up and SF-36 psychological investigation**

During the chemotherapy procedure, patients were monitored every two months using chest CT scans and radiographs of the surgically treated leg. After treatment completion, patients were typically followed up every three months for the first four years and then every six months for the next ten years. Bone scans were performed biannually. Throughout each follow-up, orthopedic doctors evaluated the functional status of patients with limb preservation using Enneking's approach for musculoskeletal surgery for tumors [19].

The SF-36, a comprehensive health questionnaire, covers eight health aspects: Physical functioning (PF), role physical (RP), role emotional (RE), social functioning (SF), mental health (MH), vitality (V), bodily pain (BP), and general health perception (GH). The questionnaire consists of 36 items divided into these eight categories, with scores on each scale ranging from 0 to 100, where 100 represents optimal health. SF-36 health assessments were administered at 12, 24, and 36 months after the diagnosis of osteosarcoma.

#### **Statistical analysis**

Descriptive statistics and comparative analyses were performed using SPSS version 17.0. Descriptive data were reported as means  $\pm$  SD. The overall survival (OS) time and disease-free survival (DFS) time were calculated using the Kaplan–Meier method. After testing for homogeneity of variance, quantitative variables were analyzed using one-way ANOVA. The level of significance for all two-tailed analyses was set at 0.05.

## **3. Results**

### **3.1. Clinical-pathological features and outcomes of 26 patients with osteosarcoma in the proximal fibula**

As of August 2020, the average follow-up time for the 26 patients was 43 months (range: 22–115 months). Information on each patient's symptoms was provided, revealing that 25 out of 26 patients experienced discomfort, and 19 had localized edema. The pre-diagnosis symptom duration ranged from 0.7 to 5 months, with a median of two months. Initial assessments found no evidence of distant metastases, and all 26 patients were categorized as being in surgical stage IIB according to the Enneking stage system. Biopsy specimens revealed osteoblastic osteosarcoma in 10 patients, chondroblastic osteosarcoma in 9, and fibroblastic osteosarcoma in 7. Twenty-four patients underwent two cycles of neoadjuvant chemotherapy with cisplatin, ifosfamide, methotrexate, and doxorubicin; 15 of these patients experienced satisfactory ( $> 90\%$ ) tumor necrosis from the chemotherapy, while 9 had unsatisfactory results (**Table 1**).

**Table 1.** clinical features of the recruitments.

| n                 |                |    |
|-------------------|----------------|----|
| sex               | male           | 17 |
|                   | female         | 9  |
| Histological type | fibroblastic   | 10 |
|                   | osteoblastic   | 9  |
|                   | chondroblastic | 7  |
| necrosis          | ≥ 90%          | 15 |
|                   | < 90%          | 9  |
| Local symptoms    | pain           | 25 |
|                   | no pain        | 1  |
|                   | swelling       | 19 |
|                   | no swelling    | 7  |
| First surgery     | limb-sparing   | 23 |
|                   | amputation     | 3  |
| Last follow up    | recurrence     | 2  |
|                   | metastasis     | 4  |
|                   | none of them   | 20 |

Treatment outcomes for proximal fibula osteosarcoma are generally favorable, with both the 3-year overall survival rate and the 3-year disease-free survival rate being 88.5% (23/26). Two patients experienced local recurrences, necessitating further above-knee amputations, and four cases had distant metastases. Among the 23 patients who survived beyond three years without local recurrence or distant metastases, the mean disease-free survival time was 67 months (range: 38–74 months), and the overall mean survival time was 109 months (range: 45–115 months). As of the last follow-up in August 2020, twenty patients had not experienced local recurrence or distant metastases.

For the 20 patients without local recurrence at the final follow-up, the Enneking functional evaluation system revealed scores between 92 and 99 for limb retention patients, with a median score of 96. No complaints of knee instability or signs of valgus instability were detected upon physical examination.

### 3.2. Comparison of SF-36 survey data at three time points

From the cohort of 23 patients who successfully avoided local recurrence or distant metastasis beyond three years (21 with limb-sparing surgery and 2 with amputation), 22 (95.6%, 20 with limb-sparing surgery and 2 with amputation) completed all items on the questionnaire and were available for assessment at three time points. Due to the limited number of amputation patients ( $n = 2$ ) and the established consensus that limb-salvage surgery offers functional and cosmetic advantages over amputation [20], the data from these 2 patients were excluded from the analysis.

The scores of overall health, physical functioning, role physical, role emotional, social functioning, mental health, vitality, bodily pain, and general health perception

from 20 patients were presented in **Table 2**. At the 24-month time point, the scores of overall health, role physical, role emotional, social functioning, general health, mental health, and vitality were significantly lower ( $P < 0.05$ ) compared to those at the 12-month time point. However, the scores of physical functioning and bodily pain remained constant between these two time points ( $P > 0.05$ ).

**Table 2.** Comparison of data from SF-36 health survey questionnaire at three time points.

| Items                | 12 months     | 24 months      | 36 months     | P-value |
|----------------------|---------------|----------------|---------------|---------|
| Overall health       | 137.26 ± 4.24 | 114.95 ± 12.48 | 123.43 ± 8.31 | < 0.05* |
| Physical functioning | 82.04 ± 7.96  | 83.63 ± 4.92   | 80.45 ± 7.38  | > 0.05  |
| Role-physical        | 92.04 ± 14.19 | 80.68 ± 18.79  | 76.13 ± 21.09 | < 0.05* |
| Bodily pain          | 94.95 ± 11.20 | 96.36 ± 7.28   | 96.63 ± 7.30  | > 0.05  |
| General health       | 64.31 ± 4.70  | 43.41 ± 9.31   | 51.33 ± 1.97  | < 0.05* |
| Vitality             | 89.09 ± 5.70  | 65.00 ± 19.94  | 76.14 ± 12.53 | < 0.05* |
| Social functioning   | 99.43 ± 2.66  | 70.45 ± 20.24  | 86.36 ± 9.38  | < 0.05* |
| Mental health        | 90.54 ± 6.70  | 65.27 ± 16.53  | 77.27 ± 11.60 | < 0.05* |
| Role-Emotional       | 89.37 ± 15.92 | 37.85 ± 33.00  | 60.56 ± 24.43 | < 0.05* |

\* One way ANOVA was conducted after homogeneity of variance test.

At the 36-month time point, the scores of overall health, role emotional, social functioning, general health, mental health, and vitality were significantly higher ( $P < 0.05$ ) compared to those at the 24-month time point. The scores of role physical at the 36-month time point increased without a significant difference compared to those at 24 months. Nonetheless, the scores of overall health, role physical, role emotional, social functioning, general health, mental health, and vitality at the 36-month time point remained significantly lower ( $P < 0.05$ ) than those at 12 months.

The scores of physical functioning and bodily pain remained constant at all three time points ( $P > 0.05$ ). During the three-year follow-up, only 2 out of 20 patients sought psychological intervention from a professional clinician. When asked about the major factor affecting their quality of life during follow-up, 17 patients chose “footdrop after surgery”, 3 chose “scar on the skin”, and 2 chose “obesity induced by insufficient exercise”.

## 4. Discussion

Recent advancements in oncology have led to an increase in the number of long-term cancer survivors, including those with osteosarcoma, which is the most common malignant primary bone tumor in childhood. Consequently, there has been a growing focus on the long-term side effects of treatment that may impact the quality of life, including psychological side effects.

The proximal fibula is a relatively uncommon site for osteosarcoma occurrence. However, data from 26 cases of osteosarcoma in the proximal fibula suggest that this rare location may be associated with a favorable prognosis, with an 88.5% 3-year disease-free survival and overall survival rate. Simultaneously, previous reports and

data from our institute indicate that the majority of proximal fibula osteosarcoma patients are in their second decade of life. All of the above findings underscore the importance of addressing health status concerns, including psychological well-being, after successful treatment.

Surgical treatment remains the primary approach for managing osteosarcoma in the proximal fibula. However, to ensure a safe surgical margin, sacrificing the peroneal nerve is unavoidable, resulting in an iatrogenic footdrop. Although some surgeons have attempted to preserve the peroneal nerve through marginal or intralesional procedures, most researchers maintain that achieving tumor-free resection limits takes precedence, even at the cost of a resultant drop foot.

Data from the SF-36 health survey questionnaire, completed by 20 patients who underwent limb-sparing surgery, revealed that at the 24-month time point, patients perceived themselves as less healthy, both physically and emotionally, compared to their status at 12 months. At the 36-month time point, despite significant recovery, the health status still did not parallel that at 12 months. The remarkable deterioration of health status at the 24-month time point could be attributed to two factors: 1) At the 12-month time point, patients had just completed their hospital treatment and had not yet engaged in social or school activities. 2) At the 24-month time point, most patients had participated in social or school activities and perceived the side effects of their previous treatment. The improvement in health status at the 36-month time point might be a result of patients' self-adjustment, as only two patients underwent psychological intervention, and scores of physical functioning remained constant at all three follow-up time points.

It is disappointing that only two patients sought psychological intervention from a professional clinician. In China, psychological health and its related issues are still unfamiliar to the majority of people. In cases of psychological disorder, most individuals choose "self-adjustment" over seeking help from a professional clinician.

The data indicated that the major factor affecting patients' quality of life during follow-up was "drop foot after surgery". This phenomenon presents a challenge to surgeons. While achieving tumor-free resection limits is a priority, the health status of patients after being cured should also be considered. We wonder if an "equilibrium point"—minimizing the risk of recurrence while preserving the function of the peroneal nerve—could be reached through the cooperation of surgery, radiation, and medical oncology.

This study has several limitations that should be acknowledged. First, the potential patient selection bias inherent in the retrospective study design may influence the validity of the data. Second, the small sample size ( $n = 26$ ) limits the ability to draw definitive conclusions. Additionally, while the SF-36 health survey questionnaire was used to assess overall health, physical functioning, role-physical, role-emotional, social functioning, mental health, vitality, bodily pain, and general health among cancer survivors, suggesting that footdrop due to surgery would impact patients' psychological well-being, there is a need to incorporate other assessment tools, such as the Musculoskeletal Tumor Society Scoring System 93 (MSTS 93), to further confirm this finding. Future studies will aim to refine the scoring system to address this limitation. Despite these limitations, this article is the first to investigate the health status of patients with osteosarcoma in the proximal fibula treated with

limb-sparing surgery while summarizing the clinical-pathological features of this osteosarcoma subgroup. To more accurately explore the health status of these patients, studies with larger sample sizes are necessary.

## 5. Conclusions

In general, osteosarcoma patients with proximal fibula involvement tend to demonstrate favorable prognoses after the introduction of multi-modal treatment. However, their health status, including psychological well-being, requires improvement and may benefit from psychological intervention. Clinicians in oncology should strive to reach an “equilibrium point” by minimizing the risk of recurrence while preserving the function of the peroneal nerve.

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**Availability of data and materials:** The datasets generated during and analyzed during the current study are available from the corresponding author on reasonable request.

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## Abbreviation

|     |                            |
|-----|----------------------------|
| QOL | quality of life            |
| CT  | computerized tomography    |
| MRI | magnetic resonance imaging |
| DFS | disease-free survival      |
| OS  | overall-survival           |
| PF  | physical functioning       |
| RP  | role physical              |
| RE  | role emotional             |
| SF  | social functioning         |
| MH  | mental health              |
| V   | vitality                   |
| BP  | bodily pain                |
| GH  | general health perception  |

## References

1. Freedman IG, Dowd HN, Dhodapkar MM, et al. Second primary malignancies of the bones and joints: More common than expected in osteosarcoma patients. *Am. Acad. Orthop. Surg. Glob. Res. Rev.* 2023; 7(1).
2. Saadon I, Amit B, Zolquarnian A, Muhamad F. Primary osteosarcoma of the distal fibula treated with distal fibulectomy with a five-year follow-up: A case report. *Malays. Orthop. J.* 2017; 11(2): 64–67.
3. Muslu O, Cengiz T, Şimşek SA, et al. Osteosarcoma of the proximal fibula: A case report and review of the literature. *Cureus.* 2023; 15(4): e38195.
4. Pu F, Yu Y, Zhang Z, et al. Clinical effect of surgical resection on primary malignant and invasive bone tumours of the proximal fibula. *Mol. Clin. Oncol.* 2023; 18(4): 27.
5. Lushiku HB, Gebhart M. Osteosarcoma of the proximal fibula: Report of 3 cases. *Acta. Chir. Belg.* 1997; 97(5): 260–263.
6. Malawer MM. Surgical management of aggressive and malignant tumors of the proximal fibula. *Clin. Orthop. Relat. Res.* 1984; 186: 172–181.
7. Natarajan M, Paraskumar M, Rajkumar G, et al. Limb salvage in aggressive and malignant tumours of the fibula. *Int. Orthop.* 2004; 28(5): 307–310.
8. Kanazawa Y, Tsuchiya H, Nonomura A, et al. Intentional marginal excision of osteosarcoma of the proximal fibula to preserve limb function. *J. Orthop. Sci.* 2003; 8(6): 757–761.
9. Ozaki T, Hillmann A, Lindner N, Winkelmann W. Surgical treatment of bone sarcomas of the fibula. Analysis of 19 cases. *Arch. Orthop. Trauma. Surg.* 1997; 116(8): 475–479.
10. Hayashi K, Tsuchiya H, Yamamoto N, et al. Functional outcome in patients with osteosarcoma around the knee joint treated by minimised surgery. *Int. Orthop.* 2008; 32(1): 63–68.
11. Yan TQ, Yang RL, Guo W. The clinical outcome of proximal fibular osteosarcoma with en-bloc resection. *Zhonghua Wai Ke Za Zhi.* 2008; 46(9): 661–663.
12. Pranikoff S, Miller VLA, Heiling H, et al. Frail young adult cancer survivors experience poor health-related quality of life. *Cancer.* 2022; 128(12): 2375–2383.
13. Vargo MM. Outcome measures and patient-reported metrics in cancer rehabilitation. *Curr. Oncol. Rep.* 2023; 25(8): 869–882.
14. Munshi L, Dumas G, Rochweg B, et al. Long-term survival and functional outcomes of critically ill patients with hematologic malignancies: A Canadian multicenter prospective study. *Intensive Care Med.* 2024; 50(4): 561–572.
15. LeBlanc MR, Zimmerman S, LeBlanc TW, et al. Persistent fatigue among long-term non-Hodgkin lymphoma survivors. *Leuk. Lymphoma.* 2022; 63(2): 344–352.
16. Stefanski KJ, Anixt JS, Goodman P, et al., Long-Term neurocognitive and psychosocial outcomes after acute myeloid leukemia: A childhood cancer survivor study report. *J. Natl. Cancer Inst.* 2021; 113(4): 481–495.
17. Madenci AL, Dieffenbach BV, Liu Q, et al., Late-onset anorectal disease and psychosocial impact in survivors of childhood cancer: A report from the childhood cancer survivor study. *Cancer.* 2019; 125(21): 3873–3881.
18. Lin F, Wang Q, Yu W, et al. Clinical analysis of Chinese limb osteosarcoma patients treated by two combinations of methotrexate, cisplatin, doxorubicin and ifosfamide. *Asia. Pac. J. Clin. Oncol.* 2011; 7(3): 270–275.
19. Ennekong WF, Dunham W, Gebhardt MC, et al. A system for the functional evaluation of reconstructive procedures after surgical treatment of tumors of the musculoskeletal system. *Clin. Orthop. Relat. Res.* 1993; 286: 241–246.
20. Robert RS, Ottaviani G, Huh WW, et al. Psychosocial and functional outcomes in long-term survivors of osteosarcoma: A comparison of limb-salvage surgery and amputation. *Pediatr Blood Cancer.* 2010; 54(7): 990–999.

Article

# A theory-based study on the vaccination behaviors of breast cancer patients during the COVID-19 pandemic in Taiwan

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**Abstract:** The study aimed to expand the behavioral analysis of the Theory of Planned Behavior (TPB) to examine COVID-19 vaccine willingness among breast cancer patients. While both the WHO and the U.S. CDC have utilized adapted versions of the Increasing Vaccine Model to study vaccination trends across various populations and industries, limited research has explored vaccine acceptance in specific groups such as breast cancer patients. From May to July 2022, an online cross-sectional study was conducted in Taiwan, coinciding with the initial COVID-19 vaccination rollout. A total of 278 participants were included in the statistical analysis. Structural Equation Modeling (SEM) was employed to assess the conceptual validity of the measurements and test the proposed model. The analysis revealed that the model explained 36.8% of the variance in patients' willingness to receive the COVID-19 vaccine and 40.3% of the variance in predicting future vaccination behaviors based on regret following vaccination. Fear of COVID-19 was found to indirectly influence vaccination willingness through shared decision-making, highlighting the importance of discussions between patients and their physicians. Patients who had more opportunities to consult with their doctors were more inclined to get vaccinated. Moreover, fear of COVID-19 enhanced the trust breast cancer patients placed in their physicians. However, decision conflicts and shared decision-making impacted vaccine willingness independently and directly, rather than through the mediating effect of trust in physicians. Furthermore, the study confirmed that patients who hesitated to get vaccinated were more likely to experience regret. These findings provide valuable insights into the behavioral aspects of vaccination among cancer patients, offering strategies to mitigate fear and improve preventive health measures.

**Keywords:** willingness of vaccination; decision conflict; share decision making; decision regret; COVID-19; breast cancer

## 1. Introduction

The COVID-19 pandemic has had an extraordinary impact on global health, societal dynamics, and the economic landscape. The emergence of variant strains has posed significant physical and mental challenges, inducing stress, fear, and anxiety among individuals, particularly those with underlying conditions. Numerous studies have applied theoretical frameworks such as the Health Belief Model, Protection Motivation Theory, and the Theory of Planned Behavior to investigate factors influencing COVID-19 vaccination decisions. These models, grounded in behavioral science and social cognition theories, have demonstrated substantial explanatory power and yielded compelling insights [1,2]. Intervention strategies, including information dissemination and the provision of supportive messaging, have been shown to foster trust in medical interventions, improve vaccine-related attitudes, and ultimately influence behavioral intentions [2]. Both the World Health Organization (WHO) and the U.S. Centers for Disease Control and Prevention (CDC) have utilized adapted versions of the Increasing Vaccine Model to assess vaccination behaviors across various demographics, professions, and age groups. This approach has not only validated the cognition-affection-behavior effector pathway but also elucidated the decision-making processes underpinning vaccine uptake [3]. Despite these advancements, research remains limited concerning vaccine acceptance among specific populations, such as breast cancer patients. This knowledge gap highlights the need for targeted studies to better understand the unique factors influencing vaccination behaviors in this vulnerable group.

The COVID-19 pandemic has significantly disrupted the treatment management of breast cancer patients [4,5]. Recent research has examined breast cancer patients' attitudes toward COVID-19 vaccines and their acceptance rates, shedding light on predictors of vaccination [6,7]. While receiving the COVID-19 vaccine is critical for breast cancer patients, there is limited research explaining their vaccination intentions and health-seeking behaviors.

Taiwan's COVID-19 vaccination policy, guided by the Ministry of Health and Welfare (MOHW) [8], emphasizes voluntary participation based on informed consent, reflecting the nation's commitment to public health and individual autonomy. Vaccination is prioritized for healthcare workers, individuals at higher risk of severe illness, and specific occupational groups such as airport staff, airline crew, and care institution workers. Vaccines such as AstraZeneca, Moderna, and Medigen were approved under emergency use authorization by the Taiwan Food and Drug Administration (TFDA) during the study period. Citizens can schedule appointments through a centralized platform, selecting their preferred vaccine type and time. While vaccination is not mandatory, booster doses are recommended for high-risk groups, including individuals with chronic illnesses or cancers. The policy ensures that participants are fully informed of the benefits and risks before providing consent.

Understanding the health-seeking behavior of breast cancer patients is crucial for several reasons. Breast cancer remains the most prevalent cancer among Taiwanese women [9]. Additionally, the diverse clinical treatment options for breast cancer patients are further complicated by the introduction of the COVID-19 vaccine, emphasizing the need to integrate vaccination into optimal treatment models [10].

Medical decisions often dominate in life-threatening situations, with patients seeking solutions that address unmet needs. Encouraging shared decision-making between patients and physicians allows for a clearer understanding of the risks and benefits of interventions, facilitating informed choices [7].

Studies have consistently highlighted the importance of trust in clinical treatment [11–13] for effective risk communication and managing decision conflicts among breast cancer patients [14,15]. Trust not only strengthens physician-patient dialogues but also improves treatment adherence [15,16]. However, most prior research has focused on short-term vaccination predictors, with few studies addressing the medium- and long-term impacts of vaccination on attitudes and emotional well-being [16].

Furthermore, integrating quality-of-life observations for breast cancer patients into clinical decision-making processes remains underexplored. Future research must consider how subjective and objective threats influence decision regret behaviors and identify factors that could modify these dynamics to enhance prognosis in the post-pandemic era.

Numerous studies have validated and demonstrated the predictive utility of the Theory of Planned Behavior (TPB) in understanding various health behaviors [4–7, 9]. For example, Fan et al. applied TPB to investigate factors influencing Chinese undergraduate students' intentions to receive the COVID-19 vaccine. Their findings highlighted that attitudes, knowledge, risk perception, and previous influenza vaccination behaviors satisfactorily explained students' vaccination intentions. Similarly, other researchers have combined TPB with the Health Belief Model (HBM) to explore the general public's health-related behaviors and intentions to receive influenza vaccines. These studies identified key characteristics influencing individuals' decisions to accept the COVID-19 vaccine [9, 17–19].

Building on this foundation, the present study aims to examine the antecedents of vaccination intentions among breast cancer patients, focusing on the mediating effects of quality of life and demographic factors within a social decision-making framework. Additionally, this research seeks to explore potential changes in patients' emotional responses during the post-vaccination period, offering valuable insights to enhance the overall well-being of breast cancer patients.

## **2. Materials and methods**

### **2.1. Research framework**

The Theory of Planned Behavior (TPB) delineates three stages of behavior formation: An individual's behavior is guided by their behavioral intention (Intention), which is shaped by their attitude towards the behavior (Attitude), perceived social pressure (Subjective Norms), and perceived control over the behavior (Perceived Behavioral Control, PBC). Since its introduction by Ajzen, PBC has served as a core element of TPB, with subsequent studies incorporating concepts such as self-efficacy and controllability to refine its framework.

TPB provides a robust theoretical foundation for exploring the factors influencing vaccination decisions among breast cancer patients during the COVID-19 pandemic. **Figure 1** presents the research framework, developed through an integration of literature review and practical considerations. This study examines the behavioral

determinants of vaccination, focusing on how fear of vaccination (Fear) impacts decision conflict (DC), trust, and shared decision-making (SDM). These factors, in turn, precede the willingness to vaccinate and may result in decision regret (DR) following vaccination.

Additionally, the study investigates whether decision regret (DR) is influenced by personal characteristics, as assessed using the Ten-Item Personality Inventory (TIPI). By employing a modified TPB framework and incorporating expert guidance, this research seeks to uncover the factors shaping breast cancer patients' COVID-19 vaccination behaviors, including their potential for regret. These insights aim to provide a comprehensive understanding of the psychological and behavioral processes involved in vaccination decision-making for this vulnerable population.

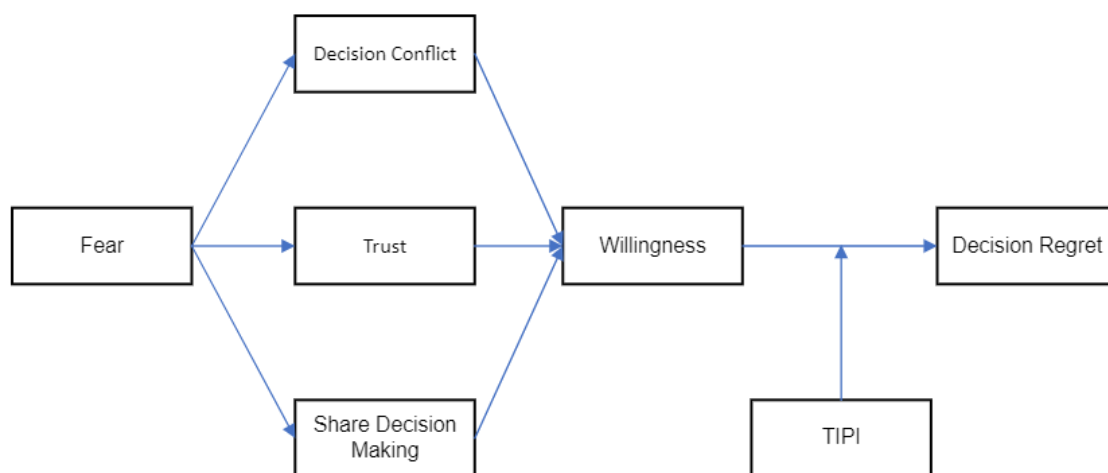


**Figure 1.** The research framework.

## 2.2. Data collection

An online cross-sectional study was conducted in Taiwan from May to July 2022, coinciding with the initial COVID-19 vaccination rollout in the region. The study received ethical approval from the Institutional Review Board (IRB) of Chung Shan Medical University, Taiwan (IRB code: CS2-21150, 10/07/2021). To ensure completeness, all survey items were mandatory in the Google Forms platform, preventing submission unless all questions were answered. Participants were required to meet the inclusion criteria of being Taiwanese, aged 20 years or older, and having a history of breast cancer. Patients must have a confirmed diagnosis of breast cancer within the past five years. Patients in different stages of treatment (e.g., newly diagnosed, undergoing treatment, in remission, metastatic disease) will be included to account for variation in clinical and psychological factors. Informed consent was obtained from all participants, who were also required to provide valid email addresses. Measures were taken to verify that each respondent completed the survey only once. Based on these criteria, a total of 278 participants were included for statistical analysis (**Figure 2: Strobe flow diagram**).

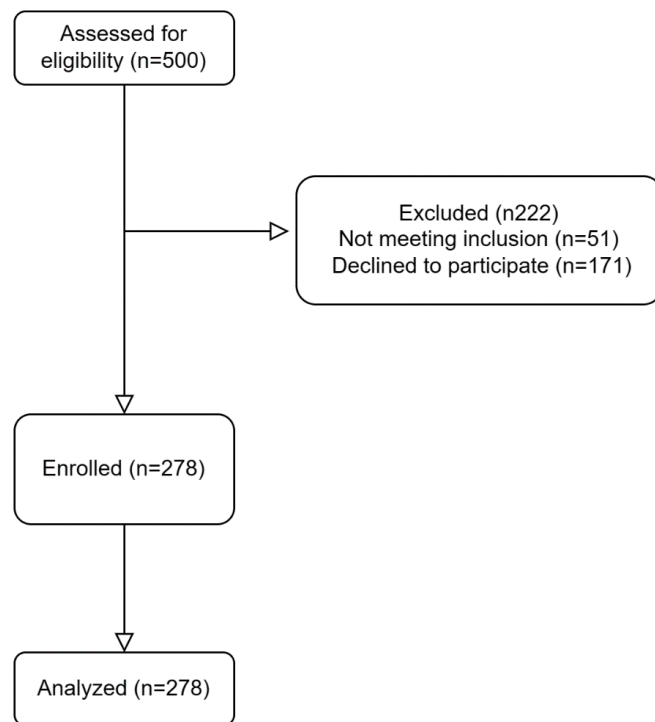


**Figure 2.** Flow diagram for subject enrollment.

### 2.3. Measurements development

An online cross-sectional study was conducted in Taiwan from May to July 2022, coinciding with the initial COVID-19 vaccination rollout in the region. The study received ethical approval from the Institutional Review Board (IRB) of Chung Shan Medical University, Taiwan (IRB code: CS2-21150, 10/07/2021). To ensure completeness, all survey items were mandatory in the Google Forms platform, preventing submission unless all questions were answered.

Participants were required to meet the inclusion criteria of being Taiwanese, aged 20 years or older, and having a history of breast cancer. Informed consent was obtained from all participants, who were also required to provide valid email addresses. Measures were taken to verify that each respondent completed the survey only once. Based on these criteria, a total of 278 participants were included for statistical analysis (**Figure 2**: Strobe flow diagram).

This study utilized questionnaires adapted from established theoretical frameworks, with fear considered as a key antecedent. All constructs were measured using a five-point Likert scale. The Fear scale, comprising 12 items, assessed the extent of COVID-19-related anxiety and fear. Attitude was reflected through Decisional Conflict, measured by a 15-item scale that evaluated uncertainty in choices and its underlying causes. Additionally, the subjective norm from the original TPB framework was replaced with Confidence, defined as the degree of protection patients perceive when making vaccination decisions based on their trust in the vaccine's reliability, benefits, and safety.

Perceived Behavioral Control (PBC) was replaced by Shared Decision-Making (SDM), which measured the extent to which patients were encouraged to engage in

clinical decision-making. SDM emphasized patient autonomy by promoting information sharing and aligning decisions with individual needs and values. Vaccination intention was redefined as Willingness, representing the degree to which an individual was inclined to receive the vaccine. Finally, Decision Regret (DR) replaced perceptions of vaccination, capturing the distress or remorse experienced after making a vaccine decision.

The adapted measures based on TPB demonstrated satisfactory psychometric properties, ensuring reliability and validity in assessing the behavioral factors influencing COVID-19 vaccination decisions among breast cancer patients.

## **2.4. Data analysis**

Participant characteristics were analyzed using descriptive statistics, including means and frequencies. Pearson correlation coefficients were calculated to explore the relationships between the key constructs in the model. Structural Equation Modeling (SEM) was employed to validate the conceptual framework and assess the proposed relationships. Confirmatory Factor Analysis (CFA) was conducted to ensure construct validity, verifying that each measurement item appropriately represented its intended domain. Reliability coefficients, factor loadings, and average variance extracted (AVE) values were computed for all measurement tools.

Given the sample size, the analysis utilized the partial least square (PLS) estimation method within the Smart-PLS 4.0 software, supplemented by bootstrapping for robust statistical testing. Missing data were addressed through imputation, preserving all cases by substituting missing values with estimates based on available information.

The model tested the effects of Decision Conflict (DC), Trust, Shared Decision-Making (SDM), and Fear as antecedent factors. Additionally, the role of personal characteristics, assessed using the Ten-Item Personality Inventory (TIPI), was evaluated as a moderating variable in the relationship between vaccination willingness and Decision Regret (DR).

## **3. Results**

### **3.1. Descriptive analysis**

Between April and June 2022, an online survey targeting women diagnosed with breast cancer was conducted. Of the 500 invited participants, 278 completed the survey, resulting in a response rate of 55.6%. Detailed respondent characteristics are provided in **Table S1** (Supplementary file). The respondent characteristics are as follows: Most participants had an education level of senior high school or above (81%), were married (69.1%), and employed (54.3%). A majority identified as religious (61.5%), while only 1.8% reported chronic diseases, including hypertension (60%) and asthma or mitral valve prolapse (20% each).

### **3.2. Common method bias**

Multiple respondents were involved in data collection to minimize the threat of common method bias. A single self-reported informant approach was adopted for

survey data collection; therefore, the risk of common method bias was carefully considered. Two statistical analyses were conducted to evaluate the severity of common method bias. All constructs in the model were included in the factorial analysis of the main components. Despite the small sample size and the insignificance of method variables, the results indicated no substantial variance attributable to common method bias. Thus, common method bias is not expected to pose a significant issue in this study.

### 3.3. Measurement model

Factor scores for integrative antecedents and latent representations of “willingness” and “decision regret” were utilized for further analysis. All concepts and sub-concepts in the model were assessed using multiple indicators. The measurement properties in the PLS were evaluated based on scale reliability, convergent validity, discriminant validity, and element reliability. The reliability of an individual item was determined by examining its structural loadings. A factor loading of 0.707 or higher indicates that 50% or more of the variance in the item is shared with the latent construct, as shown in **Table S2** (Supplementary file). Items with factor loadings below 0.5 were excluded from the analysis [20].

Convergent validity can be assessed through construct reliability, composite reliability, and average variance extracted (AVE) by constructs [21]. Cronbach’s alpha is used to evaluate construct reliability, measuring the homogeneity of items within a construct based on the assumption that each item contributes equally to the latent construct. Composite reliability employs item loadings from the measurement model to determine internal consistency [20]. We evaluated both convergent and discriminant validity for the construct scales before testing the hypothesized structural relationships. **Tables S2** and **S3** (Supplementary) present the composite reliability, Cronbach’s alpha, and AVE values for all constructs in the research model. Cronbach’s alpha values and composite reliabilities exceeded the recommended threshold of 0.7 [21], while AVE values were all above 0.50 [22], confirming internal consistency and convergent validity.

As shown in **Table S3**, discriminant validity was also supported because (1) all indicators loaded more strongly on their corresponding construct than on other constructs in the model; and (2) the square root of the AVE for each major construct exceeded the inter-construct correlations [23]. These findings indicate that the measurement model demonstrates adequate convergent and discriminant validity.

### 3.4. Structural model

The proposed research model was evaluated by analyzing the significance of the paths within the structural model. Using the PLS method, a bootstrap procedure with 500 subsamples was employed to generate t-statistics and standard errors [23]. **Figure 3** illustrates the estimated path coefficients and the explained variance in the structural model. Several path coefficients were significant, providing support for the research objectives. The results demonstrated positive associations between “fear” and “trust” as well as between “fear” and “shared decision-making” (SDM). From the perspective of “willingness”, there was a negative association with “decision conflict”.

Additionally, “willingness” negatively influenced “decision regret” (DR) with moderation by the Ten-Item Personality Inventory (TIPI). Since “quality of life” did not moderate the relationship between “willingness” and “decision regret”, it was removed from the structural model.

The path coefficients for all constructs are presented in **Figure 2**, with significance tested using bootstrapping at a  $p$ -value below 0.05. The explained variances ( $R^2$ ) for the endogenous variables including Decision Conflict (DC), Trust, SDM, Willingness, and DR were 36.8% and 40.3%, respectively. Regarding the control variables included in the model, these findings support the research framework and indicate that significant variances in the dependent variables are well explained by the proposed independent and control variables.

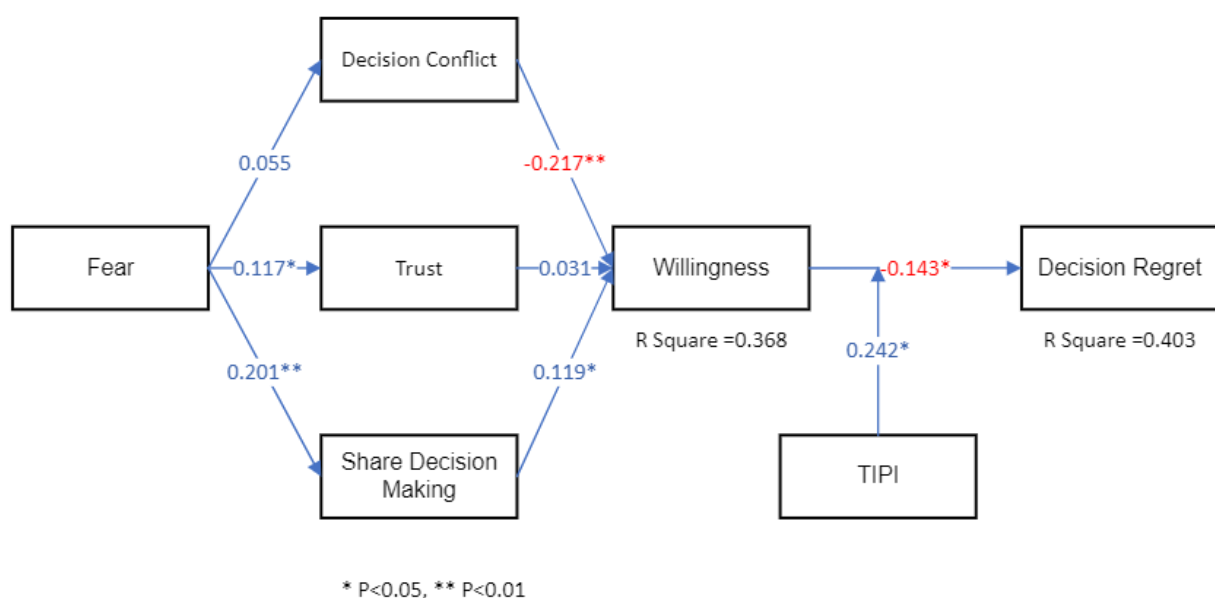


**Figure 3.** The results of structure model test.

## 4. Discussion

As a result, our study demonstrates that TPB is an effective tool for addressing the vaccination behavior of Taiwanese breast cancer patients in relation to COVID-19. The proposed model expands existing knowledge by incorporating the impact of personality traits on the behavior of breast cancer patients receiving future COVID-19 booster shots. The aim of this study was to extend the behavioral analysis of TPB concerning the willingness to be vaccinated against COVID-19 in breast cancer patients. The following discussion addresses Intention, Attitude (Subjective Norms), and Perceived Behavior Control. The model explains approximately 36.8% of the total variance in breast cancer patients’ willingness to receive the COVID-19 vaccine and 40.3% of the variance in predicting their future vaccination behaviors, including whether they regret their decision to get vaccinated. Compared to the original TPB, which explained about 34.0% variance, our model demonstrated better explanatory power [24]. Collectively, our theoretical framework provides strong evidence for understanding breast cancer patients’ vaccination behaviors and predicting future vaccination behaviors for COVID-19.

This study suggests that breast cancer patients' fear of COVID-19 does not influence their decision conflicts regarding cancer treatment. Consequently, their concerns about COVID-19 have not affected their choices of cancer treatment options. However, fear of COVID-19 indirectly affects their willingness to receive vaccination through shared decision-making. Patients are more likely to get vaccinated if they have increased opportunities to discuss their treatment with their physicians. These findings contrast with previous studies indicating that cancer patients may use less healthcare during the pandemic [25,26].

Furthermore, fear of COVID-19 has increased the trust breast cancer patients place in their physicians. As fear intensifies, physicians become more trusted. A recent study in five European countries on nurses' intentions to get vaccinated against COVID-19 found that nurses who trusted the government and physicians for COVID-19-related information were more likely to get vaccinated than those who did not [27]. However, this study did not investigate the relationship between trust in physicians and fear of COVID-19. Another study examining institutional trust and attitudes toward COVID-19 vaccination found that trust and fear positively influenced vaccination attitudes in the general population. Li et al. also found that physicians' advice is a critical factor in shaping public vaccination intentions [28]. Similar observations were reported by other researchers [29–33].

Additionally, our findings indicate that fear of COVID-19 significantly impacts breast cancer patients' vaccination decision-making. An Iranian study showed that fear of COVID-19 and the perception of its infectivity positively influenced public willingness to vaccinate. However, to the best of our knowledge, no previous study has explored the link between fear of COVID-19 and shared decision-making. Results from our study revealed that decision conflicts and shared decision-making directly and independently affect breast cancer patients' willingness (or reluctance) to get vaccinated, rather than being mediated through trust in physicians.

Notably, decision conflicts strongly undermined willingness to vaccinate. These results contradict Zhang et al.'s findings, which suggested that decision conflict was not a barrier to COVID-19 vaccination [18]. However, Wang et al. found that uncertainty about which type of booster vaccine to receive reduced individuals' likelihood of getting a booster dose [19]. Regarding shared decision-making, Durand et al. argued that discussions with multidisciplinary healthcare teams positively impact vaccination rates, particularly in influenza vaccination [34]. Our study provides empirical evidence supporting Durand's findings. However, we observed that decision conflicts and shared decision-making did not significantly affect trust in physicians.

Finally, our results confirmed that breast cancer patients hesitant to get vaccinated are more likely to experience regret. Previous studies primarily examined the relationship between vaccine hesitancy and vaccination rates among oncologic patients [35–37]. To the best of our knowledge, this study is the first to assess COVID-19 vaccination decision regret among breast cancer patients, highlighting its potential influence on their future willingness to be vaccinated.

## **5. Conclusions**

The findings from this study demonstrate that TPB is an effective tool for

addressing the complex vaccination behaviors associated with COVID-19 in Taiwanese breast cancer patients. The aim of this study was to extend the behavioral analysis of breast cancer patients' willingness to receive the COVID-19 vaccine. The structure of the model explained 36.8% of the variance in willingness to be vaccinated. Additionally, it explained 40.3% of the variance in predicting future vaccination behaviors. The theoretical framework of this study provides robust evidence for understanding the vaccination behaviors of breast cancer patients and predicting their future responses to COVID-19 vaccination.

The study also found that patients who were given more opportunities to discuss their treatment with their physicians were more likely to be vaccinated against COVID-19. While previous studies have explored the relationship between fear of COVID-19 and vaccination decisions, this study investigated whether the trust relationship between cancer patients and their physicians influenced their willingness to be vaccinated. The findings suggest that this trust did not significantly impact vaccination decisions during the pandemic.

Finally, the research confirms that breast cancer patients who hesitate to get vaccinated are more likely to experience regret. These findings provide valuable insights into the behavioral aspects of cancer patients' vaccination decisions, offering strategies to reduce fear and enhance the effectiveness of preventive measures in the future.

### **5.1. Limitations**

The study acknowledges several limitations that may influence the interpretation of the findings. First, the lack of stratification by treatment stage (e.g., newly diagnosed, in remission, metastatic disease) may limit the generalizability of the results. Patients at different stages of treatment often experience varying psychological and physical challenges, which could impact their decision-making processes regarding vaccination. Future research should include stratified analyses to explore how treatment stages influence shared decision-making, decisional conflict, and vaccination willingness; Second, while the study modeled key psychosocial factors, it did not include trust in physicians as a formal mediator or moderator in the structural equation modeling.

In addition, although the model supports direct effects of SDM and decisional conflicts, limitations in the design prevent us from excluding potential underlying mediators or moderators, such as trust or other unmeasured psychosocial factors. These findings should be interpreted in light of this limitation, with a need for future investigations to confirm and refine these relationships.

### **5.2. Recommendations for future research**

**Stratified Analyses by Treatment Stage:** To address the limitation of not accounting for the treatment stage, future studies should stratify participants based on their treatment status (e.g., newly diagnosed, in remission, or metastatic disease). This approach can provide insights into how the psychological and physical challenges at each stage affect shared decision-making (SDM), decisional conflict, and vaccination

behaviors. Comparing these subgroups can help identify tailored interventions that address the unique needs of each patient category.

**Incorporating Trust in Physicians:** Given the importance of trust in healthcare providers, future research should explicitly include trust in physicians as a potential mediator or moderator in the structural equation modeling. By doing so, researchers can better understand how trust influences the relationship between SDM, decisional conflict, and vaccination willingness, thereby providing a more nuanced view of patient decision-making.

**Exploration of Additional Mediators and Moderators:** To overcome the design limitations related to unmeasured psychosocial factors, future studies should explore other potential mediators or moderators, such as health literacy, social support, or cultural influences. These factors may offer valuable insights into the mechanisms driving vaccination behaviors among cancer patients.

**Longitudinal Study Design:** A longitudinal study could address the current limitations by examining how SDM, decisional conflict, trust in physicians, and other psychosocial factors evolve over time. Such an approach would enable researchers to capture changes in vaccination willingness and identify causal pathways.

**Qualitative Insights:** Incorporating qualitative methods, such as interviews or focus groups, could provide deeper insights into the subjective experiences of patients at different treatment stages. This can complement quantitative findings and offer a more comprehensive understanding of the barriers and facilitators to vaccination.

**Cross-Cultural Studies:** To enhance the generalizability of findings, future research should include diverse populations from different cultural and healthcare settings. Examining variations across these contexts can help identify universal and context-specific factors influencing vaccination behaviors.

**Supplementary materials:** Supplementary materials include detailed respondent characteristics (Supplementary **Table S1**), reliability metrics (Supplementary **Table S2**), and AVE for constructs (Supplementary **Table S3**), available online.

**Author contributions:** Conceptualization, HYK and WCT; study design, HYK and WCT; data analysis, HYK and WCT; writing the initial draft of the manuscript, HYK and YCAL; revising the initial draft of the manuscript, HYK and YCAL; manuscript submission, YCAL; addressing the reviewers' comments, YCAL; funding, WCT and CCC; project administration, WCT and CCC; data collection, WCT and CCC; supervised the research, CHL (Ching-Hsiang Lai); facilitated execution of research, CHL (Ching-Hsiang Lai); data analysis, IFC; assisted with the initial draft, IFC; literature review, CHL (Chiu-Hsiang Lee) and CLC; data validation, CHL (Chiu-Hsiang Lee) and CLC; manuscript refinement, CHL (Chiu-Hsiang Lee) and CLC. All authors have read and agreed to the published version of the manuscript.

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**Ethical approval:** This study was conducted in accordance with the Declaration of Helsinki. Ethical approval for this study was obtained from the Institutional Review Board (IRB) of Sun Yat-sen University of Medical Sciences, Taiwan, with IRB code CS2-21150. All procedures involving human participants complied with the ethical standards of the Institutional Research Board, and informed consent was obtained from all participants.

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

## References

1. Albarracín D, Jung H. A research agenda for the post-COVID-19 world: Theory and research in social psychology. *Asian Journal of Social Psychology*. 2021; 24(1): 10–17. doi: 10.1111/ajsp.12469
2. Hagger MS, Hamilton K. Social cognition theories and behavior change in COVID-19: A conceptual review. *Behaviour Research and Therapy*. 2022; 154: 104095. doi: 10.1016/j.brat.2022.104095
3. Huang Q, Gilkey MB, Thompson P, et al. Explaining higher Covid-19 vaccination among some US primary care professionals. *Social Science & Medicine*. 2022; 301: 114935. doi: 10.1016/j.socscimed.2022.114935
4. Kuderer NM, Choueiri TK, Shah DP, et al. Clinical impact of COVID-19 on patients with cancer (CCC19): a cohort study. *The Lancet*. 2020; 395(10241): 1907–1918. doi: 10.1016/s0140-6736(20)31187-9
5. Rüttrich MM, Giessen-Jung C, Borgmann S, et al. COVID-19 in cancer patients: clinical characteristics and outcome—an analysis of the LEOSS registry. *Annals of Hematology*. 2020; 100(2): 383–393. doi: 10.1007/s00277-020-04328-4
6. Gheorghe AS, Negru ŞM, Niţipir C, et al. Knowledge, attitudes and practices related to the COVID-19 outbreak among Romanian adults with cancer: a cross-sectional national survey. *ESMO Open*. 2021; 6(1): 100027. doi: 10.1016/j.esmoop.2020.100027
7. Chun JY, Kim SI, Park EY, et al. Cancer Patients' Willingness to Take COVID-19 Vaccination: A Nationwide Multicenter Survey in Korea. *Cancers*. 2021; 13(15): 3883. doi: 10.3390/cancers13153883
8. Centers for Disease Control, Ministry of Health and Welfare, Taiwan. COVID-19 Vaccination Guidelines. Available online: <https://www.cdc.gov.tw/En> (accessed on 24 October 2024).
9. Chen YC, Su SY, Jhuang JR, et al. Forecast of a future leveling of the incidence trends of female breast cancer in Taiwan: an age-period-cohort analysis. *Scientific Reports*. 2022; 12(1): 12481. doi: 10.1038/s41598-022-16056-y
10. National Comprehensive Cancer Network. Recommendations of the NCCN COVID-19 Vaccination Advisory Committee. Available online: <https://www.cdc.gov.tw/En> (accessed on 24 October 2024).
11. Chang CC. Developing the First Validity of Shared Medical Decision-Making Questionnaire in Taiwan. *Global Journal of Medical Research*. 2014; 14(K2): 9–15.
12. Epstein RM, Shields CG, Franks P, et al. Exploring and validating patient concerns: relation to prescribing for depression. *The Annals of Family Medicine*. 2007; 5(1): 21–28. doi: 10.1370/afm.621
13. Cheng SL, Liao HH, Shueng PW, et al. Exploring Oral Cancer Patients' Preference in Medical Decision Making and Quality of Life. *Stud Health Technol Inform*. 2017; 238: 32–35.
14. O'Connor AM. Validation of a decisional conflict scale. *Med Decis Making*. 1995; 15(1): 25–30. doi: 10.1177/0272989x9501500105
15. Liao HH, Cheng SL, Chang CC, et al. Decisional trust and regret mediate the HRQL in work-related hand injury patients. *European Psychiatry*. 2016; 33(S1): S479–S479. doi: 10.1016/j.eurpsy.2016.01.1753
16. Thom DH, Kravitz RL, Bell RA, et al. Patient trust in the physician: relationship to patient requests. *Family Practice*. 2002; 19(5): 476–483. doi: 10.1093/fampra/19.5.476
17. Fan CW, Chen IH, Ko NY, et al. Extended theory of planned behavior in explaining the intention to COVID-19 vaccination uptake among mainland Chinese university students: an online survey study. *Human vaccines & immunotherapeutics*. 2021; 17(10): 3413–3420. doi: 10.1080/21645515.2021.1933687

18. Zhang K, Fang Y, Chan PS, et al. Behavioral Intention to Get a Booster Dose of COVID-19 Vaccine among Chinese Factory Workers. *International Journal of Environmental Research and Public Health*. 2022; 19(9): 5245. doi: 10.3390/ijerph19095245
19. Wang XY, Liu Q, Zhang WX, et al. External Supports Are Associated With the COVID-19 Vaccination in Chinese Breast Cancer Patients: A Cross-Sectional Survey. *World Journal of Oncology*. 2022; 13(4): 172–184. doi: 10.14740/wjon1460
20. Werts CE, Linn RL, Jöreskog KG. Intraclass Reliability Estimates: Testing Structural Assumptions. *Educational and Psychological Measurement*. 1974; 34(1): 25–33. doi: 10.1177/001316447403400104
21. Nunnally JC, Bernstein IH. In: *Psychometric Theory*, 3rd ed. McGraw-Hill; 1967.
22. Fornell C, Larcker DF. Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*. 1981; 18(3): 382–388. doi: 10.2307/3150980
23. Chin WW. The partial least squares approach for structural equation modeling. In: *Modern methods for business research*. Lawrence Erlbaum Associates Publishers; 1998. pp. 295–336.
24. Han H, Al-Ansi A, Chua BL, et al. The Post-Coronavirus World in the International Tourism Industry: Application of the Theory of Planned Behavior to Safer Destination Choices in the Case of US Outbound Tourism. *International Journal of Environmental Research and Public Health*. 2020; 17(18): 6485. doi: 10.3390/ijerph17186485
25. Patt D, Gordan L, Diaz M, et al. Impact of COVID-19 on Cancer Care: How the Pandemic Is Delaying Cancer Diagnosis and Treatment for American Seniors. *JCO Clinical Cancer Informatics*. 2020; 4: 1059–1071. doi: 10.1200/cci.20.00134
26. Caston NE, Lawhon VM, Smith KL, et al. Examining the association among fear of COVID-19, psychological distress, and delays in cancer care. *Cancer Medicine*. 2021; 10(24): 8854–8865. doi: 10.1002/cam4.4391
27. Patelarou A, Saliaj A, Galanis P, et al. Predictors of nurses' intention to accept COVID-19 vaccination: A cross-sectional study in five European countries. *Journal of Clinical Nursing*. 2021; 31(9–10): 1258–1266. doi: 10.1111/jocn.15980
28. Li Z, Ji Y, Sun X. The impact of vaccine hesitation on the intentions to get COVID-19 vaccines: The use of the health belief model and the theory of planned behavior model. *Frontiers in Public Health*. 2022; 10: 882909. doi: 10.3389/fpubh.2022.882909
29. Chu A, Gupta V, Unni EJ. Utilizing the Theory of Planned Behavior to determine the intentions to receive the influenza vaccine during COVID-19: A cross-sectional survey of US adults. *Preventive Medicine Reports*. 2021; 23: 101417. doi: 10.1016/j.pmedr.2021.101417
30. Patwary MM, Bardhan M, Disha AS, et al. Determinants of COVID-19 Vaccine Acceptance among the Adult Population of Bangladesh Using the Health Belief Model and the Theory of Planned Behavior Model. *Vaccines*. 2021; 9(12): 1393. doi: 10.3390/vaccines9121393
31. Servidio R, Malvaso A, Vizza D, et al. The intention to get COVID-19 vaccine and vaccine uptake among cancer patients: An extension of the theory of planned behaviour (TPB). *Supportive Care in Cancer*. 2022; 30(10): 7973–7982. doi: 10.1007/s00520-022-07238-5
32. Liu W, Wu Y, Yang R, et al. COVID-19 Vaccination Status and Hesitancy among Breast Cancer Patients after Two Years of Pandemic: A Cross-Sectional Survey. *Vaccines*. 2022; 10(9): 1530. doi: 10.3390/vaccines10091530
33. Wang XY, Liu Q, Zhang WX, et al. External Supports Are Associated With the COVID-19 Vaccination in Chinese Breast Cancer Patients: A Cross-Sectional Survey. *World Journal of Oncology*. 2022; 13(4): 172–184. doi: 10.14740/wjon1460
34. Durand MA, Scalia P, Elwyn G. Can shared decision making address COVID-19 vaccine hesitancy? *BMJ Evidence-Based Medicine*. 2022; 27(3): 159–161. doi: 10.1136/bmjebm-2021-111695
35. Villarreal-Garza C, Vaca-Cartagena BF, Becerril-Gaitan A, et al. Attitudes and Factors Associated With COVID-19 Vaccine Hesitancy Among Patients With Breast Cancer. *JAMA Oncology*. 2021; 7(8): 1242–1244. doi: 10.1001/jamaoncol.2021.1962
36. Hossain MB, Alam MdZ, Islam MdS, et al. Health Belief Model, Theory of Planned Behavior, or Psychological Antecedents: What Predicts COVID-19 Vaccine Hesitancy Better Among the Bangladeshi Adults? *Frontiers in Public Health*. 2021; 9. doi: 10.3389/fpubh.2021.711066
37. An PL, Nguyen HTN, Dang HTB, et al. Integrating Health Behavior Theories to Predict Intention to Get a COVID-19 Vaccine. *Health Services Insights*. 2021; 14. doi: 10.1177/11786329211060130

Article

# The impact of cross disciplinary communication methods on the support needs, quality of life, and emotions of patients with advanced lung cancer

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**Abstract: Background:** The condition of advanced lung cancer patients is already quite severe. At this stage, the tumor has basically spread to other areas or caused multiple recurrent lesions, which not only increases the difficulty of treatment but also leads to a significant decrease in disease control rate. **Aim:** To analyze the impact of cross disciplinary communication methods on patients with advanced lung cancer. **Methods:** A comparative study involving 152 advanced lung cancer patients from January 2022 to January 2024 was conducted. Patients were randomly divided into an observation group (73 cases, using interdisciplinary communication) and a control group (79 cases, using routine nursing). An interdisciplinary team, including nurses, physicians, head nurses, and psychology experts, developed communication plans. The study compared emotional states (DASS-21), supportive care needs (SCNS-SF34), disease uncertainty (MUIS), quality of life (FACT-L), and compliance between the two groups. The study's limitation is the relatively single sample selection, potentially affecting result generalizability. **Result:** After intervention, the DASS-21 score, SCNS-SF34 score, and MUIS score in the observation group were lower than those in the control group, while the FACT-L score was higher than that in the control group ( $P < 0.05$ ); the good compliance rate of the observation group was 97.26% (71/73), which was higher than that of the control group (86.08% (68/79) ( $P < 0.05$ )). **Conclusion:** For patients with advanced lung cancer, adopting cross disciplinary communication for intervention can not only effectively alleviate their negative emotions and reduce their sense of disease uncertainty, but also maximize the satisfaction of their supportive care needs, ensure their quality of life, and to some extent, obtain good cooperation from patients.

**Keywords:** interdisciplinary communication methods; advanced lung cancer; support requirements; quality of life; emotions; disease uncertainty

## 1. Introduction

Late-stage lung cancer refers to the period when lung cancer develops to the final stage, which can present with various symptoms such as difficulty breathing, chest pain, hoarseness, decreased appetite, and lack of energy [1]. Patients are plagued by long-term pain and psychological problems, and there is an urgent need to carry out reasonable and effective intervention measures to change this situation [2,3]. The focus of routine nursing intervention is on the disease itself, mainly providing some basic life care and medical care, but it is easy to overlook the psychological needs of patients, so the overall intervention effect is difficult to achieve expectations [4,5]. Cross disciplinary communication refers to the effective exchange of information between individuals from different professional backgrounds to achieve common understanding, collaboration, and problem-solving. This intervention method not only improves the work efficiency of nursing staff, but also provides more comprehensive

nursing services for patients [6–9]. However, there are currently few clinical research reports on the application of cross disciplinary communication methods in advanced lung cancer patients. In view of this, to further clarify the role of cross disciplinary communication methods, this study will make the following analysis.

## **2. Materials and methods**

### **2.1. General information**

The study will ask patients and families to sign informed consent before the study and inform the possible intervention received as well as grouping measures (Approval number: JD-HG-2024-080). Patients and their families are informed in detail about the relevant content of the study, and consent is obtained before implementation. According to the simple random grouping, 152 patients with advanced lung cancer admitted to our hospital from January 2022 to January 2024 were divided into groups. Among them, there were 43 male patients and 36 female patients in the control group ( $n = 79$ ), with an age range of 47–80 years, an average age of  $(63.57 \pm 5.52)$  years, an average survival year of  $(3.03 \pm 0.75)$  years, and 13 cases of small cell lung cancer and 66 cases of non-small cell lung cancer as histology; There were 42 male patients and 31 female patients in the observation group ( $n = 73$ ), aged between 45 and 79 years, with an average age of  $(62.08 \pm 5.74)$  years and an average survival year of  $(2.99 \pm 0.71)$  years. The histology were 11 cases of small cell lung cancer and 62 cases of non-small cell lung cancer. The difference between the two groups was not statistically different.

Inclusion criteria: 1) After comprehensive evaluation by imaging examination, pathological examination, laboratory examination, it meets the relevant diagnostic criteria for lung cancer [3], and the condition has progressed to the late stage; 2) expected survival period of more than six months; 3) there are no abnormalities in cognitive function, speech function, audio-visual function; 4) patients are all willing to participate and each item has been agreed upon in writing.

Exclusion criteria: 1) Patients in the terminal stage with unstable conditions are excluded. During the observation period, we need to assess the mental health status of each patient. Therefore, patients who have already received mental health treatment also need to be excluded; 2) other types of malignant tumors; 3) suffering from mental illness or having a history of mental illness; 4) refuse to participate or withdraw midway.

### **2.2. Methods**

#### **2.2.1. Implementation of routine care in the control group**

Mainly including disease monitoring, nutritional support, medication guidance, daily life management.

#### **2.2.2. On the basis of the control group, the observation group implements interdisciplinary communication methods**

- 1) Build a cross disciplinary communication team. Select 3–5 responsible nurses from departments such as oncology, respiratory medicine, and thoracic surgery, collaborate with attending physicians, head nurses, psychology experts, and

combine literature and clinical experience to discuss communication plans with patients with advanced lung cancer. Encourage the above members to share their personal experience and professional knowledge, regularly organize group members to learn about lung cancer, nursing, psychology, and other related knowledge, and conduct communication skills training courses.

- 2) Establish a shared information platform. Summarize and organize the medical records, laboratory test results, radiological images. of advanced lung cancer patients, establish electronic files, and delegate access permissions to departments such as oncology, respiratory medicine, and thoracic surgery. The attending physician, responsible nurse, and nurse are responsible for timely and accurate transmission of patient information and medical plans. Personnel from departments such as oncology, respiratory medicine, and thoracic surgery, as well as psychology experts, provide corresponding opinions and suggestions on their professional fields, and team members participate in decision-making together.
- 3) Establish an effective communication mechanism. Develop a communication outline guided by the patient's existing problems and needs; from the patient's perspective, refine communication content based on their emotions and stance; determine the final communication method through open communication and discussion, and encourage mutual supervision and reminders among members. Under the joint advice of departments such as oncology, respiratory medicine, and thoracic surgery, the attending physician can first provide diversified health education with written materials, graphic materials, video materials, and other resources to explain the relevant knowledge of lung cancer to patients in detail. Secondly, the focus should be on the treatment plan and prognosis of advanced lung cancer, and then follow the patient's wishes to clarify the final treatment plan [10]. The responsible nurse maintains close communication with the attending physician to understand the patient's treatment plan and instructions, so that when communicating with the patient's family, they can accurately convey the patient's condition and treatment progress; collaborative psychology experts jointly participate in face-to-face communication with patients, with psychological experts observing the patient's words and actions, summarizing their current psychological problems [11]. Then, under the joint guidance of the attending physician, professionals from various departments, and psychological experts, responsible nurses provide personalized psychological counseling to the patient. They first guide the patient to actively express their true thoughts and concerns, and then intervene with music therapy, attention transfer, mindfulness meditation training [12–14]. The psychological consultant communicates with the patient and their families, evaluates the psychological status, understands the real thoughts, and gives targeted counseling. At the same time, explain more successful cases of advanced lung cancer, so that patients can see hope, improve confidence and eliminate psychological stress. Finally, it is recommended that patients can self-regulate their psychology through exercise, listening to music, and other methods when negative emotions occur [15]. During the entire intervention period, the head nurse improved the nursing management of late-stage lung cancer patients based on the instructions of the attending physician and the guidance of professional personnel in various departments. She was

mainly responsible for coordinating the nursing work plan of late-stage lung cancer patients, supervising the work of responsible nurses, and coordinating the relationship between medical staff and patients [16].

### 2.3. Observation indicators

- 1) Emotional state: The Chinese version of the Depression Anxiety Stress Scale 21 (DASS-21) [4] was used for evaluation, divided into three indicator factors of anxiety, depression, and stress, with a total of 21 items. Each indicator factor contains 7 items, and the scoring standard is 0–3 points. Higher scores represent higher levels of anxiety, depression and stress in patients. The evaluation timeline is before and after the intervention. (Note: The reliability coefficient of DASS-21 is 0.891, and the validity coefficient is 0.925).
- 2) Supportive Care Needs: The Chinese version of the Cancer Patient Supportive Care Needs Survey-Short Form (SCNS-SF34) [5] was used for evaluation, covering 5 dimensions: Physiological and daily life needs (5 items, 5–25 points), psychological needs (10 items, 10–50 points), sexual needs (3 items, 3–15 points), medical system service and information needs (11 items, 11–55 points), care and support needs (5 items, 5–25 points), totaling 34 items. Each item has a minimum score of 1 point and a maximum score of 5 points, resulting in a total score of 34 items. The evaluation timeline is before and after the intervention. (Note: The reliability coefficient of SCNS-SF34 is 0.953, and the validity coefficient is 0.896).
- 3) Disease Uncertainty: The Chinese version of the Mishel-Uncertainty of Illness Scale (MUIS) [6] was used for evaluation. The scale includes three dimensions: Fuzzy, unclear, and unpredictable, with a total of 20 items. The number of items in each dimension is 8, 7, and 5, respectively. According to the Likert Level 4 score, 0 represents no correlation, and 3 represents strong correlation. The patient's disease uncertainty can increase with the increase of the obtained score. The evaluation time point is before and after the intervention. (Note: The reliability coefficient of MUIS is 0.836, and the validity coefficient is 0.810).
- 4) Quality of Life: The Chinese version of the Functional Assessment of Cancer Therapy Lung Cancer (FACT-L) [7] was used for evaluation. The scale mainly consists of 6 fields and 44 items (each item is assigned a score of 1–5), namely physiological status, social/family status, relationship with doctors, emotional status, functional status, and attention to attachments. The number of items included is 8, 8, 3, 7, 8, and 10, respectively. The higher the score, the higher the quality of life of the patient. The evaluation timeline is before and after the intervention. (Note: The reliability coefficient of FACT-L is 0.841, and the validity coefficient is 0.823).
- 5) Medical compliance behavior: After intervention, patients are classified into three levels based on their level of cooperation: Excellent, fair, and poor. The good rate of medical compliance behavior is the sum of excellent rate and fair rate.

## 2.4. Statistical analysis

All the data collected in this study were processed using SPSS 27.0 software, and the quantitative data showed ( $\bar{x} \pm s$ ). After relevant tests and processing adjustments, all data conforms to a normal distribution. Independent sample t-tests were used for inter group comparisons, and paired sample t-tests were used for intra group comparisons; the counting data shows a percentage rate (%), and an  $X^2$  test is used; rank sum test ( $Z$ ) is used for rank data;  $P < 0.05$  indicates a statistically significant difference.

## 3. Result

### 3.1. Comparison of emotional states between two groups

Before intervention, the scores of the three indicator factors in the DASS-21 score between groups were well balanced, and the difference was not statistically significant ( $P > 0.05$ ). After intervention, the scores of the above indicator factors were compared within and between groups, and the difference was statistically significant ( $P < 0.05$ ). See **Table 1** for details:

**Table 1.** Comparison of the emotional state of the two groups ( $\bar{x} \pm s$ , score).

| group             | n  | anxious             |                    | depressed           |                    | pressure            |                    |
|-------------------|----|---------------------|--------------------|---------------------|--------------------|---------------------|--------------------|
|                   |    | Before intervention | After intervention | Before intervention | After intervention | Before intervention | After intervention |
| control group     | 79 | 16.52 $\pm$ 2.47    | 13.21 $\pm$ 2.38*  | 15.36 $\pm$ 2.58    | 12.83 $\pm$ 2.21*  | 17.79 $\pm$ 2.64    | 14.85 $\pm$ 2.43*  |
| observation group | 73 | 16.39 $\pm$ 2.50    | 12.14 $\pm$ 2.26*  | 15.43 $\pm$ 2.61    | 11.79 $\pm$ 2.14*  | 17.63 $\pm$ 2.59    | 13.78 $\pm$ 2.32*  |
| t                 |    | 0.322               | 2.837              | 0.166               | 2.943              | 0.377               | 2.772              |
| p                 |    | 0.748               | 0.005              | 0.868               | 0.004              | 0.707               | 0.006              |

Note: Specific values against the same group before the intervention, \*  $P < 0.05$ .

### 3.2. Comparison of two groups of supportive care needs

**Table 2.** Comparison of supportive care needs between the two groups ( $\bar{x} \pm s$ , sub-group).

| group             | n  | Physiological and daily life needs |                    | psychological need  |                    | Sexual needs        |                    | Medical system services and information needs |                    | Care and support needs |                    |
|-------------------|----|------------------------------------|--------------------|---------------------|--------------------|---------------------|--------------------|-----------------------------------------------|--------------------|------------------------|--------------------|
|                   |    | Before intervention                | After intervention | Before intervention | After intervention | Before intervention | After intervention | Before intervention                           | After intervention | Before intervention    | After intervention |
| control group     | 79 | 19.18 $\pm$ 20.36                  | 16.49 $\pm$ 20.24* | 37.29 $\pm$ 50.45   | 28.35 $\pm$ 50.28* | 10.57 $\pm$ 20.32   | 7.15 $\pm$ 20.21*  | 42.08 $\pm$ 50.47                             | 30.02 $\pm$ 50.23* | 20.78 $\pm$ 20.21      | 17.29 $\pm$ 20.10* |
| observation group | 73 | 19.21 $\pm$ 20.42                  | 15.57 $\pm$ 20.13* | 37.16 $\pm$ 50.30   | 26.24 $\pm$ 50.10* | 10.59 $\pm$ 20.26   | 6.23 $\pm$ 20.04*  | 42.10 $\pm$ 50.51                             | 27.84 $\pm$ 50.16* | 20.64 $\pm$ 20.19      | 16.41 $\pm$ 20.07* |
| t                 |    | 0.077                              | 2.590              | 0.149               | 2.502              | 0.054               | 2.660              | 0.022                                         | 2.584              | 0.392                  | 2.599              |
| p                 |    | 0.938                              | 0.011              | 0.882               | 0.013              | 0.957               | 0.009              | 0.982                                         | 0.011              | 0.696                  | 0.010              |

Note: Specific values against the same group before the intervention, \*  $P < 0.05$ .

Before intervention, the scores obtained from the 5 dimensions of the SCNS-SF34 score between groups were well balanced, and the difference was not statistically

significant ( $P > 0.05$ ). After intervention, the scores obtained from the above dimensions were compared within and between groups, and the difference was statistically significant ( $P < 0.05$ ). See **Table 2** for details.

### 3.3. Comparison of uncertainty in three groups of diseases

Before intervention, the scores obtained from the three dimensions of the MUIS score between groups were well balanced, and the difference was not statistically significant ( $P > 0.05$ ). After intervention, the scores obtained from the above dimensions were compared within and between groups, and the difference was statistically significant ( $P < 0.05$ ). See **Table 3** for details:

**Table 3.** Comparison of disease uncertainty between the two groups ( $\bar{x} \pm s$ , points).

| group             | n  | vague               |                    | Lack of clarification |                    | unpredictable       |                    |
|-------------------|----|---------------------|--------------------|-----------------------|--------------------|---------------------|--------------------|
|                   |    | Before intervention | After intervention | Before intervention   | After intervention | Before intervention | After intervention |
| control group     | 79 | 18.28 $\pm$ 2.45    | 15.48 $\pm$ 2.29*  | 17.25 $\pm$ 2.39      | 14.09 $\pm$ 2.23*  | 12.09 $\pm$ 2.20    | 10.21 $\pm$ 2.15*  |
| observation group | 73 | 18.10 $\pm$ 2.37    | 14.52 $\pm$ 2.16*  | 17.32 $\pm$ 2.27      | 13.20 $\pm$ 2.12*  | 12.14 $\pm$ 2.32    | 9.32 $\pm$ 2.06*   |
| t                 |    | 0.460               | 2.653              | 0.185                 | 2.517              | 0.136               | 2.601              |
| p                 |    | 0.646               | 0.009              | 0.854                 | 0.013              | 0.892               | 0.010              |

Note: Specific values against the same group before the intervention, \*  $P < 0.05$ .

### 3.4. Comparison of quality of life between two groups

Before intervention, the scores obtained in the six areas of the FACT-L score between groups were well balanced, and the difference was not statistically significant ( $P > 0.05$ ). After intervention, the scores obtained in the above areas were compared within and between groups, and the difference was statistically significant ( $P < 0.05$ ). See **Table 4** for details:

**Table 4.** Comparison of the quality of life between the two groups ( $\bar{x} \pm s$ , points).

| group             | n  | Physiological condition |                    | Social/family situation |                    | Relationship with doctors |                    |
|-------------------|----|-------------------------|--------------------|-------------------------|--------------------|---------------------------|--------------------|
|                   |    | Before intervention     | After intervention | Before intervention     | After intervention | Before intervention       | After intervention |
| control group     | 79 | 22.65 $\pm$ 5.12        | 27.86 $\pm$ 5.34*  | 26.18 $\pm$ 5.07        | 29.36 $\pm$ 5.18*  | 9.65 $\pm$ 1.06           | 11.49 $\pm$ 1.24*  |
| observation group | 73 | 22.54 $\pm$ 5.09        | 30.11 $\pm$ 5.53*  | 26.22 $\pm$ 5.10        | 31.53 $\pm$ 5.25*  | 9.58 $\pm$ 1.13           | 12.05 $\pm$ 1.36*  |
| t                 |    | 0.133                   | 2.551              | 0.048                   | 2.564              | 0.394                     | 2.655              |
| p                 |    | 0.895                   | 0.012              | 0.961                   | 0.011              | 0.694                     | 0.009              |
| control group     | 79 | 22.05 $\pm$ 5.12        | 25.74 $\pm$ 5.26*  | 27.24 $\pm$ 5.18        | 30.51 $\pm$ 5.33*  | 32.16 $\pm$ 5.25          | 36.56 $\pm$ 5.43*  |
| observation group | 73 | 22.17 $\pm$ 5.21        | 28.01 $\pm$ 5.34*  | 27.15 $\pm$ 5.23        | 32.75 $\pm$ 5.48*  | 32.20 $\pm$ 5.18          | 38.84 $\pm$ 5.51*  |
| t                 |    | 0.143                   | 2.639              | 0.107                   | 2.554              | 0.047                     | 2.568              |
| p                 |    | 0.886                   | 0.009              | 0.915                   | 0.012              | 0.962                     | 0.011              |

Note: Specific values against the same group before the intervention, \*  $P < 0.05$ .

### 3.5. Comparison of medical compliance behaviors between two groups

The comparison of good compliance rates between groups showed that the observation group had a higher rate, and the difference between groups was statistically significant (86.08% vs. 97.26%),  $Z = 2.047$ ,  $P < 0.05$ ). See **Table 5** for details:

**Table 5.** Comparison of medical compliance behavior between the two groups (n, %).

| group             | n  | outstanding | tolerableness | range      | Good behavior rate of medical compliance |
|-------------------|----|-------------|---------------|------------|------------------------------------------|
| control group     | 79 | 30 (37.97)  | 38 (48.10)    | 10 (12.66) | 68 (86.08)                               |
| observation group | 73 | 39 (53.42)  | 32 (43.84)    | 2 (2.74)   | 71 (97.26)                               |
| Z                 |    | 2.047       |               |            |                                          |
| p                 |    | 0.040       |               |            |                                          |

## 4. Discussion

According to relevant epidemiological data [17], in recent years, with the continuous progress of medical technology, the risk, development, disease control and other aspects of lung cancer have made progress, but its incidence rate and mortality are still at a high level, which should not be underestimated [18–20]. It may be related to the lack of typicality in the early clinical symptoms of patients, and most patients are diagnosed in the middle and late stages. Late-stage lung cancer patients not only have to endure physiological discomfort, but also are prone to complex psychological problems [20]. Therefore, in addition to delaying the progression of the disease, psychological and other aspects of care need to be added. Conventional nursing interventions have universal applicability, but for patients with advanced lung cancer, they cannot meet their psychological needs and the overall intervention effect is difficult to achieve [21–23]. Adopting interdisciplinary communication methods for intervention can help patients improve their disease awareness, reduce psychological pressure, and correct bad behaviors from a cognitive and belief perspective [24].

The results of this study showed that after intervention, the DASS-21 score and MUIS score of the observation group were both at lower levels ( $P < 0.05$ ). The reason for the analysis is that patients with advanced lung cancer often suffer from factors such as insufficient understanding of the disease and turning pale when talking about cancer [25]. While bearing the burden of the disease, they also have to endure discrimination from others and society. Therefore, they generally have negative emotions such as anxiety and depression, and are prone to developing a sense of learned helplessness or disease uncertainty, which exacerbates psychological problems and forms a vicious cycle. In the intervention of cross disciplinary communication methods, the attending physician collaborates with professionals from various departments to carry out diversified health education, which can help patients correctly understand their own diseases, establish correct disease concepts and corresponding risk awareness, weaken their sense of disease uncertainty, and encourage them to self perceive and follow the doctor's advice to take behaviors that are conducive to alleviating their own conditions [26–28]. Personalized psychological counseling by responsible nurses in collaboration with psychological experts can

effectively adjust the emotional state of patients, enabling them to maintain a good mood and subsequently correct pathological psychology and abnormal behavior. In addition, according to the data in **Table 5** of this study, the good compliance rate of the observation group can reach 97.26%, indicating that cross professional communication methods are more helpful in mobilizing the initiative and enthusiasm of patients, thereby achieving good cooperation between nurses and patients.

The results of this study showed that after intervention, compared to the control group, the observation group had a lower SCNS-SF34 score and a higher FACT-L score ( $P < 0.05$ ). The reason for the analysis is that supportive care needs are a collective term for various types of assistance needed to better cope with and adapt to diseases, manage disease symptoms and complications, and maintain individual quality of life, in addition to necessary medical measures. Due to the fact that most patients with advanced lung cancer are already suffering from pain interference at the time of treatment, and even their daily life order has been severely disrupted, and their psychological state is mostly in an imbalanced state, there is an urgent need for relevant medical system services, information, psychological needs [29]. In the intervention of cross disciplinary communication methods, building cross disciplinary communication groups and establishing shared information platforms can ensure that the formulation and implementation of various intervention measures can be accurately implemented; effective communication mechanisms such as diversified health education and personalized psychological counseling can meet the nursing needs of patients in terms of related medical system services, information needs, psychological needs, and other aspects [30]; all of the above can help patients restore normal life order as soon as possible.

The limitations of this study lie in the relatively single sample selection, which may affect the universality of the results. Moreover, the sample size is small. Therefore, in the future, a larger sample size is needed for observational research. In addition, this study only conducted short-term observation and evaluation of patients. In the future, further follow-up research is needed to observe the long-term effects.

## 5. Conclusion

By using cross disciplinary communication to intervene in advanced lung cancer patients, satisfactory intervention results can be achieved. On the one hand, it can effectively alleviate the negative emotions of patients, reduce their psychological burden, reduce disease uncertainty, and encourage patients to actively cooperate with medical staff, laying a good foundation for ensuring their quality of life; on the other hand, it can meet the different nursing needs of patients and is committed to providing high-quality nursing services, which can be an ideal communication method for patients with advanced lung cancer. This study provides a scientific basis for the clinical treatment and prognosis of patients with advanced lung cancer. In the future, further improvement and exploration of more application possibilities of the interdisciplinary communication nursing model are needed.

**Author contributions:** Designed the research study, CY; performed the primary literature review, ZW; data extraction, ZW; analyzed the data, DC; wrote the

manuscript, DC; revising the manuscript for important intellectual content, YH and JQ. All authors have read and agreed to the published version of the manuscript.

**Ethical approval:** The procedures for both T1 and T2 surveys adhered to the (i) Declaration of Helsinki; and (ii) ethical principles for medical, psychological, and sociological research involving human participants. The Nantong Cancer Hospital Research Ethics Committee approved the study protocol (NO. JD-HG-2024-080). All participants signed the informed consent in this study.

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

## References

1. Mosher CE, Krueger E, Secinti E, et al. Symptom experiences in advanced cancer: Relationships to acceptance and commitment therapy constructs. *Psycho-Oncology*. 2021; 30(9): 1485–1491.
2. Franz S, Muser J, Thielhorn U, et al. Inter-professional communication and interaction in the neurological rehabilitation team: A literature review. *Disabil. Rehabil.* 2020; 42(11): 1607–1615.
3. Baudin E, Caplin M, Garcia-Carbonero R, et al. Lung and thymic carcinoids: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann. Oncol.* 2021; 32(4): 439–451.
4. Oei TPS, Sawang S, Goh YW, et al. Using the Depression Anxiety Stress Scale 21 (DASS-21) across cultures. *Int. J. Psychol.* 2013; 48(6): 1018–1029.
5. Lyu J, Yin L, Cheng P, et al. Reliability and validity of the mandarin version of the supportive care needs survey short-form (SCNS-SF34) and the head and neck cancer-specific supportive care needs (SCNS-HNC) module. *BMC Health Serv. Res.* 2020; 20(1): 956.
6. Hagen KB, Aas T, Lode K, et al. Illness uncertainty in breast cancer patients: Validation of the 5-item short form of the Mishel Uncertainty in Illness Scale. *Eur. J. Oncol. Nurs.* 2015; 19(2):113–119.
7. Wan C, Zhang C, Cai L, et al. Psychometric properties of the Chinese version of the FACT-L for measuring quality of life in patients with lung cancer. *Lung Cancer* 2007; 56(3): 415–421.
8. Bade BC, Cruz CSD. Lung Cancer 2020: Epidemiology, Etiology, and Prevention. *Clin. Chest Med.* 2020; 41(1): 1–24.
9. Wang T, Sun J, Gu D, et al. Dyadic effects of social support, illness uncertainty on anxiety and depression among lung cancer patients and their caregivers: A cross-sectional study. *Support Care Cancer.* 2023; 31(7): 402.
10. Cochrane A, Woods S, Dunne S, et al. Unmet supportive care needs associated with quality of life for people with lung cancer: A systematic review of the evidence 2007–2020. *Eur. J Cancer Care (Engl).* 2022; 31(1): e13525.
11. Wang M, Sun Y, Zhang M, et al. Effects of high-quality nursing care on quality of life, survival, and recurrence in patients with advanced nonsmall cell lung cancer. *Medicine (Baltimore)*. 2022; 101(37): e30569. doi: 10.1097/MD.00000000000030569
12. Jiang S, Wang B, Zhang M, et al. Quality of life after lung cancer surgery: Sublobar resection versus lobectomy. *BMC Surg.* 2023; 23(1): 353. doi: 10.1186/s12893-023-02259-1
13. Takemura N, Cheung DST, Fong DYT, et al. Effectiveness of Aerobic Exercise and Tai Chi Interventions on Sleep Quality in Patients with Advanced Lung Cancer: A Randomized Clinical Trial. *JAMA Oncol.* 2024;10(2): 176–184. doi: 10.1001/jamaoncol.2023.5248
14. Li J, Li C, Puts M, et al. Effectiveness of mindfulness-based interventions on anxiety, depression, and fatigue in people with lung cancer: A systematic review and meta-analysis. *Int. J. Nurs. Stud.* 2023;1 40: 104447. doi: 10.1016/j.ijnurstu.2023.104447
15. Avancini A, Sartori G, Gkoutakos A, et al. Physical Activity and Exercise in Lung Cancer Care: Will Promises Be Fulfilled? *Oncologist.* 2020; 25(3): e555–e569. doi: 10.1634/theoncologist.2019-0463
16. Waisberg F, Lopez C, Enrico D, et al. Assessing the methodological quality of quality-of-life analyses in first-line non-small cell lung cancer trials: A systematic review. *Crit. Rev. Oncol. Hematol.* 2022; 176: 103747. doi: 10.1016/j.critrevonc.2022.103747
17. Martin RE, Loomis DM, Dean GE. Sleep and quality of life in lung cancer patients and survivors. *J. Am. Assoc. Nurse Pract.* 2021; 34(2): 284–291. doi: 10.1097/JXX.0000000000000625

18. Couderc AL, Bouhnik AD, Rey D, et al. Quality of life in older French long-term lung cancer survivors: VICAN5 national survey. *Lung Cancer*. 2023; 180: 107197. doi: 10.1016/j.lungcan.2023.107197
19. Cochrane A, Woods S, Dunne S, Gallagher P. Unmet supportive care needs associated with quality of life for people with lung cancer: A systematic review of the evidence 2007–2020. *Eur. J. Cancer Care (Engl)*. 2022; 31(1): e13525. doi: 10.1111/ecc.13525
20. Peddireddy V. Psychological interventions to improve the quality of life in Indian lung cancer patients: A neglected area. *J. Health Psychol*. 2019; 24(1): 100–112. doi: 10.1177/1359105316650930
21. Lu Y, Bai X, Pan C. Impact of exercise interventions on quality of life and depression in lung cancer patients: A systematic review and meta-analysis. *Int. J. Psychiatry Med*. 2024; 59(2): 199–217. doi: 10.1177/00912174231190451
22. Westeel V, Bourdon M, Cortot AB, et al. Management of lung cancer patients' quality of life in clinical practice: A Delphi study. *ESMO Open*. 2021; 6(4): 100239. doi: 10.1016/j.esmoop.2021.100239
23. Liu YY, Zhao Y, Yin YY, et al. Effects of transitional care interventions on quality of life in people with lung cancer: A systematic review and meta-analysis. *J. Clin. Nurs*. 2024; 33(5): 1976–1994. doi: 10.1111/jocn.17092
24. Ester M, Culos-Reed SN, Abdul-Razzak A, et al. Feasibility of a multimodal exercise, nutrition, and palliative care intervention in advanced lung cancer. *BMC Cancer*. 2021; 21(1): 159. doi: 10.1186/s12885-021-07872-y
25. Ohashi K, Suzuki H, Sata Y, et al. Postoperative pain and quality of life after lung cancer surgery: A prospective observational study. *Ann. Palliat. Med*. 2023; 12(2): 346–355. doi: 10.21037/apm-22-207
26. Li Y, Wang Q, Liu C, Hu X. Symptom clusters and their impact on quality of life among Chinese patients with lung cancer: A cross-sectional study. *Eur. J. Oncol. Nurs*. 2023; 67: 102465. doi: 10.1016/j.ejon.2023.102465
27. Johnson LA, Schreier AM, Swanson M, et al. Stigma and Quality of Life in Patients with Advanced Lung Cancer. *Oncol. Nurs. Forum*. 2019 ;46(3): 318–328. doi: 10.1188/19.ONF.318-328
28. Schad F, Steinmann D, Oei SL, et al. Evaluation of quality of life in lung cancer patients receiving radiation and Viscum album L.: A real-world data study. *Radiat. Oncol*. 2023; 18(1): 47. doi: 10.1186/s13014-023-02234-3
29. Gonzalez-Ling A, Galindo Vázquez O, Espinoza Bello M, et al. Quality of life, anxiety, depression, and distress in patients with advanced and metastatic lung cancer. *Palliat. Support. Care*. 2023; 21(4): 608–615. doi: 10.1017/S147895152200116X
30. Llamas-Ramos I, Alvarado-Omenat JJ, Rodrigo-Reguilón M, Llamas-Ramos R. Quality of Life and Side Effects Management in Cancer Treatment-A Cross Sectional Study. *Int. J. Environ. Res. Public Health*. 2023; 20(3): 1708. doi: 10.3390/ijerph20031708

## Article

# Beyond pain: The surprising connection between tramadol and depression

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**Abstract: Background:** Tramadol, a centrally acting analgesic with a dual mechanism, is frequently prescribed for pain management, including in cancer patients. However, its association with depression, a multifactorial condition influenced by genetic, biochemical, environmental, and psychosocial factors, requires further elucidation. **Objective:** This study aims to investigate the potential link between tramadol exposure and depression through a comprehensive analysis of pharmacovigilance data and Mendelian randomization methods. **Methods:** We conducted a retrospective analysis using the FDA Adverse Event Reporting System (FAERS) database, focusing on reports from Q1 2004 to Q1 2023. Data from the EBI and UK Biobank databases were also utilized. Disproportionate analysis methods, including Reporting Odds Ratio (ROR), Proportional Reporting Ratio (PRR), and Bayesian Confidence Propagation Neural Network (BCPNN), were applied to evaluate the relationship between tramadol and depression. Mendelian randomization was performed using the “TwoSampleMR” package in R software to assess the causal relationship. **Results:** The pharmacovigilance analysis revealed that mental disorders were the most frequently reported adverse events associated with tramadol use, with a significant positive association between tramadol and depression reports (ROR 1.34, 95% CI 1.25–1.44; PRR 1.34, 95% CI 1.26–1.43). Mendelian randomization analysis indicated a significant positive correlation between tramadol exposure and depression ( $P$  (IVW) = 0.01). At the same time, our comparative analysis of the risk of depression between tramadol and other opioids found that tramadol was more associated with depression risk than other opioids. Multivariate Mendelian randomization results showed that a causal relationship between tramadol and depression remained when chronic pain was considered an important confounder. **Conclusion:** The association between tramadol use and depression has significant clinical implications for patient safety and the optimization of treatment strategies. Future research should explore the impact of tramadol on the neurotransmitter system and its efficacy and safety in different subpopulations of patients with depression.

**Keywords:** tramadol; depression; pharmacovigilance; mendelian randomization; pain management; adverse events

## 1. Introduction

The complexity of depression lies in its multifactorial etiology, which encompasses genetic, biochemical, environmental, and psychosocial factors [1]. Cancer patients often experience depressive moods due to prolonged physical suffering and psychological stress, which can develop into depression in severe cases. This is not only due to concerns about the prognosis of survival, but also because some pharmacological treatments can lead to the onset of depression [2,3]. Tramadol, as a synthetic opioid analgesic, is widely used in pain management. However, its impact

on mood and mental health, as well as its relationship with depression, has not yet been fully elucidated [4]. Studies have shown that patients with chronic pain who switch to larger doses of slow-release tramadol can achieve significantly better pain relief in a short period of time, safely and without serious adverse effects [5].

Tramadol exerts its analgesic effects by acting on the  $\mu$ -opioid receptors in the central nervous system and the noradrenergic/serotonergic systems. This dual mechanism of action may have profound implications for mood regulation [6]. Some studies indicate that opioids may affect the brain's reward system and stress response, both of which are closely related to the pathophysiological mechanisms of depression [7,8]. Furthermore, the serotonin reuptake inhibition effect of tramadol may lead to mood fluctuations or exacerbation of depressive symptoms in certain individuals [9,10].

Although research has begun to explore the relationship between opioid drugs and mental health crises, there is still a lack of in-depth understanding of how tramadol affects the neurobiological pathways of depression and whether this relationship is universal. This study aims to investigate the potential link between tramadol exposure and depression through comprehensive analysis and Mendelian randomization methods.

Pharmacovigilance, as a critical tool for monitoring drug safety, identifies potential risks in drug use by collecting and analyzing Adverse Event Reports (AERs). This method provides real-time data, assisting regulatory agencies and healthcare professionals in promptly detecting and responding to safety issues. However, the limitation of pharmacovigilance data lies in the difficulty of establishing causality, especially when dealing with confounding factors and reverse causality [11].

Mendelian Randomization (MR) offers a pathway to assess the causal relationship between exposure and outcome by utilizing genetic variants as instrumental variables. The advantage of the MR method lies in its ability to mimic randomized controlled trials, thereby reducing the biases inherent in traditional observational studies and providing a more solid foundation for causal inference [12].

In this study, we have combined the real-time monitoring advantages of pharmacovigilance data with the causal inference capabilities of the Mendelian randomization method to explore the relationship between the use of Tramadol and depression. By analyzing reports from the FDA Adverse Event Reporting System (FAERS) database, we have been able to identify an association between the use of Tramadol and reports of depression. Furthermore, through MR analysis, we attempt to verify whether this association is causal and explore its potential biological mechanisms [13].

The findings of this study not only provide significant safety considerations for the clinical use of Tramadol but also offer new perspectives for future research to further explore the role of Tramadol in the treatment and management of depression. Future research should delve into the impact of Tramadol on the neurotransmitter system and its efficacy and safety among different subpopulations of patients with depression, thereby providing more personalized and safe strategies for the pharmacological treatment of patients with depression.

## 2. Materials and methods

### 2.1. Data source

Publicly available FAERS database (It has been updated quarterly since the first quarter of 2004). The data extracted in this study covers all the data in ASCII packets from Q1 2004 to Q1 2023 (77 quarters), and is cleaned and analyzed in SAS 9.4 software.

Depression data was pulled from The EBI database. The dataset contained ncase: 27,568; ncontrol: 457,030 and was collected in 2021. Tramadol was pulled from The UKbiobank database. The dataset contained ncase: 3724; ncontrol: 333,435 and was collected in 2017. Codeine was pulled from The UKbiobank database. The dataset contained ncase: 2423; ncontrol: 460,510 and was collected in 2018. Morphine was pulled from The UKbiobank database. The dataset contained ncase: 194; ncontrol: 336,965 and was collected in 2017. Validation data: Tramadol was pulled from The UKbiobank database. The dataset contained ncase: 5106; ncontrol: 457,827 and was collected in 2018. Depressive symptoms was pulled from The Social Science Genetic Association Consortium (SSGAC) database. It was collected in 2016. Major Depressive Disorder as pulled from The EBI database. database. It was collected in 2017 (**Table 1**).

**Table 1.** Data source.

| Name                      | Year Collection | Sample size | Population | Sex               | Database                                      |
|---------------------------|-----------------|-------------|------------|-------------------|-----------------------------------------------|
| Depression                | 2021            | 484,598     | European   | Males and Females | EBI database                                  |
| Tramadol                  | 2017            | 337,159     | European   | Males and Females | UKbiobank                                     |
| Codeine                   | 2018            | 462,933     | European   | Males and Females | UKbiobank                                     |
| Morphine                  | 2017            | 337,159     | European   | Males and Females | UKbiobank                                     |
| Tramadol                  | 2018            | 462,933     | European   | Males and Females | UKbiobank                                     |
| Depressive symptoms       | 2016            | 161,460     | European   | Males and Females | Social Science Genetic Association Consortium |
| Major Depressive Disorder | 2017            | 173,005     | European   | Males and Females | EBI database                                  |

### 2.2. Data processing

In the methodology section of this study, we implemented the following steps to ensure the accuracy and standardization of the data: Initially, we selected the key fields PRIMARYID, CASEID, and FDA\_DT from the DEMO table for data preprocessing, following the method recommended by the FDA's official website. We then sorted these data by CASEID to effectively organize all reports related to the same case. Subsequently, within each case, we further sorted the reports by FDA\_DT to retain the most recent reports for each case, ensuring the timeliness of the data. Furthermore, for reports with the same CASEID and FDA\_DT, we filtered based on the size of PRIMARYID, choosing to retain the report with the largest PRIMARYID value to ensure the completeness and detail of the selected report. To further ensure the standardization of the data, we adapted and classified the terminology in the reports according to the latest edition of the MedDRA dictionary, accommodating the biannual update cycle of the MedDRA dictionary [14].

### 2.3. Disproportionate analysis method

Descriptive statistics were used to show AE reported for Tramadol and depression. In our investigative study, a disproportionate analysis applied to pharmacovigilance studies was performed to generate a potential signal between atorvastatin and adverse event reactions (ADR). There are four main methods (Reporting Odds Ratio (ROR), Proportional Reporting Ratio (PRR), and BCPNN) To evaluate the relationship between Tramadol and depression [15–17].

### 2.4. Mendelian randomisation study

According to Mendelian randomisation theory, instrumental variables must satisfy the following three assumptions: 1) Instrumental variables must be strongly correlated with exposure factors (correlation hypothesis). 2) Instrumental variables are independent of confounding factors affecting exposure-outcome (independence hypothesis). 3) Instrumental variables can only influence the occurrence of results through “exposure” factors, but not through other means (exclusivity hypothesis). The “TwoSampleMR” package for R software was used for MR data analysis, using methods such as inverse-variance weighting (The IVW method combines the influence of multiple genetic variants on the results by inverse-variance weighting the effect size of each genetic variant to obtain an estimate of causality). MR Egger (The MR Egger method provides a tool for assessing causality by linear regression of the effect of exposure on outcomes while taking into account possible horizontal diversity.) and weighted median (It estimates causal effects by considering the weight of each independent instrumental variable, providing a more robust estimate when heterogeneous or incomplete instrumental variables are present). Inverse-weighted variance analysis was used to determine the causal relationship between exposure factors and results [18–20]. MR-Egger and inverse variance-weighted functions in Cochran’s Q test were used to assess heterogeneity among the study samples, and  $P > 0.05$  was taken to indicate non-heterogeneity. Horizontal pleiotropy was analysed using the “mr\_pleiotropy\_test” function of the R package of the same name, and  $P > 0.05$  was taken to indicate the absence of horizontal pleiotropy. When selecting the instrumental variables, we used tools such as SNiPA to exclude SNPs that might exhibit horizontal pleiotropy, ensuring the robustness of the instrumental variables used in the analysis [21]. Further, I conducted multivariate Mendelian randomization analysis of tramadol and chronic pain and depression.

## 3. Results

### 3.1. Descriptive results of pharmacovigilance analysis

In this study, we conducted a comprehensive analysis of adverse events of tramadol to evaluate its safety in clinical use. Based on FDA pharmacovigilance data, we found that mental disorders were the most frequently reported adverse events, accounting for 19.32% of all adverse events. It was followed by neurological diseases at 14.57%, while general diseases and administration site conditions came in third at 13.64%. Injuries, poisoning and surgical complications were also common, accounting for 12.81%. In addition, gastrointestinal diseases accounted for 7.49% of

the fifth. Other adverse events, such as respiratory diseases, musculoskeletal and connective tissue diseases, skin and subcutaneous tissue diseases, and heart disease, although relatively small, are still of concern. These data highlight the importance of close monitoring of patients during tramadol treatment to ensure timely identification and management of potential adverse events (**Table 2**).

**Table 2.** Tramadol-induced adverse drug reactions by system organ class (SOC) statistics.

| SOC                                                                 | N      | Proportion (%) |
|---------------------------------------------------------------------|--------|----------------|
| Psychiatric disorders                                               | 21,873 | 19.32          |
| Nervous system disorders                                            | 16,496 | 14.57          |
| General disorders and administration site conditions                | 15,447 | 13.64          |
| Injury, poisoning and procedural complications                      | 14,502 | 12.81          |
| Gastrointestinal disorders                                          | 8485   | 7.49           |
| Respiratory, thoracic and mediastinal disorders                     | 4572   | 4.04           |
| Investigations                                                      | 4045   | 3.57           |
| Musculoskeletal and connective tissue disorders                     | 3795   | 3.35           |
| Skin and subcutaneous tissue disorders                              | 3494   | 3.09           |
| Cardiac disorders                                                   | 3187   | 2.82           |
| Metabolism and nutrition disorders                                  | 2203   | 1.95           |
| Vascular disorders                                                  | 1983   | 1.75           |
| Immune system disorders                                             | 1707   | 1.51           |
| Renal and urinary disorders                                         | 1625   | 1.44           |
| Eye disorders                                                       | 1604   | 1.42           |
| Infections and infestations                                         | 1524   | 1.35           |
| Social circumstances                                                | 1310   | 1.16           |
| Hepatobiliary disorders                                             | 1109   | 0.98           |
| Blood and lymphatic system disorders                                | 765    | 0.68           |
| Surgical and medical procedures                                     | 762    | 0.67           |
| Ear and labyrinth disorders                                         | 711    | 0.63           |
| Product issues                                                      | 494    | 0.44           |
| Congenital, familial and genetic disorders                          | 318    | 0.28           |
| Endocrine disorders                                                 | 316    | 0.28           |
| Neoplasms benign, malignant and unspecified (incl cysts and polyps) | 312    | 0.28           |
| Pregnancy, puerperium and perinatal conditions                      | 309    | 0.27           |
| Reproductive system and breast disorders                            | 264    | 0.23           |

At the PT level, drug Dependence was the most common adverse event at 3.64%, with 4119 cases reported, underscoring the risk that tramadol could lead to dependence in patients. This was followed by Toxicity to various agents (2.47%), involving 2797 cases reported, which may be related to factors such as drug dose, individual differences or drug formulation.

Overdose and Drug dependence were also significant safety concerns in tramadol use, ranking third and fourth at 2.31% and 2.23%, respectively. Nausea and Vomiting, the most common adverse effects of tramadol, ranked sixth and seventh with rates of

1.63% and 1.49%, respectively. Death was the most serious adverse event, accounting for 1.5%, with 1,697 reported, a reminder that Tramadol use must be carefully monitored for potentially fatal risks.

It is worth noting that Completed suicide and Intentional overdose, although relatively small in number, are not negligible in severity, accounting for 1.05% and 0.9%, respectively. This suggests that we need to evaluate the mental health status of patients before prescribing tramadol (**Table 3**).

**Table 3.** Tramadol-induced adverse reactions with PT level statistics.

| PT                         | N    | Proportion (%) |
|----------------------------|------|----------------|
| Dependence                 | 4119 | 3.64           |
| Toxicity to various agents | 2797 | 2.47           |
| Overdose                   | 2611 | 2.31           |
| Drug dependence            | 2523 | 2.23           |
| Drug abuse                 | 2157 | 1.91           |
| Nausea                     | 1842 | 1.63           |
| Death                      | 1697 | 1.5            |
| Vomiting                   | 1690 | 1.49           |
| Seizure                    | 1566 | 1.38           |
| Drug ineffective           | 1550 | 1.37           |
| Drug interaction           | 1495 | 1.32           |
| Somnolence                 | 1353 | 1.2            |
| Completed suicide          | 1190 | 1.05           |
| Dizziness                  | 1173 | 1.04           |
| Confusional state          | 1144 | 1.01           |
| Pain                       | 1044 | 0.92           |
| Drug hypersensitivity      | 1026 | 0.91           |
| Intentional overdose       | 1014 | 0.9            |
| Headache                   | 942  | 0.83           |
| Intentional product misuse | 841  | 0.74           |

In our pharmacovigilance analysis of tramadol, we paid special attention to its association with depression. The data showed that tramadol was associated with depression with a reported ratio (ROR) of 1.34, with a statistically significant 95% confidence interval (1.25–1.44), indicating a positive association between tramadol use and depression reports. This finding is also supported by the Proportional Reporting Ratio (PRR), which has a value of 1.34 and a 95% confidence interval of 1.26–1.43. The values of the information component (IC) and expected information component (EIC) further provide information and expected values about this correlation (**Table 4**).

**Table 4.** Statistical analysis of the association between tramadol use and reported adverse events.

|          | ROR (95%Ci)      | PRR (95%Ci)      | IC (95%Ci)       | EIC  |
|----------|------------------|------------------|------------------|------|
| TRAMADOL | 1.34 (1.26–1.44) | 1.34 (1.26–1.43) | 0.42 (0.32–0.52) | 0.42 |

In our analysis of the demographics of tramadol reports, we noted that the reports of patients with depression had the following characteristics: The age range of patients with depression reported in the reports was broad, but concentrated in the adult population, many of whom were 65 years of age and older. In terms of gender, the higher proportion of female patients may be related to the fact that women are more likely to seek medical help and the level of social awareness of women’s mental health issues. The weight information mentioned in the report shows that the weight of patients is mostly in the normal to overweight range, which may be related to the lifestyle habits of depressed patients or the impact of the disease itself. In terms of occupation, reporters included consumers, pharmacists, physicians, and other health professionals, indicating that the use of tramadol and its impact on the treatment of depression are of concern to all sectors of society.

In addition, the severity of the report was labeled “severe,” which may mean that there may be some risk in tramadol treatment that requires strict monitoring by a medical professional. The wide range of countries covered by the report, including North America, Europe and Asia, shows that tramadol is widely used as a pharmaceutical product on a global scale. In terms of indications, many reports indicate that the indications for product use are unclear, which may indicate that there is off-label use in practical applications or that patients do not use strictly according to medical instructions (**Table 5**).

**Table 5.** Demographic information.

|                    | N (%)               |
|--------------------|---------------------|
| Gender             |                     |
| Female             | 401 (49.57)         |
| Male               | 355 (43.88)         |
| Not Specified      | 53 (6.55)           |
| Age                |                     |
| <18 (%)            | 9 (1.11)            |
| 18–44 (%)          | 124 (15.33)         |
| 45–64 (%)          | 137 (16.93)         |
| 65–74 (%)          | 29 (3.58)           |
| ≥75 (%)            | 31 (3.83)           |
| NotSpecified (%)   | 479 (59.21)         |
| Age (quantitative) |                     |
| N (Missing)        | 330 (479)           |
| Mean (SD)          | 48.76 (17.28)       |
| Median (Q1, Q3)    | 50.00 (33.00,60.00) |
| Min, Max           | 13.00, 85.00        |

**Table 5.** (Continued).

|                                                              | N (%)              |
|--------------------------------------------------------------|--------------------|
| Reporter                                                     |                    |
| Consumer                                                     | 500 (61.80)        |
| Lawyer                                                       | 34 (4.20)          |
| Not Specified                                                | 53 (6.55)          |
| Other health-professional                                    | 70 (8.65)          |
| Pharmacist                                                   | 81 (10.01)         |
| Physician                                                    | 71 (8.78)          |
| Reporting Country                                            |                    |
| United States of America                                     | 387 (47.84)        |
| Canada                                                       | 142 (17.55)        |
| United Kingdom                                               | 109 (13.47)        |
| France                                                       | 63 (7.79)          |
| Sweden                                                       | 15 (1.85)          |
| Serious report                                               |                    |
| Serious                                                      | 774 (95.67)        |
| Non-Serious                                                  | 35 (4.33)          |
| outcome                                                      |                    |
| Life-Threatening                                             | 34 (4.20)          |
| Hospitalization - Initial or Prolonged                       | 146 (18.05)        |
| Disability                                                   | 56 (6.92)          |
| Death                                                        | 31 (3.83)          |
| Congenital Anomaly                                           | 9 (1.11)           |
| Required Intervention to Prevent Permanent Impairment/Damage | 4 (0.49)           |
| Other                                                        | 706 (87.27)        |
| Time of adverse events - date of medication (days) segment   |                    |
| 0–30 d                                                       | 48 (5.93)          |
| 31–60 d                                                      | 3 (0.37)           |
| 61–90 d                                                      | 6 (0.74)           |
| 91–120 d                                                     | 0 (0.00)           |
| 121–150 d                                                    | 0 (0.00)           |
| 151–180 d                                                    | 1 (0.12)           |
| 181–360 d                                                    | 5 (0.62)           |
| >360 d                                                       | 26 (3.21)          |
| Miss (%)                                                     | 720 (89.00)        |
| Time of adverse Event - Date of medication (days)            |                    |
| N (Missing)                                                  | 89 (720)           |
| Mean (SD)                                                    | 390.69(724.66)     |
| Median (Q1, Q3)                                              | 18.00(0.00,521.00) |

The line breaks for the reporting year are shown in **Figure 1** below, which shows an upward trend, showing the highest number of reports in 2023. It is most common at 0–30 days (48[5.93%])

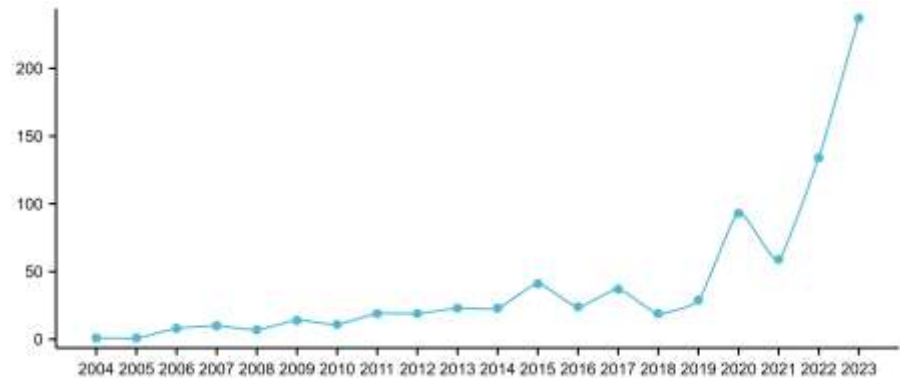


**Figure 1.** The broken line of the reporting year (tramadol and depression).

### 3.2. Mendelian randomisation analysis of tramadol and depression

In this study, we used Mendelian randomization to explore the relationship between tramadol exposure and depression. The  $P$  value of IVW method was 0.01, which was less than the significance threshold of 0.05, indicating a significant positive correlation between tramadol exposure and depression. In addition, the directionality of MR Egger ( $OR = 1.36$ ) and weighted median ( $OR = 1.03$ ) method is consistent with that of IVW method ( $OR = 1.29$ ), showing a trend of positive correlation. In our study, we employed Mendelian randomization to explore the potential association between codeine exposure and depression. The  $p$ -value obtained from the IVW method was 0.24, surpassing the conventional significance threshold of 0.05, suggesting no significant relationship between codeine exposure and depression. Similarly, when examining the relationship between morphine exposure and depression, the IVW method yielded a  $p$ -value of 0.70, which is also above the 0.05 threshold, indicating no significant correlation in this case either. Thus, our findings indicate that there is no significant link between either codeine or morphine exposure and depression based on the IVW (**Figure 2**).

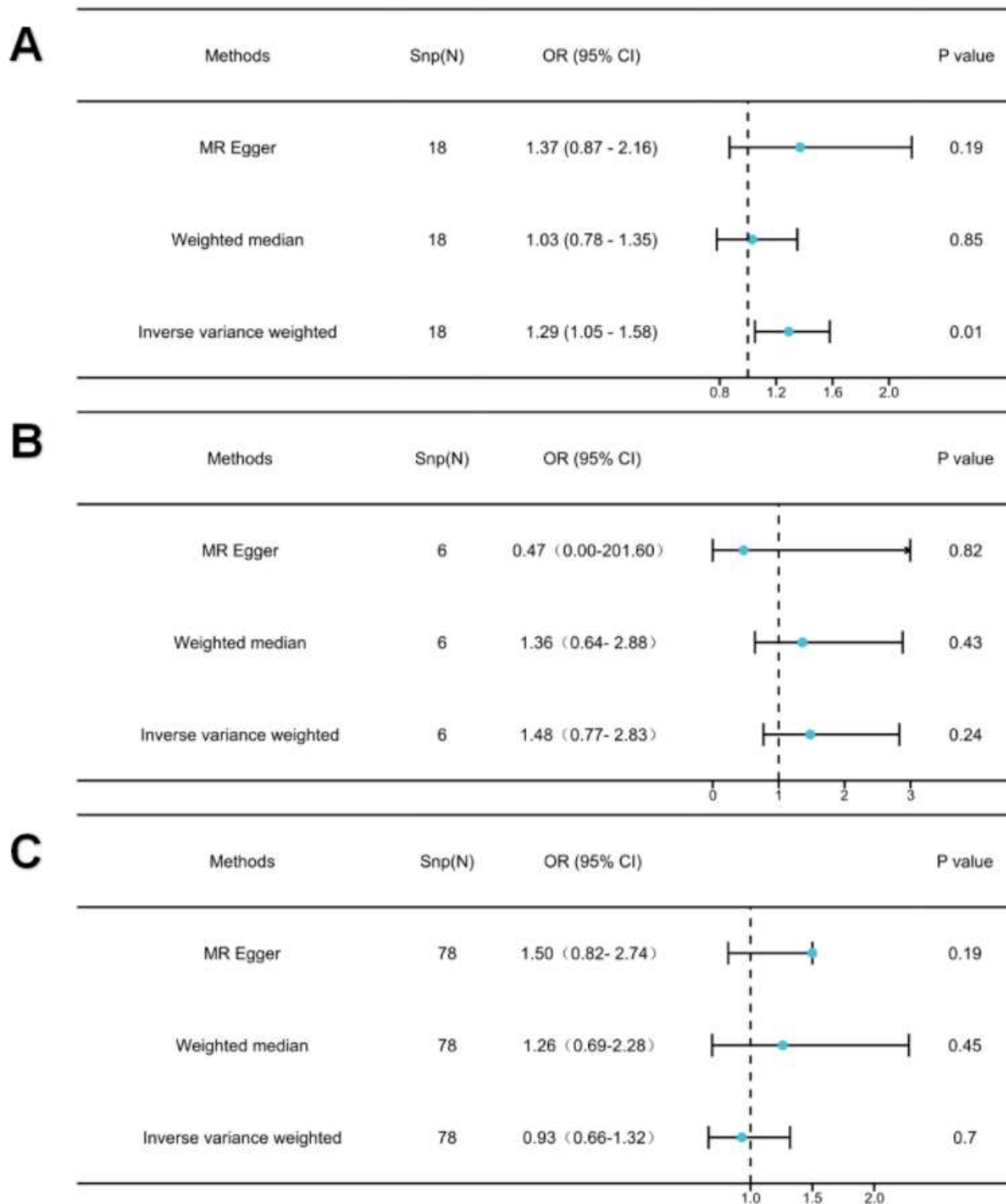


**Figure 2.** Mendelian randomized of forest map (A: tramadol, B: codeine and C: morphine).

Cochran's *Q* test results of Tramadol, Codeine and Morphine-Depression data were as follows: MR-Egger ( $P > 0.05$ ) and inverse variance-weighted ( $P > 0.05$ ). It can be seen that there is no heterogeneity in our data, and the results have good stability. Our horizontal multi-effect analysis results were not statistically significant, with  $P > 0.05$  (Table 6).

The scatter plots, leave-one-out sensitivity analyses, and forest of MR analyses for Tramadol Codeine, Morphine and Depression shown in **Figure A1** in Appendix.

**Table 6.** Pleiotropy test of mendelian randomization.

|                                     | Heterogene-test |      |        |       |      |        | Pleiotropy-test |      |      |
|-------------------------------------|-----------------|------|--------|-------|------|--------|-----------------|------|------|
|                                     | MR Egger        |      |        | IVW   |      |        | MR Egger        |      |      |
|                                     | Q               | Q_df | Q_pval | Q     | Q_df | Q_pval | intercept       | SE   | pval |
| Tramadol on Depression              | 20.6            | 16   | 0.19   | 20.71 | 17   | 0.24   | 0.00            | 0.00 | 0.78 |
| Codeine on Depression<br>Depression | 6.86            | 4    | 0.14   | 7.099 | 5    | 0.21   | 0.00            | 0.00 | 0.73 |
| Morphine on Depression              | 75.6            | 76   | 0.49   | 79.14 | 77   | 0.41   | 0.00            | 0.00 | 0.06 |

### 3.3. Mendelian randomisation analysis of tramadol and depression(verification)

Cochran's *Q* test results data were as follows: MR-Egger ( $P > 0.05$ ) and inverse variance-weighted ( $P > 0.05$ ). It can be seen that there is no heterogeneity in our data, and the results have good stability. Our horizontal multi-effect analysis results were not statistically significant, with  $P > 0.05$  (Tramadol -Depressive symptoms).

Cochran's *Q* test results data were as follows: MR-Egger ( $P > 0.05$ ) and inverse variance-weighted ( $P > 0.05$ ). there is no heterogeneity in our data, and the results have good stability. Our horizontal multi-effect analysis results were not statistically significant, with  $P > 0.05$ . (tramadol -Major Depressive Disorder) (**Table 7**).

**Table 7.** Pleiotropy test of mendelian randomization(verification).

|                                       | Heterogene-test |      |        |      |      |        | Pleiotropy-test |      |      |
|---------------------------------------|-----------------|------|--------|------|------|--------|-----------------|------|------|
|                                       | MR Egger        |      |        | IVW  |      |        | MR Egger        |      |      |
|                                       | Q               | Q_df | Q_pval | Q    | Q_df | Q_pval | intercept       | SE   | pval |
| Tramadol on Depressive symptoms       | 8.20            | 10   | 0.61   | 8.94 | 11   | 0.63   | 0.00            | 0.01 | 0.41 |
| Tramadol on Major Depressive Disorder | 8.56            | 16   | 0.93   | 9.12 | 17   | 0.94   | 0.00            | 0.00 | 0.46 |

In the validation data, we used Mendelian randomization to explore the relationship between tramadol exposure and Depressive symptoms- Major Depressive Disorder. The *P* value of IVW (tramadol-epressive symptoms: IVW: OR = 8.52 (1.07–67.81)  $P = 0.04$ ) and IVW (tramadol-Major Depressive Disorder. IVW: OR = 1.36 (1.08–1.70)  $P = 0.01$ ) method was less than the significance threshold of 0.05, indicating a significant positive correlation between tramadol exposure and depression. In addition, the directionality of MR Egger and weighted median method is consistent with that of IVW method, showing a trend of positive correlation (**Figure 3**).

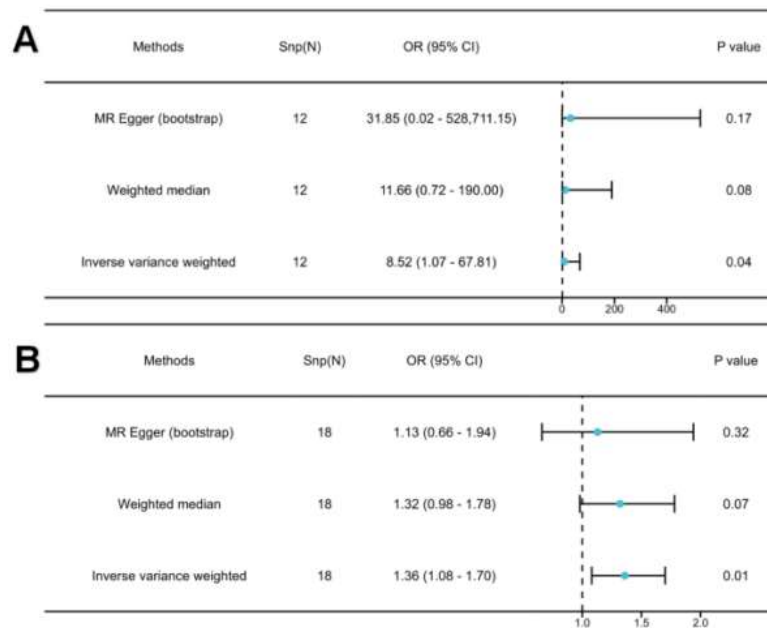


**Figure 3.** Validation of tramadol effects on depressive symptoms and major depressive disorder using MR methods (A: tramadol on depressive symptoms, B: tramadol on major depressive disorder multivariate mendelian randomization analysis of tramadol and chronic pain and depression).

The combination of multi-factor Mendelian randomization is as follows: We found that Tramadol treatment (in the context of chronic pain) was associated with a higher odds ratio (OR = 1.32, 95% CI: 1.15–1.50) with a *P* value of 0.01, indicating statistical significance. This side verifies our results (**Figure 4**).

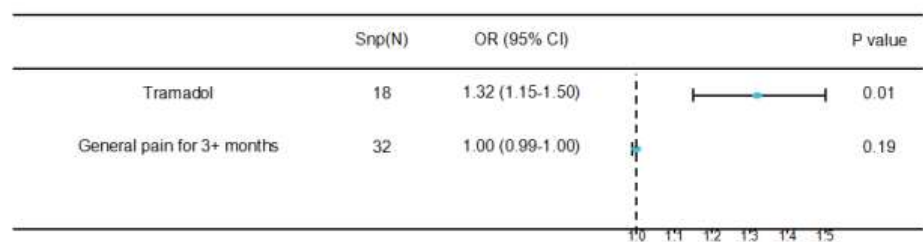


**Figure 4.** Multivariate mendelian randomization (tramadol and General pain for 3+ months pain and depression).

## 4. Discussion

Depression is a global health issue that affects the quality of life for millions of individuals. With the increasing pressures of modern society and shifts in lifestyle, the incidence of depression is on an upward trajectory [22]. Drug-induced depression is also coming into the public eye. Particularly, certain medications, including some analgesics used in cancer treatment, are suspected of potentially being associated with the development or exacerbation of depressive symptoms. However, the mechanisms by which these drugs influence mood and mental health, and their relationship to depression, have not been fully elucidated [23]. In the context of cancer treatment, the use of certain medications, including analgesics, may inadvertently contribute to the

emergence or worsening of depressive symptoms. The complex interplay between the physiological effects of cancer therapies and the psychological burden of the disease can create a challenging landscape for patients. The analgesics administered to manage pain associated with cancer can sometimes have unintended emotional side effects, including the potential to trigger or intensify depressive states [24].

Tramadol acts as an opioid with a dual analgesic effect and can be used to treat moderate to severe pain, including pain management in cancer patients [25]. However, tramadol needs to be used with caution because it may increase the risk of seizures, and at high doses its efficacy may be lower than other opioid analgesics, such as morphine [26]. In addition, the interaction of tramadol with other drugs can lead to serotonin syndrome, especially when combined with serotonin or monoamine oxidase inhibitors [27].

There is a complex relationship between cancer, tramadol and depression [28]. Depression is common in cancer patients due to long-term physical pain and psychological stress, and may develop into depression in severe cases [29]. Depression not only affects a person's mood, but may also impact their physiology, including sleep quality, appetite, and interest in daily activities, and in severe cases, it may even lead to suicidal thoughts. During treatment for cancer, patients may experience symptoms such as persistent sadness, emotion-induced behavioral disorders, loss of interest, and disruption of sleep and eating patterns, all of which are signs of depression [30].

Tramadol, as a synthetic opioid analgesic, is widely used in pain management. However, its effects on mood and mental health, as well as its relationship with depression, are the focus of current research. A comprehensive analysis of data from the FAERS database, EBI database, and UK Biobank database found a significant positive association between tramadol use and reports of depression.

Pharmacovigilance data provide us with real-time monitoring of adverse events in tramadol use, but there are limitations, such as difficulties in determining causality and the influence of confounding factors. The Mendelian randomization method provides us with a way to assess the causal relationship between tramadol exposure and depression by using genetic variation as an instrumental variable. In this study, the *P*-value of the IVW method was 0.01406, which was less than the significance threshold of 0.05, indicating a significant positive correlation between tramadol exposure and depression. At the same time, our comparative analysis of the risk of depression between tramadol and other opioids found that tramadol was more associated with depression risk than other opioids. This finding suggests that tramadol may influence mood regulation and the development of depression through pathways such as affecting neurotransmitter systems, stress hormone levels, or neuroplasticity.

Tramadol, a centrally acting opioid, exerts its analgesic effect primarily through the activation of  $\mu$ -opioid receptors and by inhibiting the reuptake of norepinephrine and 5-hydroxytryptamine (5-HT). This unique dual mechanism endows tramadol with potential mood-regulating properties that differ from those of other opioids. Notably, tramadol's inhibition of 5-HT reuptake, a feature not commonly observed with other opioids, may directly impact depressive symptoms by increasing synaptic 5-HT levels, thereby influencing mood and emotional state [31,32]. Moreover, tramadol's activation of the mu-opioid receptor can influence the brain's reward system, leading

to alterations in dopamine levels, which are crucial in the pathogenesis of depression [33,34]. The interplay between tramadol's effects on neurotransmitters and its regulation of the norepinephrine/serotonin system can significantly affect mood and stress responses [35]. While the inhibition of serotonin reuptake might induce mood swings or worsen depressive symptoms in some individuals, changes in norepinephrine levels can also modulate the stress response and mood regulation.

Chronic or high-dose use of tramadol may also impact neuroplasticity, which involves the formation and reorganization of neuronal connections [36,37]. Such neuroplastic changes could be linked to the alterations in neural structure and function observed in depression. Additionally, tramadol's use may alter the secretion of stress hormones, such as cortisol, with chronic elevations potentially contributing to the development or exacerbation of depressive symptoms [38]. Lastly, tramadol's complex interactions within the neurotransmitter system can disrupt the overall balance of neurotransmitters, affecting their synthesis, release, reuptake, or metabolism [39]. This imbalance can have significant consequences for emotional states, further highlighting the intricate relationship between tramadol's pharmacological actions and its impact on mood regulation. Tramadol, as an analgesic with a dual mechanism of action, provides an effective treatment option for pain relief in cancer patients by partially activating opioid receptors as well as inhibiting the reuptake of serotonin and norepinephrine. However, its use is also accompanied by a range of emotional side effects, especially worsening of depressive symptoms, which cannot be ignored in clinical practice.

Our analysis points out that long-term use of tramadol may lead to dependence in patients, and symptoms such as anxiety and irritability that accompany withdrawal may be confused with depression. In addition, tramadol's direct effects on the serotonin system may interfere with emotional regulation, which in turn affects patients' mental health. Notably, individual genetic polymorphisms play a key role in tramadol metabolism, which can lead to differences in how different patients respond to the drug, increasing the risk of mood side effects.

In clinical applications, we must weigh the analgesic effects of tramadol against its emotional side effects to provide patients with an individualized treatment plan. At the same time, given tramadol's potential interactions with other drugs, especially those that also affect the serotonin system, doctors should be extra cautious when prescribing. In addition, psychosocial support plays an important role in the overall treatment of cancer patients, and psychotherapy and lifestyle adjustments may help alleviate emotional problems caused by medication.

This study reveals a potential link between tramadol and depression, especially when compared to other opioids. These findings have important implications for clinical practice, as they may require reevaluation of tramadol's use in pain management. The findings also suggest that the use of tramadol may need to be reevaluated compared to existing clinical guidelines to ensure patient safety and reduce potential depression risk. In addition, the study points to differences in prescribing practices that exist across healthcare systems, highlighting the importance of physician education and decision support tools to promote more consistent and personalized pain management strategies. Future studies should continue to explore

the long-term effects of tramadol and assess the heterogeneity of depression risk in different patient populations to further guide clinical practice and optimize patient care.

Although this study provides evidence of an association between tramadol and depression, there are some limitations. As the FAERS database is a system that relies on self-reported information, the quality of FAERS data may vary depending on the expertise of the reporter and differences in reporting standards, which may affect the accuracy of the results. In addition, confounding factors that are difficult to control in the FAERS database, such as drug dose, duration of use, comorbidities, concomitant drugs, and disease type, may have an impact on the evaluation of adverse events. Chronic pain conditions are common causes of tramadol prescribing, and these conditions are often comorbidities with mental health disorders, including depression. This association may suggest that patients treated with tramadol may already be predisposed to depression, independent of their medication. While our pharmacovigilance data found a significant association between tramadol exposure and depression, it did not establish causation. However, the underlying pre-existing psychosocial problems of the patients involved may be a confounding factor that may have contributed to the observed association. In order to establish the causal relationship better, we introduce Mendelian randomization method to clarify the causal relationship. There is inevitably a degree of sample overlap in our analytical data sets, and we have taken steps to minimize its potential impact on our results. Sample overlap can lead to bias in MR Estimates, especially when the genetic association with risk factors is not strong. To assess this potential bias, we performed additional sensitivity analyses, including MR-Egger and inverse variance-weighted functions in Cochran's Q test and leave-one-out, in interpreting our results, we carefully considered the possible effects of sample overlap. While the results of our analysis support the possibility that tramadol may contribute to depression, we suggest that the potential impact of sample overlap should be considered when applying these findings to other populations or Settings. We also used different datasets to validate depression-related results to enhance the validity of our findings.

the population in this study was limited to Europeans, lacking ethnical diversity. Our subsequent study will encompass a broader population.

Our findings have important implications for clinicians considering patient mental health when using tramadol to treat pain. Tramadol may need to be used with more caution, especially in patients with known or suspected depression. In addition, these findings highlight the need to develop new pain treatments that provide pain relief without increasing the risk of mental health problems.

On a societal level, our findings alert policymakers and public health officials to the potential consequences of tramadol use and promote education and preventive measures for the safe use of these drugs.

In conclusion, the use of tramadol needs to be carefully evaluated while considering its possible effects on depressive symptoms. Future research and clinical practice should continue to explore the best ways to balance pain management and mental health.

## 5. Conclusion

Taken together, the results of this study suggest that tramadol use may be associated with the development of depression, which provides an important safety consideration for clinicians when prescribing tramadol. At the same time, this underscores the importance of future research to explore the role of tramadol in the treatment of depression and the need to optimize strategies for its use in different populations. Further research will contribute to a deeper understanding of tramadol's impact on mood regulation and its potential use in the treatment of depression.

**Author contributions:** Conceptualization, YF; methodology, YF; software, YF; data curation, KC and HW; writing-original draft preparation, KC and HW; visualization, KC; investigation, KC; supervision. All authors have read and agreed to the published version of the manuscript.

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**Availability of data and materials:** The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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

## Abbreviations

|       |                                                |
|-------|------------------------------------------------|
| FAERS | FDA Adverse Event Reporting System             |
| ROR   | Reporting Odds Ratio                           |
| PRR   | Proportional Reporting Ratio                   |
| BCPNN | Bayesian Confidence Propagation Neural Network |
| IVW   | Inverse Variance Weighting                     |
| AERs  | Adverse Event Reports                          |
| PTs   | Preferred Terms                                |
| SSGAC | Social Science Genetic Association Consortium  |
| EBI   | European Bioinformatics Institute              |
| SNPs  | Single Nucleotide Polymorphisms                |
| MR    | Mendelian Randomization                        |

## References

1. Thapar A, Eyre O, Pate V, et al. Depression in young people. *The LANCET*. 2022; 400(10352): 617-631. doi: 10.1016/S0140-6736(22)01012-1
2. Abdel Shaheed C, Hayes C, Maher CG, et al. Opioid analgesics for nociceptive cancer pain: A comprehensive review. *CA: A Cancer Journal for Clinicians*. 2023; 74(3): 286-313. doi: 10.3322/caac.21823
3. Agnoli A, Xing G, Tancredi DJ, et al. Association of Dose Tapering With Overdose or Mental Health Crisis Among Patients Prescribed Long-term Opioids. *JAMA*. 2021; 326(5): 411. doi: 10.1001/jama.2021.11013

4. Bravo L, Mico JA, Berrococo E. Discovery and development of tramadol for the treatment of pain. *Expert Opinion on Drug Discovery*. 2017; 12(12): 1281-1291. doi: 10.1080/17460441.2017.1377697
5. Hsu SK, Yeh CC, Lin CJ, et al. An open label trial of the effects and safety profile of extended-release tramadol in the management of chronic pain. *Acta Anaesthesiologica Taiwanica*. 2012; 50(3): 101-105. doi: 10.1016/j.aat.2012.08.008
6. Von Dohlen M, Jones J. Chronic use of tramadol after acute pain episode: cohort study. *The Journal of Emergency Medicine*. 2019; 57(4): 595. doi: 10.1016/j.jemermed.2019.08.050
7. Browne CJ, Godino A, Salery M, et al. Epigenetic Mechanisms of Opioid Addiction. *Biological Psychiatry*. 2020; 87(1): 22-33. doi: 10.1016/j.biopsych.2019.06.027
8. Ito H, Navratilova E, Vagnerova B, et al. Chronic pain recruits hypothalamic dynorphin/kappa opioid receptor signalling to promote wakefulness and vigilance. *Brain*. 2022; 146(3): 1186-1199. doi: 10.1093/brain/awac153
9. Hioki T, Tokuda H, Tanabe K, et al. Amplification by tramadol of PGD2-induced osteoprotegerin synthesis in osteoblasts: Involvement of  $\mu$ -opioid receptor and 5-HT transporter. *Prostaglandins, Leukotrienes and Essential Fatty Acids*. 2021; 172: 102323. doi: 10.1016/j.plefa.2021.102323
10. Talbot JN, Jutkiewicz EM, Graves SM, et al. RGS inhibition at  $G_{i2}$  selectively potentiates 5-HT<sub>1A</sub>-mediated antidepressant effects. *Proceedings of the National Academy of Sciences*. 2010; 107(24): 11086-11091. doi: 10.1073/pnas.1000003107
11. Lin S, Lei S, Liu W, et al. Global trends in pharmacovigilance-related events: a 30-year analysis from the 2019 global burden of disease study. *International Journal of Clinical Pharmacy*. 2024; 46(5): 1076-1090. doi: 10.1007/s11096-024-01738-6
12. Mukamal KJ, Stampfer MJ, Rimm EB. Genetic instrumental variable analysis: time to call mendelian randomization what it is. The example of alcohol and cardiovascular disease. *European Journal of Epidemiology*. 2019; 35(2): 93-97. doi: 10.1007/s10654-019-00578-3
13. Chen K, Huang H, Chen Y, et al. Association between atorvastatin and erectile dysfunction: a comprehensive analysis incorporating real-world pharmacovigilance and Mendelian randomization. *Frontiers in Pharmacology*. 2024; 15. doi: 10.3389/fphar.2024.1382924
14. Zhao B, Zhang X, Chen M, et al. A real-world data analysis of acetylsalicylic acid in FDA Adverse Event Reporting System (FAERS) database. *Expert Opinion on Drug Metabolism & Toxicology*. 2023; 19(6): 381-387. doi: 10.1080/17425255.2023.2235267
15. Shu Y, He X, Liu Y, et al. A Real-World Disproportionality Analysis of Olaparib: Data Mining of the Public Version of FDA Adverse Event Reporting System. *Clinical Epidemiology*. 2022; 14: 789-802. doi: 10.2147/clep.s365513
16. van Puijenbroek EP, Bate A, Leufkens HGM, et al. A comparison of measures of disproportionality for signal detection in spontaneous reporting systems for adverse drug reactions. *Pharmacoepidemiology and Drug Safety*. 2002; 11(1): 3-10. doi: 10.1002/pds.668
17. Yang H, Wan Z, Chen M, et al. A real-world data analysis of topotecan in the FDA Adverse Event Reporting System (FAERS) database. *Expert Opinion on Drug Metabolism & Toxicology*. 2023; 19(4): 217-223. doi: 10.1080/17425255.2023.2219390
18. Zagkos L, Dib MJ, Pinto R, et al. Associations of genetically predicted fatty acid levels across the phenome: A mendelian randomisation study. Ma RCW, ed. *PLOS Medicine*. 2022; 19(12): e1004141. doi: 10.1371/journal.pmed.1004141
19. Wang S, Zhu H, Pan L, et al. Systemic inflammatory regulators and risk of acute-on-chronic liver failure: A bidirectional mendelian-randomization study. *Frontiers in Cell and Developmental Biology*. 2023; 11. doi: 10.3389/fcell.2023.1125233
20. Chen X, Kong J, Diao X, et al. Depression and prostate cancer risk: A Mendelian randomization study. *Cancer Medicine*. 2020; 9(23): 9160-9167. doi: 10.1002/cam4.3493
21. Arnold M, Raffler J, Pfeufer A, et al. SNIIPA: an interactive, genetic variant-centered annotation browser. *Bioinformatics*. 2014; 31(8): 1334-1336. doi: 10.1093/bioinformatics/btu779
22. Chen S, Sun H, Song Y, et al. Transition and trend analysis of the burden of depression in China and different income countries: Based on GBD database and joinpoint regression model. *Journal of Affective Disorders*. 2024; 362: 437-449. doi: 10.1016/j.jad.2024.06.067
23. Rogers AH, Orr MF, Shepherd JM, et al. Anxiety, depression, and opioid misuse among adults with chronic pain: the role of emotion dysregulation. *Journal of Behavioral Medicine*. 2020; 44(1): 66-73. doi: 10.1007/s10865-020-00169-8
24. Tumenta T, Ugwendum DF, Chobufo MD, et al. Prevalence and Trends of Opioid Use in Patients With Depression in the United States. *Cureus*; 2021.

25. Barton MK. First-line low-dose morphine is better for the control of moderate cancer pain than weaker opioids. *CA: A Cancer Journal for Clinicians*. 2016; 66(3): 177-178. doi: 10.3322/caac.21303
26. Valian N, Sorayya M, Asadi S, et al. Preconditioning by ultra-low dose of tramadol reduces the severity of tramadol-induced seizure: Contribution of glutamate receptors. *Biomedicine & Pharmacotherapy*. 2021; 133: 111031. doi: 10.1016/j.biopha.2020.111031
27. Baldo BA. Opioid analgesic drugs and serotonin toxicity (syndrome): mechanisms, animal models, and links to clinical effects. *Archives of Toxicology*. 2018; 92(8): 2457-2473. doi: 10.1007/s00204-018-2244-6
28. Bravery B, Loughnan S, Murphy M. Depression treatment research in people with cancer does not reflect cancer prevalence: findings from a systematic review. *Evidence Based Mental Health*. 2020; 23(4): 155-160. doi: 10.1136/ebmental-2020-300145
29. Panjwani AA, Aguiar S, Gascon B, et al. Biomarker opportunities in the treatment of cancer-related depression. *Trends in Molecular Medicine*. 2022; 28(12): 1050-1069. doi: 10.1016/j.molmed.2022.10.003
30. Marinovic DA, Hunter RL. Examining the interrelationships between mindfulness-based interventions, depression, inflammation, and cancer survival. *CA: A Cancer Journal for Clinicians*. 2022; 72(5): 490-502. doi: 10.3322/caac.21733
31. Baldo BA, Rose MA. The anaesthetist, opioid analgesic drugs, and serotonin toxicity: a mechanistic and clinical review. *British Journal of Anaesthesia*. 2020; 124(1): 44-62. doi: 10.1016/j.bja.2019.08.010
32. Nutt D, Erritzoe D, Carhart-Harris R. Psychedelic Psychiatry's Brave New World. *Cell*. 2020; 181(1): 24-28. doi: 10.1016/j.cell.2020.03.020
33. Asari Y, Ikeda Y, Tateno A, et al. Acute tramadol enhances brain activity associated with reward anticipation in the nucleus accumbens. *Psychopharmacology*. 2018; 235(9): 2631-2642. doi: 10.1007/s00213-018-4955-z
34. Zhao F, Cheng Z, Piao J, et al. Dopamine Receptors: Is It Possible to Become a Therapeutic Target for Depression? *Frontiers in Pharmacology*. 2022; 13. doi: 10.3389/fphar.2022.947785
35. Franceschini D, Lipartiti M, Giusti P. Effect of acute and chronic tramadol on [<sup>3</sup>H]-norepinephrine-uptake in rat cortical synaptosomes. *Prog Neuropsychopharmacol Biol Psychiatry*. 1999; 23 (3): 485-96. doi: 10.1016/S0278-5846(99)00010-X
36. Hosseindoost S, Akbarabadi A, Sadat-Shirazi M, et al. Effect of tramadol on apoptosis and synaptogenesis in hippocampal neurons: The possible role of  $\mu$ -opioid receptor. *Drug Development Research*. 2022; 83(6): 1425-1433. doi: 10.1002/ddr.21973
37. Hare BD, Duman RS. Prefrontal cortex circuits in depression and anxiety: contribution of discrete neuronal populations and target regions. *Molecular Psychiatry*. 2020; 25(11): 2742-2758. doi: 10.1038/s41380-020-0685-9
38. Shalaby AM, Aboregela AM, Alabiad MA, et al. Tramadol Promotes Oxidative Stress, Fibrosis, Apoptosis, Ultrastructural and Biochemical alterations in the Adrenal Cortex of Adult Male Rat with Possible Reversibility after Withdrawal. *Microscopy and Microanalysis*. 2020; 26(3): 509-523. doi: 10.1017/s1431927620001397
39. Xia W, Liu G, Shao Z, et al. Toxicology of tramadol following chronic exposure based on metabolomics of the cerebrum in mice. *Scientific Reports*. 2020; 10(1). doi: 10.1038/s41598-020-67974-8

## Appendix

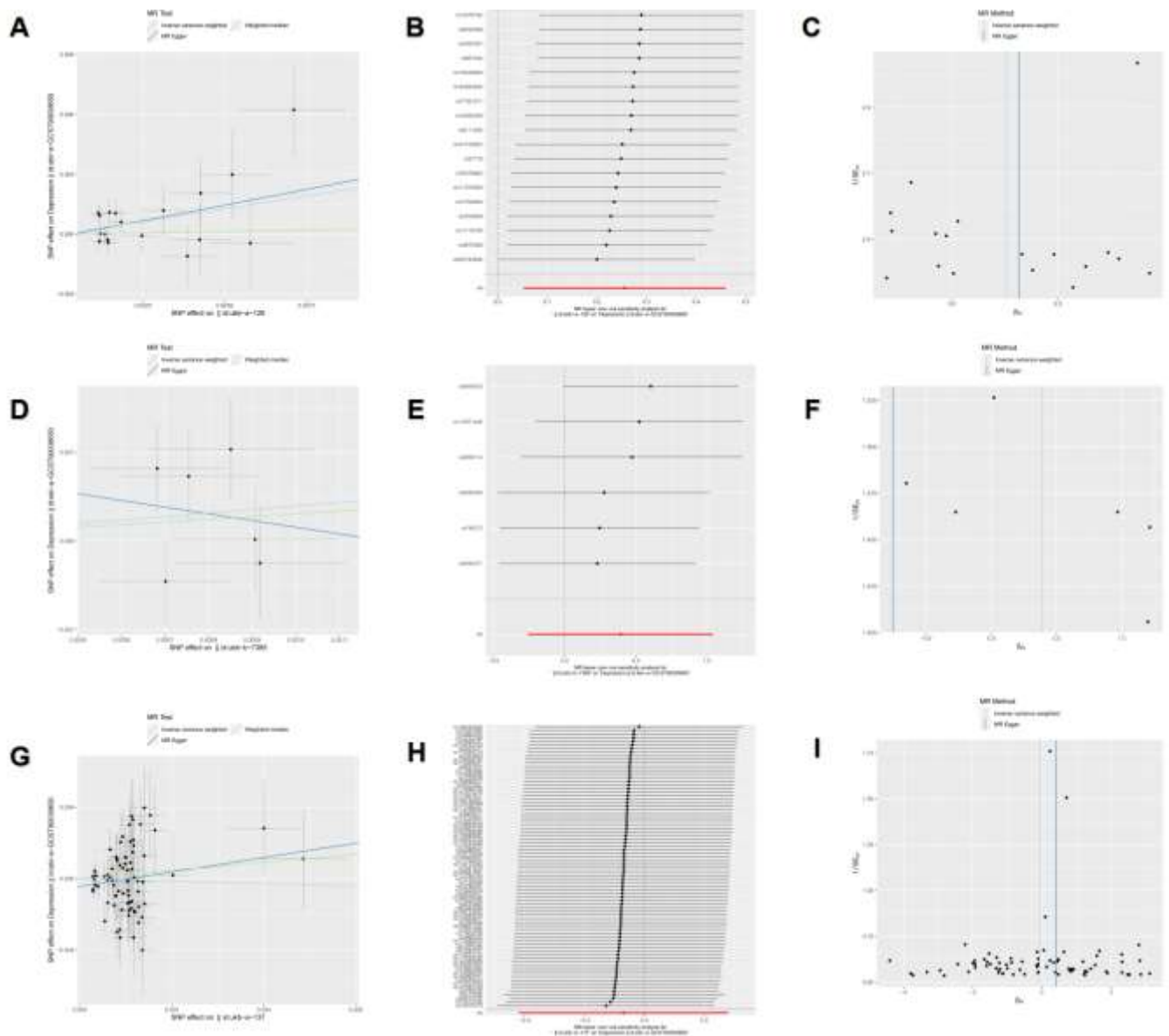


**Figure A1.** Mendelian randomized association between Tramadol, Codeine, Morphine and Depression (Tramadol: A: Scatter diagram, B: Leave-one-out and C: Funnel plot, Codeine: D: Scatter diagram, E: Leave-one-out and F: Funnel plot, Morphine: G: Scatter diagram, H: Leave-one-out and I: Funnel plot).

## Article

# Impact of family support and mental resilience on benign tumor rehabilitation in Chinese patients

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**Abstract:** This research investigated the influence of mental resilience and emotional support of family members on the rehabilitation outcomes of patients with benign tumors in China. The study investigated 100 patients and separated them into (50 for the control group and 50 for the Experimental group) across many Chinese hospitals, with patients undergoing rehabilitation for benign tumors. The research employed SPSS analytical software, focusing on four key variables, including mental resilience, family emotional support, physical recuperation, and psychological wellness. The Connor-Davidson Resilience Scale (CD-RISC) was used to examine mental resilience, while the Family Support Scale was used to assess emotional support in the family. Physical recuperation was assessed using medical records and rehabilitation progress reports. The findings show substantial correlations between significant levels of mental resilience and higher physical recovery as well as psychological well-being. Similarly, significant family emotional support has been related to better physical and psychological outcomes. A regression analysis revealed that mental resilience and family emotional support collectively account for a significant portion of the variation in physical recovery and psychological well-being among patients. The outcomes affirms that psychological resilience and family emotional support contribute to the rehabilitation of benign tumor patients in China.

**Keywords:** benign tumor rehabilitation; mental resilience; family support; statistical analysis; China

## 1. Introduction

The entire family and social network are impacted by a cancer diagnosis and treatment, which causes psychological discomfort for caregivers who encounter pressures at various phases of the illness [1]. Cognitive, emotional, behavioural and physical deficits are frequent. A Tumor patient's functional status is the main source of stress, and more physical impairment is linked to a lower quality of psychological well-being [2,3]. Depending on how caregivers perceive social support, functional status has varying effects on their psychological health. The provided associations between functional impairment domains and caregiver's psychological well-being, as well as any potential moderating effects of social supports [4]. Patients with benign tumours must ensure a taxing rehabilitation producer that calls for strong mental and emotional fortitude in addition to full physical recovery. Even if they are not malignant, benign tumours might require surgery, which can be extremely stressful mentally because of the unknowns and the risks involved [5]. Returning to mental toughness

and getting emotional support from family members are crucial steps in recovering in this instance.

Patients in rehabilitation must be mentally flexible, meaning they must be able to handle stress, trauma, and misfortune. It impairs their capacity to deal with the course of treatment, accept the diagnosis, and hold out hope for an immediate recovery [6,7]. Building mental strength is facilitated by several components, such as support for their surroundings, psychological support, and specific methods of coping. A vital part of these stimulating surroundings is family support [8]. Families and the general health of the group are highly valued, sometimes more than just personal freedom. The traditional setting emphasizes essential support from relatives is to the recovery process [9]. Family members' emotional encouragement could give patients the drive, confidence, and sense of security that are critical to psychological health. Family members usually help with everyday care, go with patients to doctor's visits, and provide comfort when situations are difficult [10]. Strong family support has been associated with investigations into better mental health outcomes and a quicker recovery for patients. By lowering stress, anxiety, and sadness, the support could improve every aspect of life [11]. Additionally, group strategies for coping can develop patients' endurance and provide a healing atmosphere. By recognizing and enhancing these factors, techniques for rehabilitation can be improved, improving patients' quality of life and treatment outcomes [12]. The identification and management of tumors, whether benign or malignant, entail considerable psychological issues for the patients, their careers, and their supporters. It shows that caregivers also feel distressed as they accompany the patients through the illness and develop several aspects, including cognitive-emotional-behavioral- physical [13–15]. The functional status of tumor patients impacts the psychological health of the caregivers, which in turn is determined by the support systems available. Patients with tumors need rehabilitation as it affects their physical, psychological, and emotional state. It intends to enhance the patient's functional status, their methods of dealing with their condition, and the encouragement of both the patient and the care provider [16]. Rehabilitation involves exercises, psychotherapy, and support that depend on the client's requirements. Such programs focus on helping patients with physical therapy, building their mental fortitude, and coping with a benign tumor.

There are severe psychological consequences associated with the diagnosis and treatment of tumors, including the benign ones, affecting not only the diseased person but also his or her family members and other related individuals [17]. The psychological impact of caregiving can be immense due to stress, which is evident in the stages of the illness, presenting with cognitive, emotional, behavioral, and physical problems. Another area of concern for tumor patients is functional status, which tends to reflect lower psychological well-being when the degree of physical disability is higher. In this case, the degree of social support available to the caregivers is critical in determining this impact on their psychological health [18]. This study aimed to address if rehabilitation of patients with benign tumors puts the patient through a rigorous process of reformation that demands a lot of physical, mental, and even emotional strength. It should, therefore, be understood that the presence of benign tumors does not negate the need for surgery, and thus, the potential for stress becomes significant enough to require adequate support and strength for rehabilitation to occur.

Stress, trauma, and uncertainty are learned experiences that patients in rehabilitation must overcome; therefore, mental resilience and support from family members are vital.

Objective of the study: This study intends to assess the impact of a rehabilitation patient maintenance program that integrates psycho-educational strategies with training in coping and communication skills on the subsequent results for patients' family caregivers who have benign tumors: psychological distress (Initial outcome), caregiving coping style, social support burden, and quality of life. The study will also include a qualitative component that will record family caregivers' perceptions of the experiment value and how it affected the experiment group's psychological discomfort.

The rest of the paper is divided into the following sections. The objective-based related works were demonstrated in section 2. The collection of material and methods were denoted in section 3. The result analysis was performed in section 4. The discussion of the paper is denoted in section 5. The paper was concluded in section 6.

## **2. Related works**

Patients with primary brain tumors, both malignant and non-malignant, had their pre- and postoperative functions compared [19]. While the groups' functional condition and gait efficiency were comparable, there were greater incidences of paresis and paralysis in the group with malignant tumors. Patients with malignant tumors had poor ADL performance upon discharge, independence, and overall health. Rehabilitation or the length of hospital stay (LOS) was unaffected by worse functional results. According to the study, patients' expectations should be appropriately managed, particularly for those who have benign tumors. The study looked at adult patients' chances of oral rehabilitation indicating high chances of survival. According to the results, around the implanted fixtures, there was no discomfort, peri-implant infection, implant movement, or radiolucency. There was no bone resorption around the fasteners in the orthopantomogram and cone beam computed tomography (CBCT) images. Except for one patient who was dissatisfied in both practical and cosmetic aspects, all patients were happy with their face shape. The study comes to the great conclusion that one of the best methods for oral rehabilitation following cystic or tumor ablation is to put dental fittings in the lower jaw. The increased neurological degeneration, motor dysfunction, cognitive decline, emotional problems, headaches, and dysphagia associated with brain tumors are drawing attention in cancer rehabilitation [20]. Functional impairment must be treated with a customized interdisciplinary intervention. A patient with a left lateral ventricle tumor who was 21 years old complained of headaches, nausea, and blurred vision. The neurological state cleared up following surgery, and was admitted to the Neuromuscular Rehabilitation Central Division. Functional assessments revealed remitted aphasia and training in self-supporting walking. The symptoms and quality of life were enhanced by drug therapy, neurosurgical intervention, and customized rehabilitation programs. The evolution, ecology, and interactions of benign and malignant tumours are covered by the author, with special attention to the non-cancerous symptoms of these tumors and the effects of intra-temporal cell composition on the tumoral microenvironment. It

implies that malignancy depends on an awareness of the distinctions and similarities between benign and malignant tumors.

Meningiomas were common primary intracranial tumors with different grades of dedifferentiation. Treatment options include radiological surveillance for low-grade asymptomatic meningiomas, surgical resection, adjuvant radiotherapy for grade III, and systemic treatments. Literature on clinical, radiological, and molecular characteristics, available treatment strategies, and clinical trials were reviewed [21,22]. They assessed the ability to differentiate between malignant and benign peripheral nerve sheath tumors using diffusion-weighted imaging and conventional magnetic resonance imaging. The tumor size, margin, and apparent diffusion coefficient (ADC) values varied significantly between the groups, according to the results; the split fat sign and ADC values worked well together. The investigation considered the application of micro vessel density (MVD), smart microvascular imaging (SMI), and radiology characteristics of identifying benign parotid glandular cancer. The results showed that the basic cell hyperplasia exhibited homogeneous internal echogenicity, with greater rate of identification for vascular classes 2 and 3. SMI provided low-velocity circulation measurements.

Investigators evaluated the gut the microbes of people with cancer in their breasts and benign tumours. Despite the combination was distinct, findings did not show an important difference in diversity [23]. There were larger concentrations of citrobacter and the metabolic system in the group with cancerous tumours. The results obtained demonstrate that an improved comprehension of the gut microbiota can help in the identification and therapy of malignant breast cancer. A large Para pharyngeal cancer had to be removed from three different people comfortably with minimal infiltration. During general anesthesia, the individual underwent Tran's nasal intubation, transpolar manipulation, a 5-cm skin incision, and a lateral resection. The patients had been free of diseases for over a decade and exhibited no visible symptoms of illness, such as misalignment or facial weakness [24]. Large Para pharyngeal cancers might be eliminated in a less aggressive and potentially harmful manner due to these strategies. Breast cancer is the most widespread cancer in women internationally and one of the leading causes of death from illness. The right therapy depends on early detection. Many machine learning (ML) techniques for breast cancer prediction were examined using the Wisconsin Breast Cancer Dataset. With an accuracy of 96.5%, Random Forest (RF) and Support Vector Machine (SVM) beat the other models, indicating that they might be utilized to create an automated diagnostic system for early detection of breast cancer.

In the Radiotherapy Unit of the General Hospital of Mexico, radiotherapy (RT) works well for benign diseases, most often paragangliomas and keloid scars. According to the study, RT provides manageable toxicity, enhances quality of life, and produces a favorable response, which contribute to disease management. The majority of instances of acute and chronic toxicity were classes 1 and 2, with a mean dosage of 31.63 Gy. In 94.1 percent of cases, a disease response was attained. The findings point to the need for inflammatory pathology to be included in therapy. Typical symptoms were the most prevalent, followed by the pain. Of the 67 patients, 50 expressed a desire to alleviate their suffering. According to the study [25], it is critical to manage local discomfort following a late parotidectomy by educating patients and possible

treatment options during pre- and postoperative counseling. A new method uses ultrasound images to differentiate, between benign and malignant breast cancers [26]. The technique extracts texture and morphological information, trains a support vector machine (SVM) classifier for texture features, and creates a naive Bayes (NB) classifier for morphological features. The method achieves 91.11% accuracy, 94.34% sensitivity, and 86.49% specificity, making it crucial for global women's health improvement. There are about 100 known types of cancer, making it a severe threat to humankind. There were two phases to it: benign and malignant. The former can be treated with surgery to remove the tumor, while the latter has to be advanced and treated with radiation or chemotherapy. A diagnosis becomes more complex as it moves from benign to malignant [27]. A comparative study demonstrates that the fractional strategy proposed in this work is more accurate than the other methods for benign area detection. The problem of recognizing and categorizing benign cancer cells was addressed by this technique.

The consequences of benign tumors for patients and their families are not only purely medical but are also associated with severe social and psychological implications. Different studies show that caretakers, especially close relatives, experience numerous difficulties in giving support to their close ones receiving treatment and receiving rehabilitation. Research has noted that caregivers of tumor patients suffer considerable psychological burdens. It is common for people to suffer from anxiety, depression, burden of care, communication difficulties, and lack of social support [28]. A study has further shown that caregivers of tumor patients suffer from high stress, anxiety, and depression levels due to the emotional burden of seeing their loved ones receive treatment and the demands of having to care for and console the patients. Other sources of stress for caregivers include communication difficulties, not only with other family members but also with healthcare providers. These communication barriers can arise because the patient and his or her family fail to understand aspects such as the disease, the treatment plan, or the prognosis, making them feel helpless [1,7].

Moreover, the social aspect of caring for tumor patients has also been described across different aspects of research. Several potential issues have been identified, and among them is the caregiver burden, which is the physical, emotional, and financial stress experienced by a person caring for a family member [6,10]. The effects of the caregiver burden on the general psycho-social health of the caregiver and the patient make it very important to develop multi-faceted and well-coordinated care structures [18]. Furthermore, the effectiveness of social support in reducing the adverse impact of caregiving has been well documented. Researchers have established that social support, or the ability of the caregiver and patient to tap support networks and resources to overcome caregiving challenges, can significantly reduce the burden and improve the quality of life of both the caregiver and patient. This can be professional support from doctors and other healthcare personnel and social support from friends, relatives, and other members of society. According to the literature, caregivers found it challenging to cope with the care of tumor patients and explained that social support and good communication are essential in handling the challenges. These accounts of the social context concerning caregiving for patients with benign tumors reveal why interdisciplinary and more extensive rehabilitation programs are required to address

the needs of patients and their caregivers, not only from a medical perspective but from psychological, emotional, and social aspects as well [29].

### 3. Materials and methods

The methodology contains collecting the data and includes criteria for finding the exact data to assess how a patient support program for rehabilitation that combines psychoeducational techniques with coping and communication skills training affects the psychological distress (initial outcome), coping style, social support, caregiving burden, and quality of life of benign tumour patients with having family caregivers.

#### 3.1. Dataset

This is a randomized controlled trial that is parallel-group, controlled, and single-blind. The Experiment will be provided to rehabilitation patients with benign tumours and entails six in-person meetings with the caregiver, as well as 15 days phone follow-ups following discharge. At baseline (B0), 28 days (B1), and 84 days (B2) following the Experiment, caregiver outcomes will be assessed. In this study, we collected 600 rehabilitation benign tumor patient data from various hospitals in China. The study data inclusion and Exclusion criteria of flow of randomized experiment control are shown in **Figure 1**.

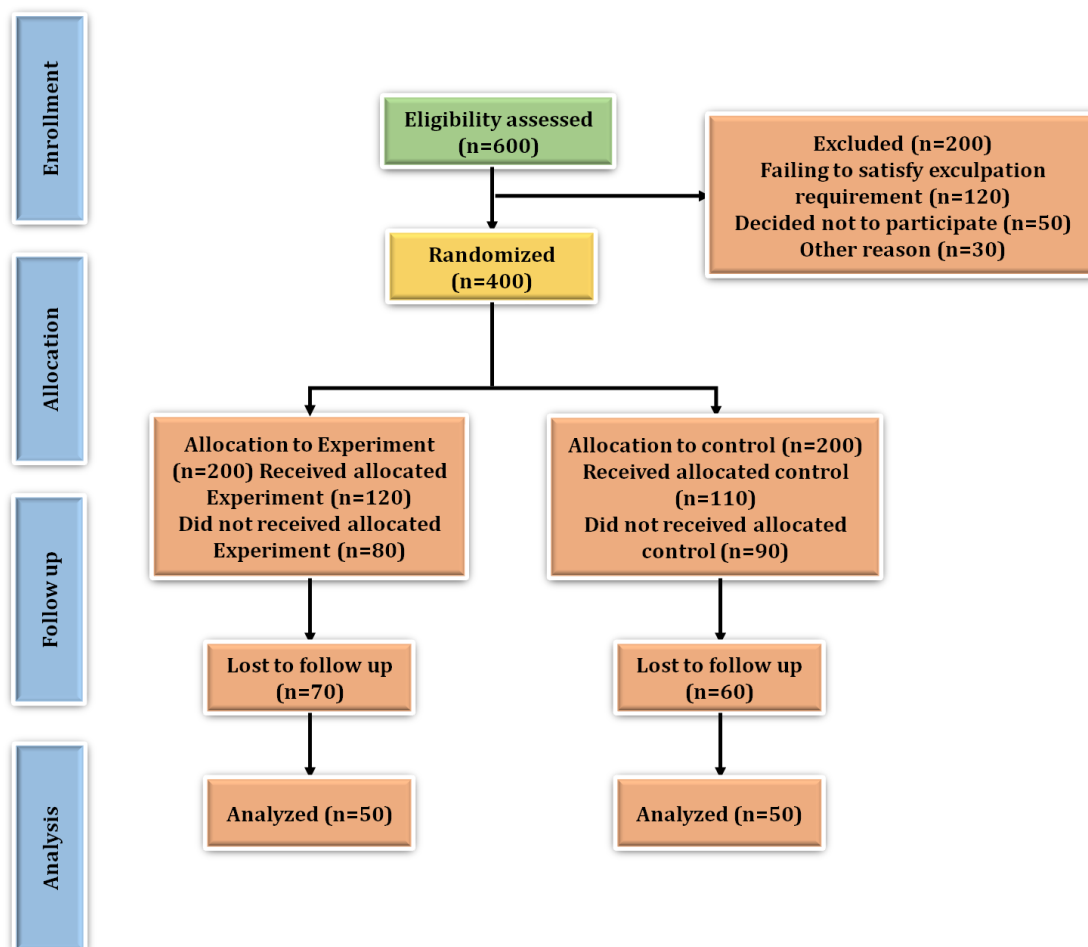


**Figure 1.** Study flow.

### **3.2. Splitting of data**

Participants in the program are benign tumor patients with family caregivers who are at various phases of rehabilitation. The collected benign tumor patients included data that were split and excluded using some of the criteria.

**Inclusion criteria:** The inclusion criteria contain the group of 600 rehabilitated benign tumor patients and they are splitting into categories. The following are the inclusion requirements for family caregivers: (1) be 20 years of age or older; (2) be able to read and speak Chinese; (3) be able to give written informed permission; and (4) be acknowledged by patients as the major caregivers who will provide day-to-day assistance and emotional support throughout the patient's recovery.

**Exclusion Criteria:** This criterion that contains 500 patients excluded for some reason is shown below. The following criteria are used for exclusion: (1) caregivers receiving active treatment for benign tumors; (2) caregivers receiving similar support Experiment; and (3) Caregivers who had a professional or pecuniary interest in the outcomes of the study, including healthcare professionals directly involved in the treatment of the patients, were excluded to maintain independence and mitigate potential conflicts of interest.

Both the control group and the experimental group received care from caregivers, aligning with the inclusion criteria, which specify the active involvement of caregivers in providing day-to-day assistance and emotional support throughout the patient's recovery process. This consistency in caregiver involvement ensures that the study's design maintains comparability and enhances the validity of the results, as both groups received similar support from caregivers. Therefore, with this understanding, the study's findings would be robust and reflective of the intended focus on caregiver support for patients undergoing rehabilitation for benign tumors. Caregivers in the experimental group received comprehensive training to support benign tumor rehabilitator patients. The training included: 1. Psycho-Educational Strategies: Enhancing understanding of patients' psychological challenges and providing tailored emotional support. 2. Communication Skills Training: Improving communication with patients, healthcare professionals, and other caregivers. 3. Coping Strategies: Equipping caregivers with tools to manage emotional well-being. 4. Social Support Resources: Providing information on support networks and community resources. The training aimed to empower caregivers to provide holistic support and contribute to patients' well-being and rehabilitation outcomes.

### **3.3. Groups**

The inclusion and exclusion criteria analysis were split into two groups: The control and Experiment group of rehabilitated benign tumor patients. After Allocation and follow-up are processed the control group contained ( $n = 50$ ) and the Experiment group contained ( $n = 50$ ) patients.

**Control Group:** The control group's participants will get standard treatment, which includes perioperative care, pain management, and exercise for rehabilitation. They will not get any further treatments beyond standard medical care, nor will they take part in the rehabilitative patient support program. This group is used as a benchmark to assess how well the experiment group's support system is working.

Experiment Group: Before the rehabilitation of patients with early-stage benign tumors, a multidisciplinary team of family caregivers, clinical nurses, thoracic surgeons, and psychologists created a patient support plan for rehabilitation. The program consists of two phone follow-up meetings every week and four in-person group meetings led by an oncology nurse. The goal of the experiment, which starts at admission and lasts for up to two weeks beyond hospital discharge, is to increase the quality of life, lessen psychological distress, and lessen caregiver burden while also improving caregivers' understanding of perioperative care and coping mechanisms. The main investigator will record how the experiment was modified to fit the requirements, engagement, and material comprehension of the caregivers. The length of sessions, extra contacts, and missed appointments will all be recorded to monitor the experiment dosage.

### **3.4. Randomization**

Those who provide family care and fit the eligibility requirements are randomized to either the experiment or control group. To ensure balance in group sizes, the data will be grouped using block randomization with block sizes of four or six. The lead investigator, who is the intervener and the participants won't be blinded because of the nature of the experiment. To reduce bias, participants' group assignments will not be disclosed resulting in assessors who oversee the assessing results. By minimizing any biases that can affect the evaluation of the Experiment's efficacy on caregivers' outcomes, this strategy preserves the study's integrity.

### **3.5. Hiring**

The staff and thoracic surgeons will collaborate to select suitable patients for admission every day. The primary investigator will determine whether patients are eligible by looking through the computerized patient data management system. After eligibility has been determined, the lead investigator will get in touch with the qualified patient's family caregivers, respond to inquiries, and gauge interest in participation. Informed consent will be looked for the caregiver's consent to enrolling. The online supplemental material includes a sample consent form. With informed permission, family caregivers will undergo a comprehensive baseline examination.

### **3.6. Statistical analysis**

The study will employ the evaluation of the purpose of treatment. The significance level will be set at 0.05 for all analyses, which will be carried out with SPSS Statistics for Windows, version 26.0. The ranges, medians, means, Standard deviations (SDs), and Interquartile range (IQRs) will be used to summarize continuous data. The Mann-Whitney U Test will be employed to verify that the ranges are appropriate. Continuous statistics will be compared using the student's *t*-test. Further, use either Fisher's exact test or  $\chi^2$  to compare categorical data. Three endpoints (B0, B1, and B2) will be utilized to assess the differences in variations in results between the control and experiment groups using a generalized estimating equation model. The overall CD-RISC was used and a score (range = 0–100) will be used to determine the sample size because distress is the initial outcome. 50 individuals in each group

are needed for a *t*-test with two sides on the overall result CD-RISC score with 20% power to find a somewhat substantial variance with  $\alpha = 0.06$ . There will be 400 participants given the 80% loss of participation rate.

### 3.7. Ethical statement and approval

This study, approved by the ethical committee of Beijing Normal University, China (approval number IRB2022-2489-001), used participant data from individuals receiving therapy for benign tumors. Researchers ensured confidentiality and privacy protection for participants, following ethical guidelines. Explicit consent was obtained from all participants, and data integrity is maintained throughout and after the study.

## 4. Result analysis

The results evaluations for caregivers in the experiment and control groups will be gathered by a trained study worker who will be blinded to the selection of groups either in presence at baseline or over through telephone throughout the follow-ups. The primary periods for data collection are baseline (B0), 28 days (B1), and 84 days (B2) following the conclusion of the Experiment. The summary of research findings and Metrics specifics are displayed in **Table 1**. The initial step will involve gathering the caregivers' sociodemographic information to evaluate the similarity between the groupings and, consequently, the outside strength of the findings.

**Table 1.** Metrics specifics.

| Outcomes                         | Metrics                                  | B0 Baseline | B1 28 days after the Experiment | B2 84 days after the Experiment |
|----------------------------------|------------------------------------------|-------------|---------------------------------|---------------------------------|
| Initial outcome                  |                                          |             |                                 |                                 |
| Anxiety psychology               | CD-RISC                                  | -           | -                               | -                               |
| Subsequent outcomes              |                                          |             |                                 |                                 |
| standard of life                 | The Family Edition of Standard of Life   | -           | -                               | -                               |
| Social support                   | The scale of Social Support Rates        | -           | -                               | -                               |
| Coping mechanism                 | Coping Style Assessment                  | -           | -                               | -                               |
| Public and patient participation | Interview about Zarit's caregiver burden | -           | -                               | -                               |

### 4.1. Initial outcome

Anxiety psychological: The CD-RISC will be used as the main outcome measure in this study to assess the resilience of family caregivers. Each question graded on resistance is measured on a 25-item CD-RISC scale, which has a 5-point range from 0 to 4. Higher scores on the scale translate into stronger resilience. The overall score range is 0 to 100. This instrument is frequently used to measure anxiety, sadness, depression, aggressive and distress in a variety of populations with a range of medical illnesses as well as in the general public without a specific medical condition, such as family caregivers of benign tumors. Patients are divided into controlled and experiment groups. Regarding the anxiety and sadness subscales, caregivers of

patients with benign tumors have demonstrated the validity and reliability of the Chinese versions of the CD-RISC. The experiment group achieved higher result when compared with the control group as shown in **Table 2** and **Figure 2**.

**Table 2.** Mental state of benign tumor patient.

| Mental State   | Value (%)     |                  |
|----------------|---------------|------------------|
|                | Control group | Experiment group |
| Anxiety        | 79            | 23               |
| Sadness        | 67            | 25               |
| Depression     | 72            | 30               |
| Aggressiveness | 58            | 28               |
| Distress       | 68            | 29               |

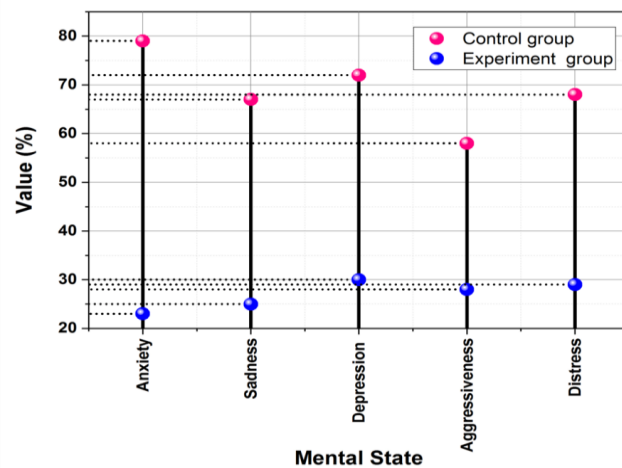


**Figure 2.** Mental state comparison.

#### 4.2. Subsequent outcome

**Standard of living:** The caregivers of patients with rehabilitator tumour will have their Well-being assessed with the Quality of Life Family Edition. The instrument's Chinese version had four subscales that were categorized (physical, psychological, social, and spiritual health states). A scale with values from 0 (worst consequence) to 10 (best outcome) will be used to determine the score. The overall and subscale scores that have been used to evaluate the scale are shown in **Table 3** and **Figure 3**. A high score denotes a good standard of living. The scale has strong construct validity and reliability.

**Table 3.** Health state of benign tumor patient.

| Health State         | Value (%)     |                  |
|----------------------|---------------|------------------|
|                      | Control group | Experiment group |
| Physical health      | 61            | 87               |
| Psychological health | 60            | 86               |
| Social health        | 65            | 75               |
| Spiritual health     | 66            | 82               |

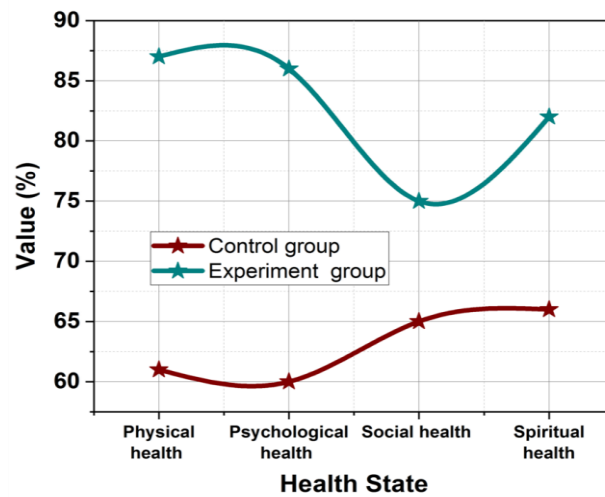


**Figure 3.** Health state comparison.

Social assistance for caregivers: The social support provided by caregivers will be assessed using the Social Support Rate Scale. Three aspects of social support are evaluated by this 10-item measure: use of support, objective support, and subjective support. The overall score, which might vary, that will be determined by adding each item to the total. High levels of perceived social support are indicated by a high score are shown in **Table 4**. **Figure 4** shows the comparison of the affectionate caregivers of women and men to the rehabilitee benign tumor patients.

**Table 4.** Aspects of social support.

| Social Support     | Definition                                                                                                                                               |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Use of Support     | Gauges the frequency which caregivers make use of the social support networks at their disposal.                                                         |
| Objective Support  | Evaluates the material help that caregivers get from their social network, such as tools or practical support.                                           |
| Subjective Support | Assesses how caregivers view the psychological and emotional assistance that comes from their social networks.                                           |
| Overall Score      | Calculated by summing the results of the Social Support Rate Scale's ten items. Higher ratings represent caregivers' perceived levels of social support. |

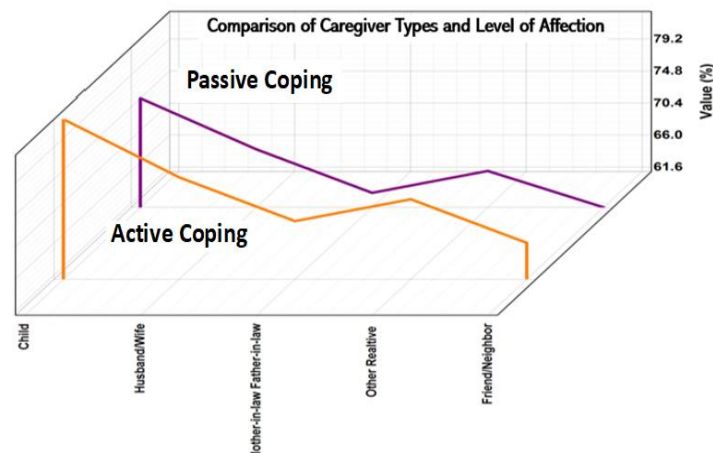


**Figure 4.** Comparison of affectionate of caregiver.

Caregivers' coping mechanisms: **Figure 4** compares caregivers' coping mechanisms using the Coping Style Questionnaire (CSQ), which assesses preferences for passive and active coping strategies. The figure categorizes responses into these two coping styles, each evaluated through a scale of 25 items that measure how frequently caregivers employ these strategies, rated on a 5-point Likert scale from 0 (never) to 4 (very often). It presents mean scores for both passive and active coping mechanisms, allowing for a comparison between the Experimental group, which may have received additional interventions, and the Control group. This visual representation highlights the differences in coping styles among caregivers, providing insights into their emotional support capabilities in the rehabilitation process. The mean score of each subscale will be intended; a higher score denotes a greater propensity to employ that specific coping mechanism. The passive and active coping subscales of the CSQ have demonstrated strong internal consistency, indicating the instrument's beneficial accuracy and dependability in the Chinese community. When *t*-test value was applied to the coping style preferences, calculated mean and SD for control and experiment groups are shown in **Table 5**.

**Table 5.** *T*-test value calculation.

| Coping style   | Group      | Mean | SD  | <i>T</i> -test value | <i>p</i> -value |
|----------------|------------|------|-----|----------------------|-----------------|
| Active Coping  | Control    | 40   | 5   | 17.69                | < 0.0001        |
|                | Experiment | 10   | 6   |                      |                 |
| Passive Coping | Control    | 30   | 4   | 5.76                 | 0.00000003      |
|                | Experiment | 20   | 4.5 |                      |                 |

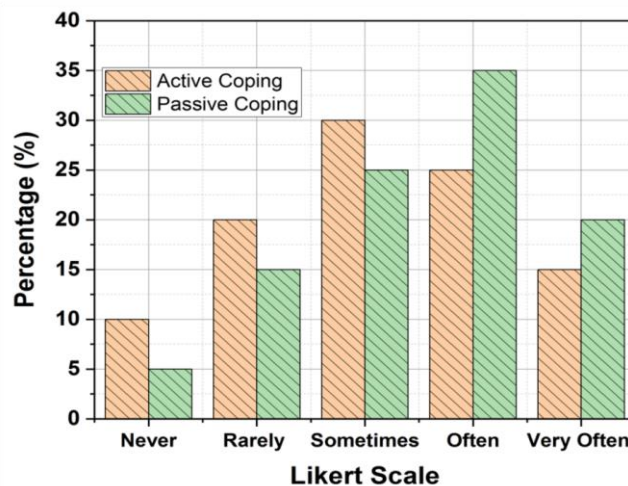


**Figure 5.** Comparison of 5-point likert scale.

Public and patient participation: The clinical nurses, thoracic surgeons, family caregivers, and psychologists of patients with early-stage rehabilitator benign tumor participated in focus groups throughout the development of trial elements for the previously described study. The Caregivers of families were asked to attend the rehabilitation support program's key sessions before the pilot study's launch to guarantee understanding and clarity. Following the navigator study, Caregivers will be asked for their opinions about the questionnaire. Each session's content, and the

program's structure. The experiment will be further optimized for the next effectiveness assessment research using input from participants in the feasibility study. The lead investigator will conduct the focus group interviews with experiment group participants once the trial is completed to get their opinions on the acceptability and usefulness of the rehabilitation support program (**Figure 5**).

## **5. Discussion**

Being their primary source of support, family caregivers are crucial to the care of patients with benign tumors. They disregard their health to care for a relative who has a tumor, though this burden upends their lives. To stay well and carry out their caregiving duties, family caregivers need to be given the tools, knowledge, and assistance they require. Nearing the end of their lives was the subject of most of the earlier caregiver research. There is a dearth of evidence on support programs designed especially for family caregivers following thoracic surgery. To offer specialized assistance to family caregivers of patients with benign tumors, the rehabilitation support program was created. In contrast to other Experiments, this one is specifically designed to meet the requirements of family caregivers of patients who have benign tumors. It is also provided throughout the rehabilitation phase, which emphasizes the needs of caregivers and combines psychoeducational techniques with training in coping and communication skills. It is predicted that family caregivers who get the experiment will experience a greater quality of life and less psychological distress and caregiver load than those in the control group. The findings of this study are consistent with prior research concerning the difficulties that caregivers of tumor patients experience and the importance of social support for lessening caregiver stress [11]. The current study focuses on the psychological and emotional aspects of patients with benign tumors and their caregivers to propose the necessity of incorporating these aspects into the rehabilitation process. Mental resilience, family emotional support, and positive rehabilitation outcomes establish significant correlations in our study that align with previous findings on these factors' well-being. Consequently, this study adds value to the existing research by explaining the exact pain points of caregiving for mortally ill patients, especially those with benign tumors, and the need to design an appropriate support system for them [11,18]. In this study, by describing the psychological distress, caregiving coping style, social support burden, and quality of life of the caregivers, we contribute to the understanding of a more complex picture of caregiver burden in this case. This adds to existing knowledge about the social and psychological effects of benign tumors on patients and their families and underlines the necessity of developing integrated rehabilitation programs that include not only medical treatments but also social and psychological rehabilitation of patients [4,5].

In addition, the results of the present study support the importance of communication and social support in reducing the burden on caregivers. Previous studies have emphasized the importance of communication difficulties and the advantages of social support in the caregiving setting, and the present research also supports these findings. The proposed study supports the effective and efficient use of effective communication, social support, and caregiver well-being in rehabilitation programs for patients and caregivers. Moreover, the present research enriches the

current literature by offering real-life data regarding the critical predictors of the rehabilitation success of benign tumor patients: mental resilience and family emotional support [6–10]. The findings demonstrate the importance of social support in rehabilitating benign tumor patients and their caregivers.

## 6. Conclusion

The findings have demonstrated the impact of mental resilience and family emotional support on the rehabilitation of Chinese patients with benign tumors. It underscores the complexity of the difficulties experienced by caregivers and the centrality of social support in reducing caregiver stress. By identifying the relationships between mental health, family emotional support, and positive patterns of rehabilitation, this study makes an essential contribution to understanding the needs of the patients and their families in the context of benign tumors. In the future, more attention should be paid to teaching and implementing psycho-educational approaches and communication skills as a part of the rehabilitation programs for patients with benign tumors in healthcare services. Such interventions should entail physical rehabilitation and integrate effective coping strategies and propitious social support for the patient and their families and caregivers. These findings stress the necessity of investigating and managing the psychological, emotional, and social rehabilitation needs of patients. Thus, this study raises an argument for the need to recognize individuals' mental resilience, family support, and communication in the rehabilitation process to advocate for a comprehensive approach to rehabilitation instead of strictly medical-focused solutions for clients with benign tumors. By targeting these areas, healthcare practitioners and support networks can improve the quality of care and support extended to patients and their caregivers, making the rehabilitation of patients with benign tumors more valuable and effective.

**Author contributions:** Conceptualization, QZ and CG; methodology, CG; software, QZ; validation, QZ, CG and SY; formal analysis, QZ; investigation, CG; resources, SY; data curation, CG; writing—original draft preparation, QZ; writing—review and editing, CG; visualization, SY; supervision, CG; project administration, CG. All authors have read and agreed to the published version of the manuscript.

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**Ethics approval:** The study was conducted in accordance with the Declaration of Helsinki, and approved by the ethical committee of Beijing Normal University, China (approval number IRB2022-2489-001), used participant data from individuals receiving therapy for benign tumors. Researchers ensured confidentiality and privacy protection for participants, following ethical guidelines. Explicit consent was obtained from all participants, and data integrity is maintained throughout and after the study.

**Availability of data and materials:** The data contains sensitive information about patients and healthcare providers and sharing it could pose significant privacy risks. Primary health care corporation (PHCC) is the data set owner. PHCC organizational policies allow for the release of data for research purposes only and do not permit publication of the raw data. Therefore, in compliance with these regulations and to uphold the highest standards of ethical conduct, the data cannot be made publicly available.

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

## References

1. Melguizo-Garín A, Benítez-Márquez MD, Hombrados-Mendieta I, et al. Importance of Social Support of Parents of Children with Cancer: A Multicomponent Model Using Partial Least Squares-Path Modelling. *International Journal of Environmental Research and Public Health*. 2023; 20(3): 1757. doi: 10.3390/ijerph20031757
2. Tay MRJ, Seah JD, Chua KSG. Long-Term Outcomes of Patients with Primary Brain Tumors after Acute Rehabilitation: A Retrospective Analyses of Factors. *Life*. 2022; 12(8): 1208. doi: 10.3390/life12081208
3. Åke S, Hartelius L, Jakola AS, et al. Experiences of language and communication after brain-tumour treatment: A long-term follow-up after glioma surgery. *Neuropsychological Rehabilitation*. 2022; 33(7): 1225-1261. doi: 10.1080/09602011.2022.2080720
4. Kos N, Velnar T, Brcar M, et al. Improvement in Body's Dynamic Adaptation during Walking with Vestibular Rehabilitation Therapy in Patients with Cerebellopontine Angle Tumor Resection. *Life*. 2024; 14(9): 1100. doi: 10.3390/life14091100
5. Novak AM, Lev-Ari S. Resilience, Stress, Well-Being, and Sleep Quality in Multiple Sclerosis. *Journal of Clinical Medicine*. 2023; 12(2): 716. doi: 10.3390/jcm12020716
6. Seiler A, Jenewein J. Resilience in Cancer Patients. *Frontiers in Psychiatry*. 2019; 10. doi: 10.3389/fpsyt.2019.00208
7. Thakkar P, Greenwald B, Patel P. Rehabilitation of Adult Patients with Primary Brain Tumors: A Narrative Review. *Brain Sciences*. 2020; 10(8): 492. doi: 10.3390/brainsci10080492
8. Macía P, Gorbeña S, Barranco M, et al. Role of resilience and emotional control in relation to mental health in people with cancer. *Journal of Health Psychology*. 2020; 27(1): 211-222. doi: 10.1177/1359105320946358
9. de Ruiter MA, Schouten-van Meeteren AYN, van Vuurden DG, et al. Psychosocial profile of pediatric brain tumor survivors with neurocognitive complaints. *Quality of Life Research*. 2015; 25(2): 435-446. doi: 10.1007/s11136-015-1091-7
10. Ilgen J, Renovanz M, Stengel A, et al. Resilience as a Factor Influencing Psychological Distress Experience in Patients with Neuro-Oncological Disease. *Current Oncology*. 2022; 29(12): 9875-9883. doi: 10.3390/curroncol29120776
11. Chung JOK, Li WHC, Ho LLK, et al. The Association of Resilience with Way of Coping, Psychological Well-Being and Quality of Life in Parents of Children with Cancer. *International Journal of Environmental Research and Public Health*. 2023; 20(10): 5765. doi: 10.3390/ijerph20105765
12. Stavinocha PL, Askins MA, Powell SK, et al. Neurocognitive and Psychosocial Outcomes in Pediatric Brain Tumor Survivors. *Bioengineering*. 2018; 5(3): 73. doi: 10.3390/bioengineering5030073
13. Smith JA, Osborn M. Pain as an assault on the self: An interpretative phenomenological analysis of the psychological impact of chronic benign low back pain. *Psychology & Health*. 2007; 22(5): 517-534. doi: 10.1080/14768320600941756
14. Ventura LM, Grieco JA, Evans CL, et al. Executive functioning, academic skills, and quality of life in pediatric patients with brain tumors post-proton radiation therapy. *Journal of Neuro-Oncology*. 2017; 137(1): 119-126. doi: 10.1007/s11060-017-2703-6
15. Clemente M, Hezomi H. Stress and Psychological Well-being: An Explanatory Study of the Iranian Female Adolescents. *Journal of Child and Adolescent Behaviour*. 2016; 04(01). doi: 10.4172/2375-4494.1000282
16. Pertz M, Schlegel U, Thoma P. Sociocognitive Functioning and Psychosocial Burden in Patients with Brain Tumors. *Cancers*. 2022; 14(3): 767. doi: 10.3390/cancers14030767
17. Nicol C, Pinkham MB, Foote M, et al. Patient reported outcomes and short-term adjustment trajectories following gamma knife radiosurgery for benign brain tumor. *Disability and Rehabilitation*; 2024.

18. Zanutto A, Glover RN, Zanutto T, et al. Rehabilitation in People Living with Glioblastoma: A Narrative Review of the Literature. *Cancers*. 2024; 16(9): 1699. doi: 10.3390/cancers16091699
19. Toledano-Toledano F, Luna D, Moral de la Rubia J, et al. Psychosocial Factors Predicting Resilience in Family Caregivers of Children with Cancer: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health*. 2021; 18(2): 748. doi: 10.3390/ijerph18020748
20. Kadir M. Family Social Support and Children's Mental Health Resilience during COVID-19—Case of Morocco. *Youth*. 2023; 3(2): 541-552. doi: 10.3390/youth3020037
21. Pieczyńska A, Zasadzka E, Pilarska A, et al. Rehabilitation Exercises Supported by Monitor-Augmented Reality for Patients with High-Grade Glioma Undergoing Radiotherapy: Results of a Randomized Clinical Trial. *Journal of Clinical Medicine*. 2023; 12(21): 6838. doi: 10.3390/jcm12216838
22. Prates PEG, Correa-Júnior AJS, Russo TM da S, et al. Effectiveness of Family Coping Interventions in Improving Problem-Solving Skills in the Care of Children and Adolescent Cancer Survivors during and after Treatment: A Scoping Review. *Nursing Reports*. 2024; 14(3): 2153-2178. doi: 10.3390/nursrep14030161
23. Massoeurs L, Ilie G, Lawen T, et al. Psychosocial and Functional Predictors of Mental Disorder among Prostate Cancer Survivors: Informing Survivorship Care Programs with Evidence-Based Knowledge. *Current Oncology*. 2021; 28(5): 3918-3931. doi: 10.3390/curroncol28050334
24. Yang Y, He F, Li D, et al. Effect of family resilience on subjective well-being in patients with advanced cancer: the chain mediating role of perceived social support and psychological resilience. *Frontiers in Psychology*. 2024; 14. doi: 10.3389/fpsyg.2023.1222792
25. Sagy R, Amitai M, Weizman A, et al. Levels of depression and satisfaction with life as indicators of health services consumption. *International Journal of Psychiatry in Clinical Practice*. 2016; 20(4): 245-248. doi: 10.1080/13651501.2016.1223855
26. Schellekens MPJ, Zwanenburg LC, van der Lee ML. Resilience in the Face of Cancer: On the Importance of Defining and Studying Resilience as a Dynamic Process of Adaptation. *Current Oncology*. 2024; 31(7): 4003-4014. doi: 10.3390/curroncol31070297
27. Raj VS, Lofton L. Rehabilitation and treatment of spinal cord tumors. *The Journal of Spinal Cord Medicine*. 2013; 36(1): 11-14. doi: 10.1179/2045772312y.0000000015
28. Ownsworth T, Chambers S, Hawkes A, et al. Making sense of brain tumour: A qualitative investigation of personal and social processes of adjustment. *Neuropsychological Rehabilitation*. 2011; 21(1): 117-137. doi: 10.1080/09602011.2010.537073
29. van Hoefen Wijsard M, Schonfeld SJ, van Leeuwen FE, et al. Benign Tumors in Long-Term Survivors of Retinoblastoma. *Cancers*. 2021; 13(8): 1773. doi: 10.3390/cancers13081773

## Review

# Effect of narrative nursing on psychological resilience, fear of cancer recurrence and sleep quality in cancer patients

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**Abstract:** To explore the impact of narrative nursing on psychological flexibility, fear of cancer recurrence and sleep quality in cancer patients. **Methods:** 100 cancer patients admitted to the Interventional Department of Jiangnan University Affiliated Hospital from January 2023 to January 2024 were selected as the research subjects. 100 patients were randomly divided into an observation group and a control group (50 cases each). The control group received basic nursing care, while the observation group received narrative care. After three months of nursing intervention, the psychological elasticity scores of the two groups of patients were compared [using the psychological elasticity scale] (RS-14)], changes in fear of cancer recurrence (FCR) (using the Fop-Q-SF scale) and sleep quality (using the PSQI scale). **Results:** Before the intervention, there was no statistical difference in the psychological flexibility, fear of cancer (FCR) and sleep quality (PSQI) scores between the two groups ( $P > 0.05$ ); after the intervention, the RS-14 scores of the two groups were higher than before the intervention. And the observation group was higher ( $P < 0.05$ ); the Fop-Q-SF and PSQI scores of both groups decreased, and the observation group was lower (both  $P < 0.05$ ). **Conclusion:** Narrative nursing can effectively improve the psychological flexibility and sleep quality of cancer patients, reduce the fear of cancer recurrence, and has significant therapeutic effects.

**Keywords:** psychological resilience; fear of cancer recurrence; sleep quality

## 1. Introduction

Cancer has become a major chronic disease that seriously threatens people's life and health. Due to the rapid progression of cancer and the long treatment process, patients are prone to a series of serious mental health problems such as pessimism, emptiness, loneliness and a series of psychological stress reactions when facing a series of challenges such as physical pain, psychological barriers, role loss and social integration for a long time [1]. Studies have shown that compared with other groups, cancer patients generally have lower psychological resilience and sleep quality, and experience higher levels of loneliness. 82.3% of patients have a high sense of loneliness [2] and fear of cancer recurrence. Psychological resilience, also known as psychological toughness, belongs to the category of biomedicine and psychosocial disciplines, and mainly refers to the positive response of individuals to environmental challenges [3]. Narrative nursing intervention is a mental and psychological nursing model that is increasingly widely used in clinical development. It is a medical humanistic concept that helps patients actively deal with negative emotions, correctly deal with cancer problems and improve their ability to adapt to the disease [4]. It mainly interviews cancer patients and listens to their mental journey and mental and psychological burden after the onset of the disease, so that patients can effectively relieve and release mental stress, reconstruct cancer treatment knowledge, and thus

improve their potential and confidence in treatment. Narrative nursing can not only improve patients' psychological resilience and reduce their fear of cancer recurrence, but also effectively improve patients' sleep quality and physical and mental health. Many domestic scholars have adopted narrative nursing to improve the psychological state of cancer patients and reduce FCR levels [5]. This study adopted the narrative nursing model to guide and treat 100 cancer patients and achieved satisfactory results. The research results are reported as follows.

## **2. Data and methods**

### **2.1. General data**

This study selected 100 cancer patients admitted to our hospital from January 2023 to January 2024. There were 57 males and 43 females in this group, aged 39 to 77 years old, with an average age of (54.3 to 62.6) years old. Tumor types: 2 cases of pancreatic cancer, 5 cases of brain cancer, 9 cases of ovarian cancer, 11 cases of bone cancer, 14 cases of liver cancer, 17 cases of lung cancer, 20 cases of gastric cancer, and 22 cases of other cancers (changed to 2 cases of pancreatic cancer, 3 cases of lung cancer, 5 cases of gastric cancer, 10 cases of bile duct cancer, 65 cases of liver cancer, and 15 cases of other cancers); Inclusion criteria: Meet the cancer diagnosis criteria: agree to receive narrative nursing therapy; have certain reading and writing skills; strong compliance; Exclusion criteria: patients with advanced or recurrent cancer; patients with unclear consciousness or cognitive impairment; patients with aphasia. The 100 patients were randomly divided into a control group and an observation group of 50 cases each, and the general data of the two groups were comparable ( $P > 0.05$ ). Implementation was performed after the patient agreed. This study conformed to the Declaration of Helsinki.

### **2.2. Intervention methods**

#### **2.2.1. Intervention methods for the control group**

Patients in the control group were given routine basic nursing care and cancer specialist care. Health education was conducted for patients, and treatment nursing principles and follow-up plans were introduced. Emotional counseling was done for patients undergoing radiotherapy and chemotherapy (changed to interventional surgery), their nervousness was relieved, their diet was arranged reasonably, they were guaranteed to take in enough healthy and nutritious food, supplement vitamins, and avoid eating irritating and indigestible food. The follow-up time and frequency were guaranteed for patients undergoing conservative (post-interventional) treatment. The patient's condition changes and psychological fluctuations were strictly recorded. Any abnormal situation was reported to the doctor immediately for symptomatic treatment and care.

#### **2.2.2. Intervention methods of the observation group**

The observation group was given narrative medical nursing measures on the basis of the control group.

First, a narrative nursing research team was established, and psychological counseling experts and senior psychotherapists were hired to provide professional

training for professional nurses, including cancer health education knowledge and psychological knowledge, to improve the narrative skills and empathy of nurses, enhance communication skills and conversation level, so that they can correctly assess the cognitive level of patients, and strictly carry out standardized and professional nursing intervention. At the same time, narrative nursing plans and interview plans were formulated according to the specific conditions of the patients. Narrative nursing was carried out 1 to 2 times a week, 40 min to 60 min each time, for 6 weeks; discharged patients should regularly understand the patient's condition and physical and mental health problems by phone, WeChat or text messages, and home visits can also be used to understand the patient's condition in detail and record it carefully;

Secondly, the interview environment should be ventilated and quiet, the light should be soft and warm, the interior should be fresh and elegant, and soothing and gentle music can be played to make the patient happy and relaxed, so that they will have the desire to talk actively and avoid resistance and resistance. Trained full-time nursing staff should communicate with patients and sit in front of them to observe their subtle facial expressions and eye movements, so as to quickly understand their psychological changes and emotional fluctuations. We should listen carefully to patients' demands, understand the support of their family members, their economic level, and any difficulties they encounter in treatment, and establish a good trusting relationship with them.

Third, we should guide patients to actively describe the course of their illness and treatment, fully understand their emotional psychology and various problems, and obtain first-hand information. During the interview, we should respect patients' privacy, care about their psychology and emotions, understand and empathize with their demands and emotional fluctuations, effectively guide their negative emotions, and externalize their inner demands and difficulties. We should listen carefully to patients' stories and record the conversations in detail. For patients with serious negative psychology, we should take effective psychological intervention and guidance measures. We should pay attention to observe patients' emotional and psychological changes, understand their physical condition and emotional fluctuations, understand their condition and psychological state, and give timely and detailed answers to their questions. If patients have wrong ideas induced by the disease, we should guide them to respond correctly in a scientific way so that they can change their wrong cognition, and use health knowledge lectures and distribution of health knowledge manuals to reconstruct their cognition [6].

Fourth, we should carefully understand the patient's interests, past achievements or accomplishments, and enhance the patient's self-confidence and pride. We should understand the patient's fear of cancer and its impact on his or her life. We should listen to the patient's mental journey, treatment experience and anti-cancer experience in cancer treatment, especially his or her strong spirit during radiotherapy and chemotherapy (changed to interventional surgery). We should help patients relieve their psychological burden, ignite their love and desire for life, and continuously enhance their courage and confidence to defeat cancer by talking and releasing their extreme emotions such as tension, anxiety, loneliness and helplessness when facing cancer alone. We should patiently appease the patient's psychological and emotional changes, and quickly provide psychological counseling and intervention measures.

Fifth, encourage patients to talk about their psychological pressure and depression to their relatives and friends, optimistically share their personal anti-cancer experience with other patients, and through communication and sharing, make patients see hope and be full of confidence, and further strengthen their belief in recovery. Educate and support family members to cooperate with the patient's treatment and nursing work, and give the patient family affection and warmth of companionship. Encourage patients to face their own condition bravely, regard unforgettable treatment experiences as an important spiritual wealth, and record their experience of treatment in the form of diaries, letters, recordings and videos, and leave various records for every bit of progress made. There is no limit on the number of words in the text, and the length of the recording or video is not counted. The interviewer can borrow these materials regularly and conduct special research.

During the interview, the patient's emotional changes and mental state should be closely observed. If the patient has a bad mood or a related adverse event occurs, effective intervention and solution should be given according to the specific cause [7]. After each interview, the researchers should carefully organize the chat records, summarize the successful experiences and shortcomings in narrative nursing based on the collected diaries and audio-visual materials, and find the patient's current psychological problems [8]. Improve the narrative nursing plan according to the specific situation to effectively improve the effect of narrative nursing. Regularly evaluate the patient's psychological resilience, fear of cancer recurrence, and sleep quality and prepare records.

### **2.3. Observation items and evaluation criteria**

#### **2.3.1 Psychological resilience level**

The psychological resilience level was assessed using the Resilience Scale (RS-14), which was developed by American scholars CONNER and DAVIDSON [9]. The items are divided into two dimensions: personal ability and acceptance of self and life. The score is scored on a 7-point scale, ranging from "not at all" to "completely". The Cronbach's  $\alpha$  coefficient in the total scale is 0.85, and the total score is 100 points. The higher the score, the better the patient's psychological resilience [10].

#### **2.3.2 Fear of cancer recurrence level**

The fear of cancer recurrence (FCR) level of patients was assessed using the Fear of Progression Questionnaire (FoP-Q-SF) [11]. This item has 12 evaluation items, which are divided into 1 to 5 grades according to the severity of the disease, with a score of 12 to 60 points. The higher the score, the higher the fear level. Those with a score of  $>34$  is considered to have severe fear. The assessment time is at admission and after the implementation of narrative nursing intervention.

#### **2.3.3. Sleep quality**

The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality, which consists of 19 items and 7 dimensions, ranging from 0 to 21 points. The higher the score, the worse the sleep quality [12].

## 2.4. Statistical methods

The data were analyzed using SPSS 17.0 professional software, and  $t$  and  $\chi^2$  tests were used.  $P < 0.05$  was considered statistically significant.

## 3. Results

### 3.1. Comparison of clinical effects

After intervention, the treatment effectiveness of the observation group was significantly higher than that of the control group ( $P < 0.05$ ). See **Table 1**.

**Table 1.** Comparison of clinical effects between the two groups ( $n/\%$ ).

| Group             | N  | Effective | Efficient | Invalid | Total effective rate |
|-------------------|----|-----------|-----------|---------|----------------------|
| Observation Group | 50 | 19(38%)   | 26(52%)   | 5(14%)  | 45(90%)              |
| Control group     | 50 | 15(30%)   | 21(42%)   | 14(28%) | 36(72%)              |
| $\chi^2$          |    | 0.351     | 0.494     | 3.603   | 5.263                |
| P                 |    | 0.553     | 0.482     | 0.057   | <0.01                |

### 3.2. Comparison of RS-14, FoP-Q-SF and PSQI scores between the two groups of patients

After intervention, the RS-14 scores of the two groups of patients were higher than before treatment, and the observation group was higher ( $P < 0.05$ ); the FoP-Q-SF and PSQI scores of the two groups of patients were lower than before treatment, and the observation group was lower ( $P < 0.05$ ), see **Table 2** for details.

**Table 2.** Comparison of RS-14, FoP-Q-SF and PSQI scores between the two groups of patients ( $\bar{x} \pm s$ ).

| Group             | n  | Psychological resilience (RS-14) |                    | Fear of cancer recurrence (FCR) |                    | sleep disorder (PSQI) |                    |
|-------------------|----|----------------------------------|--------------------|---------------------------------|--------------------|-----------------------|--------------------|
|                   |    | Before intervention              | After intervention | Before intervention             | After intervention | Before intervention   | After intervention |
| Observation Group | 50 | 44.91 $\pm$ 8.65                 | 72.52 $\pm$ 7.31   | 36.19 $\pm$ 3.31                | 25.21 $\pm$ 3.52   | 12.21 $\pm$ 1.65      | 6.45 $\pm$ 1.25    |
| Control group     | 50 | 45.44 $\pm$ 7.54                 | 64.35 $\pm$ 6.15   | 35.27 $\pm$ 3.26                | 30.14 $\pm$ 3.29   | 12.35 $\pm$ 1.34      | 9.40 $\pm$ 1.19    |
| t                 |    | 0.3265                           | 6.047              | 1.400                           | 7.235              | -0.798                | 2.21646            |
| P                 |    | 0.697                            | <0.001             | 0.935                           | <0.001             | 0.854                 | <0.001             |

## 4. Discussion

The 2020 Global Cancer Statistics Report shows that the incidence and mortality of new cancer cases in my country are 23.7% and 30.2%, respectively [13]. Due to the pain caused by cancer itself and the various adverse reactions caused by chemotherapy, as well as the high metastasis and recurrence rates of cancer, patients are prone to cancer recurrence fear [14]. Most patients have a negative coping attitude due to huge psychological pressure, which leads to decreased psychological resilience and inability to get a good sleep [15]. Fear of cancer recurrence (FCR) is a kind of negative emotional change such as tension, anxiety, [16] irritability, fear, etc. caused by patients' fear of accelerated cancer progression or possible recurrence [17]. It will greatly increase the mental and psychological pressure of patients, thereby reducing

their quality of life and social function, leading to sleep disorders and decreased treatment compliance, and seriously affecting the prognosis of the disease [18]. Cancer patients' uncertainty about the development of their disease will lead to problems such as bedtime tension, sleep disorders and even long-term insomnia [19]. The higher the FCR level, the worse the patient's sleep quality [20]. Malnutrition and physical decline caused by tumor consumption, pain from bone metastasis, and nausea and vomiting after chemotherapy and radiotherapy [21] can also cause cancer patients to have poor sleep quality. Psychological resilience refers to the ability of people to rebound and adapt when facing adversity, pressure, tragedy, threat, and trauma, as proposed by the American Psychological Association [22]. Good psychological resilience helps individuals quickly adapt to the external environment [23]. Psychological resilience is an inherent spiritual quality and the ability to cope with stress when facing stress. The factors that affect psychological resilience include the individual's degree of cognition of external things, coping ability, strong and optimistic personality traits, healthy emotions and spirituality, and the ability to repair and grow the mind after trauma. At the same time, the understanding and help from nursing staff and the spiritual support from family members are also important factors in helping patients relieve negative emotions, enhance their ability to resist stress, calm their minds, bravely face and try to accept the reality of the disease, and can effectively encourage patients to reshape their sense of meaning in life [24]. The higher the level of psychological resilience of cancer patients, the more conducive it is for them to take a positive attitude towards difficulties and some stressful events, and enhance their psychological adaptability when coping with difficulties [25]. Some studies [26] have shown that patients with good psychological resilience can reduce insomnia caused by pain. RS-14 can predict possible psychological problems, and a score of 38 can be used as the threshold for diagnosing psychological resilience [27].

The narrative nursing model is a psychological intervention model that is patient-led and jointly participated by medical staff and nurses. Narrative nursing can not only enable patients to actively participate in nursing activities [28]. On the one hand, patients can release psychological and mental pressure and reconstruct their life and disease stories by telling their treatment experiences and their own stories. On the other hand, medical staff can also summarize the key points of nursing from the patients' stories and take professional nursing intervention measures [14] to help patients improve pain, relieve depression and anxiety [29], reduce the fear of cancer recurrence, enhance psychological resilience, and continuously improve sleep quality and improve the quality of life of patients. Narrative nursing can also analyze the causes of the fear of cancer recurrence through the specific behaviors of patients, develop ways to regulate negative emotions and positive coping strategies, thereby effectively regulating patients' negative emotions, helping patients to reduce their fear of cancer recurrence in a targeted manner [13], and improve psychological resilience and treatment confidence. Narrative nursing is an intervention care measure that provides spiritual comfort and relieves psychological pressure for patients through listening, empathy and acceptance [30]. It can not only enable patients to actively vent negative emotions with the support and encouragement of professionals, but also reshape their cognition of cancer, establish a healthy psychology [31], improve disease prognosis, and improve patients' quality of life [32].

The treatment efficacy of patients in the observation group of this study was higher than that in the control group, indicating that the use of narrative nursing measures can effectively relieve the tension of cancer patients, reduce psychological pressure, and improve treatment compliance and treatment effect. The RS-14 value of patients in the observation group of this study was significantly higher than that before the intervention, and was significantly better than that of the control group ( $P < 0.05$ ), indicating that narrative nursing intervention measures have a significant effect on improving the negative emotions and psychological resilience of cancer patients, and can promote their comprehensive physical and mental recovery and improve their quality of life. Narrative nursing can enable cancer patients to fully understand their inner needs, continuously improve their strategic ability to cope with the disease, reshape their strong and optimistic personality, and grow comprehensively after facing a major blow, and continuously expand the tension of life, which is consistent with the research conclusions of Guo Lirong et al. [33]. In this study, the FoP-Q-SF and PSQI scores of both groups were lower than before treatment, and the observation group had a lower score ( $P < 0.05$ ), indicating that narrative nursing can significantly reduce the fear of recurrence and improve sleep quality in cancer patients, which is consistent with the research results of Su Shaoyan [8].

In short, narrative nursing can effectively improve the psychological resilience of cancer patients, greatly reduce the fear of cancer recurrence, and improve the sleep quality of patients. It has a significant therapeutic effect and plays a very important role in improving the quality of life of patients. It is suitable for clinical promotion and application.

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**Ethical approval:** The study was conducted in accordance with the Declaration of Helsinki. The ethical review of this study was approved by the Ethics Committee of the Affiliated Hospital of Jiangnan University, approval number 202400171, approval date: 30 April 2024. All participants signed the informed consent in this study.

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## References

1. Lv S, Zhang X, Chen Y, et al. The relationship between loneliness and social support in cancer patients: the mediating effect of psychological resilience. *Journal of nursing administration*. 2022; 22(9): 621-625.
2. Brett M, Johanna C, Karen LW, et al. Implicit loneliness emotion regulation, and depressive symptoms in breast cancer survivors. *Journal of Behavioral Medicine*. 2016; 39(5): 832-844. doi: 10.1007/s10865-016-9751-9
3. Cosco TD, Kaushal A, Richards M, et al. Resilience measurement in later life: a systematic review and psychometric analysis. *Health and Quality of Life Outcomes*. 2016; 14(1). doi: 10.1186/s12955-016-0418-6
4. Liu L. Effects of narrative nursing on pain induced fatigue, post-traumatic growth and psychological status of patients with breast pain. *Contemporary Nurses (last ten days)*. 2022; 29(9): 6265.

5. Zhao J, Li A, Feng Y. A systematic evaluation of the impact of narrative nursing on cancer patients. *Contemporary Nurses* (Next issue). 2021; 28(9): 45-51.
6. Shi Z, Liu Y, Long Y, et al. Effects of cognitive behavioral intervention on mental resilience and fear of cancer recurrence in patients with glioma. *Journal of Qilu Nursing*. 2022; 28(3): 5-8.
7. Lin Y, Gong M, Shi R, et al. Analysis of the effects of narrative nursing combined with psychological nursing on coping style and sleep quality of breast cancer patients. *World Journal of Sleep Medicine*. 2023; 10(11): 2656-2659.
8. Su S. Effects of narrative medicine nursing on fear of cancer recurrence, cancer-related fatigue and sleep quality in patients with acute leukemia. *World Journal of Sleep Science*. 2023. 10(9): 2145-2148.
9. Conner KM, Davidson JR. Development of a new resilience Scale: the Connor Davidson Resilience Scale among Chinese adolescents. *ComprPsychiat*. 2011; 52(2): 218-224.
10. Wu Y, Zeng Z, Gao C, et al. Study on the correlation between quality of life and social support and psychological resilience of heart transplant recipients during waiting period. *Chinese medicine*. 2020; 15(4): 534-538.
11. Luo Y. Influencing factors of cancer recurrence in patients with early esophageal cancer after endoscopic submucosal dissection. *Esophagealdisease*. 2021; 3(2): 153-156.
12. Xing JH, Tang WH, Gao LP, et al. Effects of narrative nursing combined with mindfulness meditation on sleep quality and negative emotion in patients with lung cancer undergoing chemotherapy. *Contemporary nurses: last ten days*. 2022; 29(1): 86-89.
13. Wang YQ. Global Cancer statistics Report 2020. *Chinese Journal of Preventive Medicine*. 2019; 55(3): 398.
14. Yao M. Effect of positive psychological intervention under PERMA model on psychological resilience and fear of cancer recurrence in patients with gynecological tumors. *Practical electronic journal of gynecology endocrinology*. 2021; 8(22): 114-116.
15. Hong Q. Analysis of influence of psychological nursing on sleep quality of cancer patients. *Contemporary Clinical Medicine Journal*. 2019; 32(02): 122,133.
16. Xu H, Han L. Effect analysis of narrative nursing on mental toughness and quality of life in patients with gastric cancer recurrence. *Clinical research*. 2023; 31(4): 138-140.
17. Risini. Effect of narrative nursing on fear, hope and mental resilience of colorectal cancer patients. *Jilin Medical College*. 2023; 44(9): 2644-2647.
18. Shi W, Li D, Zheng M. Relationship between coping style, hope level, mental resilience, fear of cancer recurrence and depression level in patients with gastric cancer. *International Journal of Psychiatry*. 2021; 48(2): 301-305.
19. Suo L, Liu Y, Xiong L, et al. Effects of mixed Mindfulness-based stress reduction training on mental resilience and sleep quality of cancer patients. *Journal of Port Medical College*. 2020; 45(10): 1439-1442.
20. Zhao S, Wang S, Wang S, et al. Cancer-related fatigue in postoperative patients with esophageal cancer and its correlation with social support and quality of life. *Modern biomedical advances*. 2022; 22(17): 3378-3382,3400.
21. Huang L, Cai X. Effect of narrative medicine nursing on fear of cancer recurrence and sleep quality in patients with esophageal cancer after endoscopic mucosal dissection. *World Journal of Sleep Medicine*. 2024; 11(01): 163-166,170.
22. American Psychology Association. The road to resilience: what is resilience (2010-12-20). Available online: <http://www.apa.org/helpcenter/road-resilience.aapx> (accessed on 3 April 2024).
23. Sun L, Yu N. Psychological resilience and the level of social support in patients with gynecological malignancy in a Top three hospital of Nanchang City. *Occupational and health*. 2019; 35(14): 1943-1946.
24. Qian J, Gao W, Zhu Y, et al. The effect of social support on spiritual health in cancer patients: the chain mediating role of mental resilience and medical coping. *Contemporary nurse*. 2024; 31(9): 112-116.
25. Niu J, Cui J, Yang K, et al. Effect of Type C personality behavior pattern on psychological resilience and benefit finding level of patients after breast cancer surgery. *Nursing research*. 2020; 34(20): 3606-3610.
26. Mccracken LM, Williams JL, Tang NK. Psychological flexibility may reduce insomnia in persons with chronic pain: a preliminary retrospective study. *Pain Med*. 2011; 12(6): 904.
27. Tian J, Hong JS, Ni Qiany, et al. Study on Determining diagnostic threshold value of mental resilience Scale by ROC curve. *Mathematical Practice and Understanding*. 2013; 43(6): 165-171.
28. Peng L, Li J, Chen X, et al. Application of Narrative Medicine model in Communication with cancer patients with low education. *Sichuan Mental Health*. 2021; 34(2): 139-143.

29. Vega BR, Barnier PO, Bay6n C, et al. Differences in Depressed oncologic patients' Narratives after receiving two different therapeutic interventions for depression: a Qualitative study. *Psychooncology*. 2012; 21(12): 1292-1298.
30. Yu H. Theoretical Construction, curriculum development and empirical Research of Narrative nursing [DI]. Shanghai: Second Military Medical University; 2017.
31. Su X, Zhou X, Su L, et al. Effect of narrative nursing on physical and mental state of patients with esophageal cancer undergoing chemotherapy. *China Health and Nutrition*. 2021; 31(9): 168.
32. Li X, Hu Y, Tang H. Meta-analysis of the effect of narrative therapy on negative emotions in patients with malignant tumors. *Shanghai Nursing*. 2021; 21(6): 9-14.
33. Guo L, Yu D, Chen L, et al. Effect of narrative nursing on mental resilience and hospitalization satisfaction of cancer patients with chemotherapy. *Chinese and foreign medical research*. 2023; 21(24): 108-111.

Review

# Application of coping strategies and psychological interventions in the management of depression and anxiety among leukemia patients

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**Abstract:** This review aims to explore the application of coping strategies and psychological interventions in managing depression and anxiety among leukemia patients. Leukemia patients often face significant psychological burdens, with elevated rates of depression and anxiety, which deeply impact their overall health and quality of life. This article reviews the relevant literature and analyzes various psychological interventions, including Cognitive Behavioral Therapy (CBT), supportive psychotherapy, meditation, and emotional regulation techniques, evaluating their effectiveness in alleviating psychological distress among leukemia patients. The findings indicate that appropriate psychological interventions not only significantly reduce depressive and anxiety symptoms but also improve physiological health, emotional regulation, and overall quality of life. In addition, coping strategies play a critical role in mitigating anxiety and depression. Taken together, the combination of psychological interventions and coping strategies provides comprehensive support for leukemia patients, contributing to improved treatment outcomes and quality of life.

**Keywords:** leukemia; depression; anxiety; psychological interventions; coping strategies

## 1. Introduction

### 1.1. Background

Leukemia patients frequently experience significant psychological burdens, with depression and anxiety being common among them. Research shows that the psychological stress linked to leukemia diagnosis and treatment significantly affects patients' health and quality of life (QoL) [1]. For example, a study found that 17.8% of acute leukemia patients showed clinically significant depressive symptoms [2]. The study also noted a strong link between depression and the burden of physical symptoms. Individual factors, such as psychiatric history and social support, affect the psychological responses of leukemia patients [3]. Patients with less support tend to experience higher levels of distress. This underscores the urgent need for effective psychological interventions that address both the emotional and physical challenges of leukemia treatment.

### 1.2. Importance of psychological interventions

Effective emotional management is crucial for cancer patients. It can improve treatment adherence, quality of life (QoL), and overall prognosis. Cancer diagnoses often lead to emotional distress, including anxiety, depression, and stress. These emotions can make it harder for patients to follow treatment plans and manage their health effectively [4]. Research shows that interventions focused on emotional well-

being can improve treatment adherence. For example, studies show that patients who engage in psychoeducational interventions develop better coping strategies and experience less psychological distress. This leads to improved QoL [5]. Emotional intelligence is also crucial in managing pain and improving QoL among cancer patients. Developing emotional skills can help reduce the negative effects of pain and treatment side effects [6].

### **1.3. Significance of the study**

This review synthesizes current research on coping strategies and psychological interventions for leukemia patients, with a focus on their effectiveness in managing depression and anxiety. While there are studies on various interventions, most focus on single-treatment approaches like Cognitive Behavioral Therapy (CBT) or psychoeducation [7]. However, there is a significant gap in the literature regarding the integrated application of multiple psychological interventions, particularly those that address both emotional and physical challenges associated with leukemia treatment. This review aims to fill this gap by providing a comprehensive evaluation of various interventions, including CBT, digital health applications, and family support. By highlighting the most effective strategies for alleviating psychological distress across different patient demographics and leukemia subtypes, this study seeks to provide insights into targeted interventions and propose directions for future research.

## **2. Epidemiological characteristics of emotional issues in leukemia patients**

### **2.1. Prevalence of depression and anxiety**

The high prevalence of depression and anxiety among leukemia patients has been extensively studied, with notable variations observed across different ages and genders [8]. Psychological distress significantly impacts patients' ability to cope and can affect overall treatment outcomes. Research indicates that psychological distress can significantly impact patients' coping abilities and overall treatment outcomes. For instance, a systematic review highlighted that the prevalence of anxiety and depression among cancer patients, including those with leukemia, can vary widely, with some studies reporting rates as high as 52% for depression and 50% for anxiety [9]. This variability can be influenced by factors such as age, gender, and the specific type of cancer.

In older adults, the prevalence of anxiety and depression tends to be lower compared to younger patients; however, this does not negate the considerable psychological burden that leukemia can impose [10]. Gender differences also play a crucial role; studies have shown that female patients often report higher levels of anxiety and depression compared to their male counterparts [11]. Understanding these variations is essential for developing targeted interventions that address the mental health needs of leukemia patients across diverse demographics.

Summary: Depression and anxiety rates in leukemia patients show significant variability based on age, gender, and cancer type, underscoring the need for tailored psychological interventions.

## **2.2. Sources of psychological distress**

### **2.2.1. Disease progression and treatment side effects**

Major sources of emotional distress among leukemia patients include disease progression, treatment side effects, prolonged hospitalization, and the financial burden associated with their condition [12]. Patients often experience significant psychological distress due to the unpredictability of their illness and accompanying physical symptoms. For instance, individuals with chronic conditions like chronic obstructive pulmonary disease (COPD) report emotional distress stemming from restricted mobility and social participation, which can exacerbate feelings of isolation and helplessness [13].

Moreover, the treatment process can introduce additional layers of distress. Cancer patients frequently face side effects from chemotherapy, which can lead to conditions such as chemotherapy-induced peripheral neuropathy (CIPN), significantly impacting their quality of life [14]. The psychological implications of these physical symptoms are profound, as they can lead to increased anxiety and depression [15].

### **2.2.2. Prolonged hospitalization and financial burden**

Prolonged hospitalization is another critical factor contributing to psychological distress. Studies have shown that patients who experience longer hospital stays often report higher levels of emotional distress, which can be linked to their overall treatment experience and the stress of being away from their support systems [16]. The role of caregivers is also crucial, as their psychological distress can also affect the emotional well-being of patients. Research has demonstrated that caregivers' mental health issues, such as depression and anxiety, can predict similar symptoms in cancer patients, highlighting the interconnectedness of emotional distress within the patient-caregiver dynamic [17].

Summary: Psychological distress in leukemia patients stems from a variety of factors, including disease progression, treatment side effects, extended hospitalization, and financial burdens, with emotional distress in caregivers also contributing to the patient's psychological well-being.

## **2.3. Impact on quality of life**

Psychological distress is a critical factor that significantly reduces patients' quality of life (QoL) and may negatively impact treatment outcomes. Numerous studies have demonstrated that various forms of psychological distress, including depression and anxiety, are associated with poorer QoL across different patient populations. For instance, in patients with chronic conditions such as heart failure, psychological distress has been linked to lower medication adherence and lifestyle adherence, which are essential for effective disease management [18]. Similarly, in cancer patients, negative illness perceptions and psychological distress have been

shown to mediate the relationship between illness perceptions and QoL, indicating that addressing psychological factors is crucial for improving patient outcomes [19].

In patients undergoing treatments like trans-hepatic arterial chemoembolization for liver cancer, symptom distress directly impacts QoL and can also diminish hope, further complicating recovery and overall well-being [20]. Therefore, it is essential for healthcare providers to recognize the profound effects of psychological distress on QoL and to implement strategies that address these issues, ultimately leading to better treatment adherence and improved health outcomes for patients [21].

**Summary:** Psychological distress has a significant impact on the quality of life of leukemia patients, influencing not only their mental health but also their treatment adherence and recovery outcomes.

**Overall conclusion:** The interplay between psychological distress and QoL in leukemia patients is multifaceted and complex, requiring a holistic approach to patient care that integrates both mental and physical health. Addressing psychological distress through targeted interventions is essential to improving treatment adherence, enhancing patient well-being, and optimizing overall health outcomes.

### **3. Coping strategies for leukemia patients**

#### **3.1. Positive coping strategies**

Leukemia patients commonly use strategies such as emotional support, problem-solving, and positive cognitive restructuring. Research consistently shows that emotional support from family and friends plays a crucial role in strengthening patients' coping mechanisms, helping them deal with the stress of their illness [22–25]. For example, a study by Smith et al. found that patients who received strong social support had significantly lower levels of depression and anxiety during treatment [26]. Problem-solving skills are also vital, as they empower patients to effectively address the challenges posed by their treatment and daily life, thereby reducing feelings of helplessness and anxiety [27]. Furthermore, positive cognitive restructuring helps patients reframe their thoughts about their illness, fostering a more optimistic outlook and improving overall mental health [28].

In addition to these strategies, seeking social support has been identified as a critical component in maintaining emotional well-being during treatment. Engaging with support groups or connecting with others who share similar experiences can provide a sense of community and understanding, which is particularly beneficial for those feeling isolated due to their condition [29]. Moreover, the integration of coping strategies such as mindfulness and relaxation techniques can further enhance emotional resilience, allowing patients to manage stress more effectively and improve their quality of life during treatment. A 2022 meta-analysis demonstrated that mindfulness-based interventions significantly reduced anxiety and improved emotional regulation among cancer patients [30].

Overall, the combination of emotional support, problem-solving, positive cognitive restructuring, and social engagement forms a comprehensive approach to coping that can significantly benefit leukemia patients as they navigate the complexities of their treatment journey [31].

### **3.2. Avoidant coping strategies**

Some leukemia patients use avoidant coping strategies like denial and emotional suppression. These strategies may provide temporary relief but can lead to negative outcomes. Research shows that while denial helps some patients cope with the stress of their diagnosis and treatment, it can prevent them from engaging with healthcare providers and following treatment protocols. A study by Alrabiah et al. [32] found that denial among leukemia patients was correlated with lower treatment adherence and poorer health outcomes. Emotional suppression can prevent patients from expressing their feelings and seeking necessary support, ultimately exacerbating feelings of isolation and distress [33].

In a qualitative study of adults with leukemia undergoing hematopoietic stem cell transplantation, participants reported various coping strategies, including denial and avoidance, which were identified as maladaptive responses to their situation [34]. These strategies can create a cycle of avoidance that may lead to poorer psychological outcomes, such as increased anxiety and depression, as patients struggle to confront their illness and its implications. Furthermore, the use of avoidant coping strategies has been linked to lower quality of life and increased emotional burden among patients. For instance, caregivers of pediatric cancer patients also exhibit similar patterns of coping, where self-distancing and avoidance can buffer against immediate distress but may not address the underlying emotional challenges they face [33].

### **3.3. Comparative analysis of coping strategies**

Studies comparing different coping strategies show that positive coping reduces psychological distress and improves overall well-being among leukemia patients. For example, a study by Acoba et al. demonstrated that active coping strategies, such as problem-solving and seeking social support, led to significantly lower levels of anxiety and depression compared to passive coping strategies like avoidance [35]. Conversely, passive coping strategies, such as avoidance and denial, tend to correlate with higher psychological distress and negative health outcomes [36].

In a systematic review of coping strategies among cancer patients, it was found that those who employed acceptance and problem-focused coping reported better adjustment and lower levels of distress [37]. This aligns with findings from studies on breast cancer survivors, where active coping strategies were linked to reduced cortisol levels and proinflammatory cytokines, suggesting a physiological benefit to positive coping [38]. Additionally, a study on leukemia patients undergoing stem cell transplants indicated that positive coping strategies led to better post-treatment adjustment and lower psychological distress [39].

The impact of cultural and demographic factors on coping strategies is significant. For example, research on African Caribbean and Irish populations in the UK highlights the role of spirituality and community support in shaping coping mechanisms, which can differ significantly from those employed by other ethnic groups [40]. Understanding these cultural nuances is essential for developing targeted interventions that resonate with the specific experiences and backgrounds of leukemia patients. Tailoring psychological support to align with the cultural context

can enhance the effectiveness of coping strategies and ultimately improve mental health outcomes.

In conclusion, positive coping strategies are essential for improving psychological outcomes in leukemia patients. Future research should further explore the relationship between coping strategies, cultural factors, and social support. This will help develop effective interventions that meet the unique needs of this patient group [40–43].

## **4. Application of psychological interventions in managing depression and anxiety**

### **4.1. Cognitive Behavioral Therapy (CBT)**

#### **4.1.1. Overview and efficacy**

Cognitive Behavioral Therapy (CBT) has been widely applied to leukemia patients, showing positive results in reducing symptoms of depression and improving overall quality of life. Research indicates that CBT effectively addresses the psychological distress experienced by patients undergoing treatment for leukemia, which often includes feelings of anxiety, fear, and hopelessness. For instance, a study demonstrated that CBT significantly reduced depressive symptoms in patients with chronic illnesses, including cancer, by helping them develop coping strategies and alter negative thought patterns [44].

#### **4.1.2. Effectiveness in different populations**

Moreover, the efficacy of CBT in managing depression has been supported by various meta-analyses, which highlight its effectiveness across different populations, including those with chronic pain and mental health issues [45]. In the context of leukemia, CBT not only aids in alleviating depressive symptoms but also enhances patients' emotional resilience, enabling them to better navigate the challenges of their illness and treatment [46].

#### **4.1.3. Challenges in resource-limited settings**

However, the effectiveness of CBT in resource-limited settings can be influenced by various factors such as access to trained professionals, the availability of therapeutic infrastructure, and cultural perceptions of psychological therapy. For example, in low-resource settings, patients may face significant barriers to accessing CBT, including a lack of mental health professionals and cultural stigma surrounding mental health care. Research has suggested that adapted CBT interventions, delivered through telehealth or community health workers, may offer a viable alternative for these populations [47].

### **4.2. Potential of mHealth in leukemia care**

Digital health applications, such as the DREAMLAND app, offer online support and resources tailored to the unique needs of leukemia patients. These applications can facilitate self-management by providing tools for tracking symptoms, medication adherence, and emotional well-being. The integration of mobile health (mHealth) apps into the care of leukemia patients has the potential to

enhance their psychological health by promoting engagement in their treatment journey and fostering a sense of community through peer support features [48].

Recent studies have demonstrated the effectiveness of mHealth tools in improving patient engagement and psychological well-being. For instance, a 2021 study found that leukemia patients who used mobile health platforms for symptom tracking and medication adherence experienced lower levels of anxiety and depression and showed improved treatment adherence compared to those who did not use such tools [49]. Additionally, a meta-analysis conducted in 2021 found that mHealth apps significantly improved health outcomes by enhancing patients' ability to self-manage their conditions and providing ongoing emotional support, which is especially critical for leukemia patients undergoing long-term treatment [50].

#### **4.2.1. Challenges in resource-limited settings**

While these apps offer considerable promise, their effectiveness may vary in different settings. In high-resource countries, mHealth apps are well-integrated into healthcare systems, allowing patients to easily track their health data and communicate with their care teams. However, in resource-limited settings, challenges such as lack of internet access, insufficient technological infrastructure, and lower digital literacy can hinder the effectiveness of these interventions. Research has shown that in these contexts, mobile health interventions may require modifications, such as offline capabilities and local language support, to ensure they are accessible and effective [51].

#### **4.2.2. Usability and patient engagement**

Additionally, research indicates that mobile health apps can empower patients by increasing their health literacy and enabling them to take an active role in managing their condition. For leukemia patients, who often face significant psychological challenges due to the nature of their illness and treatment, these digital tools can offer valuable support. They provide access to educational materials, coping strategies, and mindfulness exercises, which are essential for managing stress and anxiety associated with cancer treatment [52].

A 2023 study by Smith et al. demonstrated that leukemia patients using mobile health applications that included emotional support and educational resources reported significant improvements in mental health, including reduced stress and enhanced quality of life [53].

#### **4.2.3. Differentiating needs: Acute vs. chronic leukemia patients**

The needs of leukemia patients can differ significantly depending on whether they are facing acute or chronic leukemia. Acute leukemia patients, often undergoing urgent and intensive treatment regimens, typically require mHealth tools that provide real-time symptom monitoring and immediate emotional support. These patients may experience heightened levels of anxiety, fear, and uncertainty about their prognosis and treatment, which makes real-time feedback and coping strategies particularly important. A study by Anderson et al. found that acute leukemia patients who used real-time symptom-monitoring apps experienced significant reductions in anxiety and improvements in managing treatment side effects [54].

In contrast, chronic leukemia patients, who are often in long-term remission or undergoing maintenance therapy, prioritize managing their condition over an extended period. These patients benefit from mHealth tools that assist in continuous disease management, including medication adherence, fatigue control, and emotional well-being. Research has demonstrated that chronic leukemia patients using mHealth applications with features such as longitudinal symptom tracking have shown improvements in both their quality of life and emotional resilience. These tools facilitate ongoing monitoring, which can enhance self-management, reduce stress, and improve overall health outcomes [55].

#### **4.2.4. Clinical implications**

From a clinical perspective, the differentiation in needs between acute and chronic leukemia patients is crucial for mHealth app design. Acute leukemia patients benefit from features that provide immediate support, such as real-time symptom tracking, quick emotional feedback, and stress-relieving techniques. These features can help patients cope with the intensive and often unpredictable nature of their treatment. Chronic leukemia patients, however, require apps designed for long-term engagement, with features like continuous symptom tracking, health reminders, and tools for managing the emotional and physical burden of ongoing treatment.

Understanding these differences allows healthcare providers to better tailor digital health interventions to the specific needs of each patient group, ensuring that mHealth tools not only meet the clinical needs but also provide meaningful psychological support at different stages of leukemia treatment.

### **4.3. Psychological nursing interventions**

#### **4.3.1. Overview and benefits**

Positive psychological nursing interventions based on the Rosenthal effect demonstrate significant benefits in enhancing the psychological well-being of patients undergoing treatment for leukemia. This approach focuses on fostering self-efficacy, reducing negative emotions, and promoting post-traumatic growth among patients. Research indicates that patients receiving this type of intervention report lower levels of anxiety and depression, as well as improved coping strategies and overall quality of life [56].

#### **4.3.2. Cultural considerations in psychological nursing**

The Rosenthal effect, which emphasizes the impact of positive expectations and support from caregivers, plays a crucial role in this nursing model. By creating an environment that encourages optimism and resilience, healthcare providers can significantly influence the mental health outcomes of leukemia patients. Studies have shown that patients who engage in positive psychological interventions demonstrate higher scores in areas such as reflections on life, individual power, and new possibilities, which are essential components of post-traumatic growth [57].

#### **4.3.3. Adapting interventions to cultural contexts**

However, the implementation of psychological nursing interventions can vary across different cultural contexts. In cultures with strong communal values, such as many African and Asian communities, positive psychological interventions that

focus on family involvement may be more effective than individualized approaches. Understanding these cultural nuances can help tailor psychological nursing interventions to better suit the needs of different patient populations [58–64].

## **5. The role of family support and social support**

### **5.1. Impact of caregiver mental health**

Family members' mental health, including anxiety and depression, significantly impacts leukemia patients. Family caregivers often experience high levels of emotional distress due to caregiving demands [65–68]. This can worsen the psychological burden on both the caregiver and the patient. Research indicates that the mental health status of family members is closely linked to the quality of life and emotional well-being of patients with chronic illnesses, including leukemia [69].

For instance, studies have shown that family members of patients with serious mental illnesses report higher levels of emotional distress, which can negatively affect their caregiving abilities and the overall family dynamic [70]. Similarly, the presence of chronic illness in a family member can lead to increased anxiety and depression among caregivers as they navigate the challenges of providing support while managing their own mental health [71].

Moreover, the interplay between the mental health of family members and the patients' conditions is critical. Family members who exhibit high levels of anxiety and depression may inadvertently contribute to a cycle of distress that affects the patient's recovery and coping mechanisms [72]. This highlights the importance of addressing the mental health needs of family caregivers, as their emotional well-being is essential for providing effective support to leukemia patients [73].

Interventions aimed at improving the mental health of family members can lead to better outcomes for patients. For example, support groups and counseling services for family caregivers can help mitigate feelings of isolation and stress, ultimately enhancing the quality of care provided to patients [74]. Understanding the mutual effects of mental health within family dynamics is crucial for developing comprehensive care strategies that benefit both patients and their caregivers [75].

### **5.2. Family involvement and support**

Education and support programs, such as WeChat-based education initiatives, can effectively enhance the involvement of family caregivers in the care of leukemia patients. These programs provide essential information and resources that empower families to better understand the disease, treatment options, and the emotional challenges associated with a cancer diagnosis [8]. Structured educational interventions have been shown to improve satisfaction and reduce anxiety among patients and their families, highlighting the importance of comprehensive education in the management of leukemia [76].

Furthermore, the integration of technology in education, such as the use of online platforms and social media, can facilitate communication and support among family members, allowing them to share experiences and coping strategies. This approach aligns with findings from studies that emphasize the need for tailored

educational resources that address the unique challenges faced by families of cancer patients [77].

Moreover, family involvement is crucial in the context of chronic illness management, as caregivers often play a significant role in supporting patients through their treatment journey. Programs that focus on enhancing health literacy among family caregivers can lead to improved patient outcomes and a better quality of life for both patients and their families [78].

In conclusion, leveraging technology and providing targeted educational support can significantly enhance family involvement in the care of leukemia patients, ultimately leading to more effective management of the disease and improved emotional well-being for all involved.

### **5.3. Building social support networks**

Building social support networks through social media and volunteer programs is crucial for improving the psychological health of patients and their families. Social support is crucial for individuals coping with serious health conditions such as leukemia. The establishment of social support networks can significantly enhance the emotional and informational resources available to patients [12].

Research indicates that online communities can provide a sense of belonging and understanding among leukemia patients, facilitating the exchange of information and emotional support [79]. For example, patients can share their treatment experiences, coping strategies, and resources. This can be especially helpful for those newly diagnosed or facing treatment challenges [80].

In addition to social media, volunteer programs can play a significant role in building support networks. These programs often connect patients with trained volunteers who can offer companionship, guidance, and practical assistance. Such interactions can foster a sense of community and provide patients with the encouragement they need to navigate their health journeys [81].

Moreover, the integration of both online and offline support mechanisms can enhance the overall well-being of leukemia patients. Studies have shown that patients who engage in both social media interactions and volunteer support report higher levels of emotional well-being and lower levels of stress [82]. This dual approach not only broadens the scope of support available but also helps in creating a more robust network that can adapt to the varying needs of patients over time.

As the landscape of social support continues to evolve, it is essential for healthcare providers to recognize the value of these networks. Encouraging leukemia patients to utilize social media and participate in volunteer programs can lead to improved health outcomes and a better quality of life. Future research should focus on identifying best practices for leveraging these platforms effectively to maximize the benefits of social support for leukemia patients [82].

## **6. Differential application of psychological interventions in different leukemia subtypes and patient populations**

### **6.1. Emotional management for children and adolescents with leukemia**

Children and adolescents have unique psychological needs. Their experiences with chronic illnesses like leukemia can greatly affect their emotional well-being. Young leukemia patients often face anxiety, depression, and emotional distress. These challenges can be worsened by the demands of treatment and uncertainty about their health outcomes [83].

Research indicates that children and adolescents with long-term physical conditions, including leukemia, are at an increased risk for psychological problems, particularly anxiety and depression [84]. This highlights the importance of addressing emotional management as a critical component of their overall care. Effective interventions should be tailored to the developmental and emotional needs of these young patients. This ensures they receive the appropriate psychological support throughout their treatment [85].

The role of family dynamics is also important. Parents and siblings of children with leukemia experience emotional distress, which affects the whole family [86]. Therefore, it is essential to provide resources and support not only for the patients but also for their families to foster resilience and coping strategies during this challenging time [87].

Psychosocial interventions, like counseling and support groups, can help children and adolescents manage emotional challenges and improve their quality of life [88]. Additionally, educational programs that promote self-regulation and emotional resilience can empower these young patients to manage their feelings and cope with the stresses associated with their illness [89].

Ultimately, a comprehensive approach that includes emotional management strategies, family support, and educational interventions is vital for addressing the unique psychological needs of children and adolescents with leukemia, ensuring they receive holistic care that promotes both their physical and emotional health [90].

### **6.2. Differentiated interventions for adult and elderly leukemia patients**

Different age groups require different psychological interventions, especially for patients with acute leukemia undergoing chemotherapy. Research indicates that psychological interventions can significantly impact the quality of life (QoL) and remission rates among these patients [91].

Elderly patients face unique challenges, including higher rates of anxiety and depression. These issues can be worsened by their medical conditions and treatment regimens [92]. Therefore, tailored psychological support that addresses the specific emotional and cognitive needs of older adults is essential. For instance, interventions that incorporate Cognitive Behavioral Therapy (CBT) and progressive muscle relaxation (PMR) have shown promise in improving QoL for elderly leukemia patients [91].

Younger adult patients may benefit from strategies that focus on enhancing resilience and coping mechanisms. This demographic often experiences stressors

related to life transitions, such as career and family responsibilities, which can influence their psychological well-being during treatment. Interventions that include peer support and individualized approaches may be more effective for this group, as they can address the social and emotional complexities faced by younger adults [93].

Moreover, the effectiveness of psychological interventions can vary based on the patient's age, with studies suggesting that younger patients may respond better to interventions that incorporate technology and social media, while older patients may prefer more traditional, face-to-face support [94].

Overall, recognizing the distinct psychological needs of adult and elderly leukemia patients is crucial for developing effective interventions that enhance their treatment experience and overall health outcomes. Tailoring these interventions not only improves adherence to treatment but also fosters a supportive environment that can lead to better psychological and physical health.

### **6.3. Intervention strategies for acute vs. chronic leukemia patients**

The psychological support needs of patients with acute leukemia (e.g., AML) differ from those of patients with chronic leukemia (e.g., CLL). Patients with acute myeloid leukemia (AML) often face a rapid decline in quality of life and mood during their hospitalization for intensive chemotherapy, necessitating targeted psychological interventions. A pilot randomized trial of the psychological mobile app, DREAMLAND, showed significant improvements in quality of life for patients with newly diagnosed AML. Those who used the app reported reduced anxiety and depression symptoms and enhanced self-efficacy compared to those receiving usual care [95].

In contrast, patients with chronic leukemia may experience a more gradual progression of their disease, leading to different psychological challenges. Chronic leukemia patients need ongoing support and coping strategies to manage the long-term effects of their condition and treatment. A holistic approach that considers comorbidities, lifestyle, and patient expectations is essential for optimizing care in chronic leukemia patients [96].

Moreover, Patients with AML experience significant psychological distress during induction treatment. This highlights the importance of routine and timely assessments of their symptoms. Research indicates that a significant proportion of patients report moderate to severe distress, particularly those with a history of psychological disorders [97]. This underscores the necessity for tailored psychological support interventions that address the unique needs of acute leukemia patients, which may differ markedly from those required for chronic leukemia patients.

In summary, while both acute and chronic leukemia patients require psychological support, the nature and timing of interventions must be adapted to the specific challenges faced by each group. Acute leukemia patients, such as those with AML, benefit from immediate and intensive psychological support during treatment, whereas chronic leukemia patients may require ongoing support to manage the long-term effects of their disease and treatment.

## **7. Future directions and research prospects for psychological interventions**

### **7.1. Personalization of intervention methods**

Personalized intervention methods are crucial for leukemia patients. They help enhance treatment outcomes and improve overall quality of life. By designing personalized psychological interventions, healthcare providers can address the unique needs and characteristics of each patient, thereby fostering a more supportive and effective treatment environment.

Recent studies have highlighted the importance of understanding individual patient experiences and the psychological strengths they possess. For instance, a qualitative study on breast cancer patients in China revealed that character strengths such as gratitude, hope, and selflessness played a significant role in their survivorship experience [98]. Similarly, leukemia patients may benefit from identifying and utilizing their personal strengths to cope with the challenges of their diagnosis and treatment.

To develop effective personalized interventions, it is essential to consider various factors, including the patient's psychological profile, social support systems, and cultural background. A framework for designing personalized interventions can use principles from adaptive digital interventions. These have been shown to optimize treatment based on individual needs and contexts. This approach can be particularly beneficial for leukemia patients, who often face complex emotional and psychological challenges throughout their treatment journey [99].

Moreover, integrating psychoeducation into the intervention design can empower patients by enhancing their understanding of their condition and treatment options. A systematic review of psychosocial interventions for dementia patients indicated that personalized education significantly improved patient engagement and coping strategies [100]. By applying similar principles to leukemia care, healthcare providers can create tailored educational resources that resonate with patients' experiences and preferences.

In addition, leveraging technology, such as mobile health applications, can facilitate personalized interventions by providing real-time feedback and support. A recent pilot study demonstrated the effectiveness of a personalized mHealth intervention in promoting physical activity among type 2 diabetes patients, highlighting the potential for similar applications in leukemia care [101]. These tools can help patients set personalized goals, track their progress, and receive tailored encouragement, ultimately fostering a sense of agency and control over their health.

Finally, ongoing evaluation and adaptation of personalized interventions are vital to ensure their effectiveness. Utilizing feedback from patients and healthcare professionals can inform necessary adjustments, making the interventions more relevant and impactful. A study on the implementation of personalized patient education protocols in post-myocardial infarction care emphasized the importance of continuous improvement based on patient and provider experiences [102].

In conclusion, the personalization of psychological interventions for leukemia patients is a multifaceted process that requires a deep understanding of individual

patient characteristics, the integration of psychoeducation, and the use of technology to enhance engagement. By adopting a patient-centered approach, healthcare providers can significantly improve the psychological well-being and treatment outcomes for leukemia patients.

## **7.2. Expansion of digital psychological health interventions**

The integration of digital psychological health interventions has emerged as a promising avenue for supporting patients with leukemia, a group that often faces significant psychological distress due to their diagnosis and treatment. Recent studies have highlighted the potential of digital health tools to enhance mental well-being and provide accessible support to patients navigating the complexities of their condition.

Digital interventions, such as mobile applications and web-based platforms, can offer tailored psychological support, including Cognitive Behavioral Therapy (CBT) and mindfulness-based approaches, which have been shown to be effective in improving mental health outcomes among various patient populations [103]. For leukemia patients, these interventions can be particularly beneficial in addressing common issues such as anxiety, depression, and emotional regulation, which are prevalent in this demographic [104].

Moreover, the scalability of these digital interventions is a critical factor in their implementation. As highlighted in the literature, the use of technology can facilitate broader access to mental health resources, especially in low- and middle-income countries where traditional mental health services may be limited [105]. By leveraging mobile technology, healthcare providers can reach underserved populations, ensuring that leukemia patients receive the psychological support they need, regardless of their geographical location [106].

The effectiveness of digital interventions has been supported by systematic reviews indicating that such tools can lead to significant improvements in psychological well-being [107]. However, it is essential to consider the unique challenges faced by leukemia patients, including treatment-related side effects and the emotional burden of their illness. Tailoring digital interventions to meet these specific needs can enhance their acceptability and effectiveness [108].

Furthermore, the role of non-clinician guidance in digital mental health interventions has been shown to improve adherence and outcomes [109]. Incorporating peer support or lay counselors into the delivery of these digital tools may provide additional motivation and reassurance for leukemia patients, fostering a sense of community and shared experience [110].

In conclusion, the expansion of digital psychological health interventions for leukemia patients presents a valuable opportunity to enhance mental health support. By focusing on the effectiveness and scalability of these interventions, healthcare providers can ensure that patients receive timely and relevant psychological care, ultimately improving their overall quality of life during and after treatment.

### **7.3. Multidisciplinary collaboration**

Collaboration among psychologists, nurses, and oncologists can provide holistic psychological support and care for leukemia patients. The integration of various healthcare professionals is essential in addressing the complex needs of these patients, who often experience significant psychological distress alongside their physical symptoms. Research indicates that effective communication and collaboration among team members can enhance patient outcomes and improve overall quality of care [111].

For instance, palliative care and rehabilitation practitioners can work together to alleviate both physical and psychological symptoms, thereby improving the quality of life for cancer patients [112]. Furthermore, the implementation of outreach telehealth services has been shown to enhance access to psychological counseling for palliative care patients, demonstrating the importance of integrating mental health support into cancer care [113].

In addition, understanding the psychosocial needs of patients is crucial. Studies have highlighted the prevalence of anxiety and depression among cancer patients, emphasizing the need for a close liaison between oncologists and mental health professionals to improve treatment outcomes [114]. By fostering a collaborative environment, healthcare providers can ensure that the psychological, social, and spiritual needs of leukemia patients are met, ultimately leading to a more comprehensive approach to their care [115].

Moreover, the role of social workers in palliative care is vital, as they can facilitate family meetings and optimize communication among the healthcare team, ensuring that the patient's and family's needs are prioritized [115]. This collaborative approach not only addresses the immediate concerns of the patients but also supports their long-term well-being and recovery.

In conclusion, a multidisciplinary team comprising psychologists, nurses, and oncologists is essential for providing holistic psychological support to leukemia patients. By working together, these professionals can create a supportive environment that addresses the multifaceted challenges faced by patients, ultimately leading to improved health outcomes and enhanced quality of life.

### **7.4. Long-term follow-up studies**

Increasing the focus on long-term follow-up studies assessing the effectiveness of psychological interventions is essential for evaluating the sustained impact of these measures. Longitudinal studies can provide valuable insights into how psychological support influences patient outcomes over time, allowing for the identification of effective practices and areas needing improvement [116].

Research into the long-term effects of psychological interventions can also help to refine existing approaches and develop new strategies tailored to the evolving needs of leukemia patients. By establishing a robust framework for continuous assessment and feedback, healthcare providers can enhance the effectiveness of psychological support and ensure it remains relevant throughout the patient's treatment journey [117,118].

## 8. Conclusion

This review emphasizes the critical importance of coping strategies and psychological interventions in improving the mental health of leukemia patients, particularly in managing depression and anxiety. These interventions are essential components of comprehensive cancer care, significantly enhancing patients' quality of life and treatment outcomes.

Effective emotional management enhances treatment adherence and fosters resilience, especially when personalized approaches that consider patient-specific factors—such as age, gender, and disease subtype—are applied. The integration of digital health applications and social support networks also plays a vital role in providing essential resources and improving communication for both patients and caregivers.

Family dynamics strongly influence the psychological well-being of leukemia patients, highlighting the necessity of caregiver involvement. Educational programs and support services for family members can mitigate the emotional burden on both patients and their families, leading to better overall health outcomes.

In conclusion, incorporating systematic psychological support into leukemia treatment plans is crucial for promoting mental health and optimizing treatment efficacy. For future research directions, we have briefly addressed these in the discussion section to highlight areas needing further exploration while ensuring this conclusion remains focused on summarizing the core findings of the review.

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## References

1. Pancar Yüksel E, Aydın F. Letter to the editor regarding article “El-Hamd MA, El Taieb MA, Ibrahim HM, Aly SS. Vitamin D levels in acne vulgaris patients treated with oral isotretinoin. *J. Cosmet. Dermatol.* 2020; 19(3): 763.
2. Gheihman G, Zimmermann C, Deckert A, et al. Depression and hopelessness in patients with acute leukemia: The psychological impact of an acute and life-threatening disorder. *Psychooncology.* 2016; 25(8): 979–989.
3. Morrison EJ, Flynn JM, Jones J, et al. Individual differences in physical symptom burden and psychological responses in individuals with chronic lymphocytic leukemia. *Ann. Hematol.* 2016; 95(12): 1989–1997.
4. Vitale E, Motamed-Jahromi M, Parvaresh-Masoud M, et al. Nursing Coaching Can Improve the Quality of Life and Immune-Endocrine Condition in Hospitalized Cancer Patients. *Endocr. Metab. Immune Disord. Drug Targets.* 2024.
5. Setyowibowo H, Yudiana W, Hunfeld JAM, et al. Psychoeducation for breast cancer: A systematic review and meta-analysis. *Breast.* 2022; 62: 36–51.
6. Anagnostopoulos F, Paraponiari A, Kafetsios K. The Role of Pain Catastrophizing, Emotional Intelligence, and Pain Intensity in the Quality of Life of Cancer Patients with Chronic Pain. *J. Clin. Psychol. Med. Settings.* 2023; 30(3): 501–519.
7. Rafiq N, Khan MH, Sahibzada M, et al. Recent Developments and Challenges in the Treatment of Acute Leukemia and Myelodysplastic Syndromes: A Systematic Review. *Cureus.* 2024; 16(10): e72599.
8. Aakvaag HF, Thoresen S, Strøm IF, et al. Shame predicts revictimization in victims of childhood violence: A prospective study of a general Norwegian population sample. *Psychol. Trauma.* 2019; 11(1): 43–50.
9. Cohen M. Depression, anxiety, and somatic symptoms in older cancer patients: A comparison across age groups. *Psychooncology.* 2014; 23(2): 151–157.
10. Suradom C, Wongpakaran N, Wongpakaran T, et al. Prevalence and associated factors of comorbid anxiety disorders in late-life depression: Findings from geriatric tertiary outpatient settings. *Neuropsychiatr. Dis. Treat.* 2019; 15: 199–204.

11. Derdikman-Eiron R, Indredavik MS, Bratberg GH, et al. Gender differences in subjective well-being, self-esteem and psychosocial functioning in adolescents with symptoms of anxiety and depression: Findings from the Nord-Trøndelag Health Study. *Scand. J. Psychol.* 2011; 52(3): 261–267.
12. Wang X, Cai J, Shang N, et al. The carbon catabolite repressor CcpA mediates optimal competence development in *Streptococcus oligofermentans* through post-transcriptional regulation. *Mol. Microbiol.* 2019; 112(2): 552–568.
13. Andenaes R, Kalfoss MH, Wahl A. Psychological distress and quality of life in hospitalized patients with chronic obstructive pulmonary disease. *J. Adv. Nurs.* 2004; 46(5): 523–530.
14. Maihöfner C, Diel I, Tesch H, et al. Chemotherapy-induced peripheral neuropathy (CIPN): Current therapies and topical treatment option with high-concentration capsaicin. *Support. Care. Cancer.* 2021; 29(8): 4223–4238.
15. Powell PA, Azlan HA, Simpson J, et al. The effect of disgust-related side-effects on symptoms of depression and anxiety in people treated for cancer: A moderated mediation model. *J. Behav. Med.* 2016; 39(4): 560–573.
16. Halawi MJ, Chiu D, Gronbeck C, et al. Psychological Distress Independently Predicts Prolonged Hospitalization After Primary Total Hip and Knee Arthroplasty. *J. Arthroplasty.* 2019; 34(8): 1598–1601.
17. Padmaja G, Vanlalhruai C, Rana S, et al. Care givers' depression, anxiety, distress, and somatization as predictors of identical symptoms in cancer patients. *J. Cancer Res. Ther.* 2016; 12(1): 53–57.
18. Eisele M, Harder M, Rakebrandt A, et al. Association of depression and anxiety with adherence in primary care patients with heart failure-cross-sectional results of the observational RECODE-HF cohort study. *Fam. Pract.* 2020; 37(5): 695–702.
19. Jabbarian LJ, Rietjens JAC, Mols F, et al. Untangling the relationship between negative illness perceptions and worse quality of life in patients with advanced cancer-a study from the population-based PROFILES registry. *Support. Care. Cancer.* 2021; 29(11): 6411–6419.
20. Chen NY, Chen KH, Wang YW, et al. The impact of symptom distress on health-related quality of life in liver cancer patients receiving arterial chemoembolization: The mediating role of hope. *BMC Gastroenterol.* 2022; 22(1): 456.
21. Cheng CM, Chang CC, Wang JD, et al. Negative Impacts of Self-Stigma on the Quality of Life of Patients in Methadone Maintenance Treatment: The Mediated Roles of Psychological Distress and Social Functioning. *Int. J. Environ. Res. Public Health.* 2019; 16(7).
22. Buchhold B, Lutze S, Arnold A, et al. Psychosocial distress and desire for support among skin cancer patients—impact of treatment setting. *J. Dtsch. Dermatol. Ges.* 2018; 16(7): 861–871.
23. Araújo AX, Berger W, Coutinho ES, et al. Comorbid depressive symptoms in treatment-seeking PTSD outpatients affect multiple domains of quality of life. *Compr. Psychiatry.* 2014; 55(1): 56–63.
24. Knowles SR, Apputhurai P, Jenkins Z, et al. Impact of chronic kidney disease on illness perceptions, coping, self-efficacy, psychological distress and quality of life. *Psychol. Health Med.* 2023; 28(7): 1963–1976.
25. Dreno B, Amici JM, Demessant-Flavigny AL, et al. The Impact of Acne, Atopic Dermatitis, Skin Toxicities and Scars on Quality of Life and the Importance of a Holistic Treatment Approach. *Clin. Cosmet. Investig. Dermatol.* 2021; 14: 623–632.
26. Li Y, Liang F, Xu Q, et al. Social Support, Attachment Closeness, and Self-Esteem Affect Depression in International Students in China. *Front. Psychol.* 2021; 12: 618105.
27. Balck F, Zschieschang A, Zimmermann A, et al. A randomized controlled trial of problem-solving training (PST) for hematopoietic stem cell transplant (HSCT) patients: Effects on anxiety, depression, distress, coping and pain. *J. Psychosoc. Oncol.* 2019; 37(5): 541–556.
28. Zamanian H, Amini-Tehrani M, Jalali Z, et al. Perceived social support, coping strategies, anxiety and depression among women with breast cancer: Evaluation of a mediation model. *Eur. J. Oncol. Nurs.* 2021; 50: 101892.
29. Parkinson M, Carr SM, Abley C. Facilitating social coping-‘seeking emotional and practical support from others’-as a critical strategy in maintaining the family care of people with dementia. *Health Soc. Care Community.* 2022; 30(2): 558–569.
30. McCloy K, Hughes C, Dunwoody L, et al. Effects of mindfulness-based interventions on fatigue and psychological wellbeing in women with cancer: A systematic review and meta-analysis of randomised control trials. *Psychooncology.* 2022; 31(11): 1821–1834.
31. Fox L, Walsh JC, Morrison TG, et al. Cognitive Coping Style and the Effectiveness of Distraction or Sensation-Focused Instructions in Chronic Pain Patients. *PLoS One.* 2016; 11(4): e0142285.
32. Alrabiah Z, Alhossan A, Yun S, et al. Adherence to tyrosine kinase inhibitor therapy in patients with chronic myeloid leukemia: Meta-analyses of prevalence rates by measurement method. *Blood.* 2016; 128(22): 3610.

33. Newcomb R, Amonoo HL, Nelson AM, et al. Coping in patients with hematologic malignancies undergoing hematopoietic cell transplantation. *Blood Adv.* 2024; 8(6): 1369–1378.
34. Farsi Z, Dehghan Nayeri N, Negarandeh R. Coping strategies of adults with leukemia undergoing hematopoietic stem cell transplantation in Iran: A qualitative study. *Nurs. Health Sci.* 2010; 12(4): 485–492.
35. Acoba EF. Social support and mental health: The mediating role of perceived stress. *Front. Psychol.* 2024; 15: 1330720.
36. Mytko JJ, Knight SJ, Chastain D, et al. Coping strategies and psychological distress in cancer patients before autologous bone marrow transplant. *J. Clin. Psychol. Med. Settings.* 1996; 3(4): 355–366.
37. Jabbarian LJ, Korfage IJ, Červ B, et al. Coping strategies of patients with advanced lung or colorectal cancer in six European countries: Insights from the ACTION Study. *Psychooncology.* 2020; 29(2): 347–355.
38. Perez-Tejada J, Garmendia L, Labaka A, et al. Active and Passive Coping Strategies: Comparing Psychological Distress, Cortisol, and Proinflammatory Cytokine Levels in Breast Cancer Survivors. *Clin. J. Oncol. Nurs.* 2019; 23(6): 583–590.
39. Shafiq S, Parveen S, Oyeboode JR. How people of African Caribbean or Irish ethnicity cope with long-term health conditions in UK community settings: A systematic review of qualitative, quantitative and mixed method studies. *Health Soc. Care Community.* 2021; 29(2): 319–327.
40. Daniels NC, Bodd MH, Locke SC, et al. In their own words: A qualitative study of coping mechanisms employed by patients with acute myeloid leukemia. *Support. Care. Cancer.* 2023; 31(7): 443.
41. Wang J, Yin Y, Li Y, et al. The effects of solution-focused nursing on leukemia chemotherapy patients' moods, cancer-related fatigue, coping styles, self-efficacy, and quality of life. *Am. J. Transl. Res.* 2021; 13(6): 6611–6619.
42. Liu H, Chen YD, Wu Y, et al. Nodular Panniculitis with Hemophagocytic Lymphohistiocytosis. *Chin. Med. J. (Engl).* 2018; 131(23): 2860–2861.
43. Amonoo HL, Bodd MH, Reynolds MJ, et al. Coping strategies in patients with acute myeloid leukemia. *Blood Adv.* 2022; 6(7): 2435–2442.
44. Castro MM, Daltro C, Kraychete DC, et al. The cognitive behavioral therapy causes an improvement in quality of life in patients with chronic musculoskeletal pain. *Arq. Neuropsiquiatr.* 2012; 70(11): 864–868.
45. Urits I, Hubble A, Peterson E, et al. An Update on Cognitive Therapy for the Management of Chronic Pain: A Comprehensive Review. *Curr. Pain. Headache. Rep.* 2019; 23(8): 57.
46. Rothbauer M, Pasek Z, Dalrymple KA, et al. Program evaluation of cognitive behavioral therapy in burn survivors. *J. Burn. Care Res.* 2024.
47. Mutamba BB, Kane JC, de Jong J, et al. Psychological treatments delivered by community health workers in low-resource government health systems: Effectiveness of group interpersonal psychotherapy for caregivers of children affected by nodding syndrome in Uganda. *Psychol. Med.* 2018; 48(15): 2573–2583.
48. Zhang Y, Flannery M, Zhang Z, et al. Digital Health Psychosocial Intervention in Adult Patients with Cancer and Their Families: Systematic Review and Meta-Analysis. *JMIR Cancer.* 2024; 10: e46116.
49. Heneghan MB, Hussain T, Barrera L, et al. Access to Technology and Preferences for an mHealth Intervention to Promote Medication Adherence in Pediatric Acute Lymphoblastic Leukemia: Approach Leveraging Behavior Change Techniques. *J. Med. Internet Res.* 2021; 23(2): e24893.
50. Iribarren SJ, Akande TO, Kamp KJ, et al. Effectiveness of Mobile Apps to Promote Health and Manage Disease: Systematic Review and Meta-analysis of Randomized Controlled Trials. *JMIR Mhealth. Uhealth.* 2021; 9(1): e21563.
51. Grekin ER, Beatty JR, Ondersma SJ. Mobile Health Interventions: Exploring the Use of Common Relationship Factors. *JMIR Mhealth. Uhealth* 2019; 7(4): e11245.
52. Bush NE, Armstrong CM, Hoyt TV. Smartphone apps for psychological health: A brief state of the science review. *Psychol. Serv.* 2019; 16(2): 188–195.
53. Goldberg SB, Lam SU, Simonsson O, et al. Mobile phone-based interventions for mental health: A systematic meta-review of 14 meta-analyses of randomized controlled trials. *PLOS Digit. Health.* 2022; 1(1).
54. Maguire R, McCann L, Kotronoulas G, et al. Real time remote symptom monitoring during chemotherapy for cancer: European multicentre randomised controlled trial (eSMART). *Bmj.* 2021; 374: n1647.
55. Gentry E, Passwater C, Barkett NL. Physical, Psychological, Social, and Spiritual Well-Being of Patients with Chronic Lymphocytic Leukemia and Their Caregivers: A Scoping Review. *Journal of Oncology Navigation & Survivorship.* 2021; 12(6).

56. Khrueakham A, Masomboon J, Roongruang J, et al. Efficient reactive blue 19 decolorization by the comparison of ozonation membrane contacting process and Fenton oxidation. *RSC Adv.* 2021; 11(29): 17775–17788.
57. Wei F, Li Q. Effects of Positive Mental Nursing on the Post-Traumatic Growth, Negative Emotions, and Coping Style of Patients after Chemotherapy for Leukemia. *Iran. J. Public Health.* 2022; 51(4): 788–796.
58. Sue S, Zane N, Nagayama Hall GC, et al. The case for cultural competency in psychotherapeutic interventions. *Annu. Rev. Psychol.* 2009; 60: 525–548.
59. Wong FK. Cognitive behavioral group treatment for Chinese people with depressive symptoms in Hong Kong: Participants' perspectives. *Int. J. Group Psychother.* 2011; 61(3): 438–459.
60. Shortis E, Warrington D, Whittaker P. The efficacy of cognitive behavioral therapy for the treatment of antenatal depression: A systematic review. *J. Affect. Disord.* 2020; 272: 485–495.
61. Sarkar U, Gourley GI, Lyles CR, et al. Usability of Commercially Available Mobile Applications for Diverse Patients. *J. Gen. Intern. Med.* 2016; 31(12): 1417–1426.
62. Farao J, Malila B, Conrad N, et al. A user-centred design framework for mHealth. *PLoS One.* 2020; 15(8): e0237910.
63. Kang M, Park E, Cho BH, et al. Recent Patient Health Monitoring Platforms Incorporating Internet of Things-Enabled Smart Devices. *Int. Neurourol. J.* 2018; 22(2): S76–82.
64. Gamwell KL, Kollin SR, Gibler RC, et al. Systematic evaluation of commercially available pain management apps examining behavior change techniques. *Pain.* 2021; 162(3): 856–865.
65. Teo I, Krishnan A, Lee GL. Psychosocial interventions for advanced cancer patients: A systematic review. *Psychooncology.* 2019; 28(7): 1394–1407.
66. Boucher NA, Johnson KS, LeBlanc TW. Acute Leukemia Patients' Needs: Qualitative Findings and Opportunities for Early Palliative Care. *J. Pain. Symptom Manage.* 2018; 55(2): 433–439.
67. von Heymann-Horan AB, Puggaard LB, Nissen KG, et al. Dyadic psychological intervention for patients with cancer and caregivers in home-based specialized palliative care: The Domus model. *Palliat. Support. Care.* 2018; 16(2): 189–197.
68. Preisler M, Heuse S, Riemer M, et al. Early integration of palliative cancer care: Patients' and caregivers' challenges, treatment preferences, and knowledge of illness and treatment throughout the cancer trajectory. *Support. Care. Cancer.* 2018; 26(3): 921–931.
69. Russet F, Humbertclaude V, Dieleman G, et al. Training of adult psychiatrists and child and adolescent psychiatrists in europe: A systematic review of training characteristics and transition from child/adolescent to adult mental health services. *BMC Med. Educ.* 2019; 19(1): 204.
70. Zauszniewski JA, Bekhet AK. Factors associated with the emotional distress of women family members of adults with serious mental illness. *Arch. Psychiatr. Nurs.* 2014; 28(2): 102–107.
71. Nogueira DJ, Minamisava R, Teles SA, et al. Factors Associated with Marital Satisfaction and Quality of Life in Family Caregivers of Patients with Mental Disorders. *Int. J. Environ. Res. Public Health.* 2019; 16(16).
72. Huang LT, McMillan SC. Mutual Effects of Depression on Quality of Life in Patients and Family Caregivers. *Oncol. Nurs. Forum.* 2019; 46(2): 208–216.
73. Mosher CE, Bakas T, Champion VL. Physical health, mental health, and life changes among family caregivers of patients with lung cancer. *Oncol. Nurs. Forum.* 2013; 40(1): 53–61.
74. Rowaert S, Audenaert K, Lemmens G, Vandeveldel S. Family Support Groups for Family Members of Mentally Ill Offenders: Family Expectations and Experiences. *Int. J. Offender. Ther. Comp. Criminol.* 2018; 62(15): 4854–4874.
75. McCarthy J, Higgins A, McCarthy B, et al. Family members' perspectives of hope when supporting a relative experiencing mental health problems. *Int. J. Ment. Health Nurs.* 2023; 32(5): 1405–1415.
76. Høeg BL, Bidstrup PE, Karlsen RV, et al. Follow-up strategies following completion of primary cancer treatment in adult cancer survivors. *Cochrane. Database. Syst. Rev.* 2019; 2019(11).
77. Morris JN, Ohan J, Martini A. An investigation of support services available by Internet searching to families impacted by a parent's cancer. *Psychooncology.* 2018; 27(1): 114–124.
78. Cianfrocca C, Caponnetto V, Donati D, et al. The effects of a multidisciplinary education course on the burden, health literacy and needs of family caregivers. *Appl. Nurs. Res.* 2018; 44: 100–106.
79. Westmaas JL, Fallon E, McDonald BR, et al. Investigating relationships among cancer survivors' engagement in an online support community, social support perceptions, well-being, and moderating effects of existing (offline) social support. *Support. Care. Cancer.* 2020; 28(8): 3791–3799.

80. Acquati C, Head KJ, Rand KL, et al. Psychosocial Experiences, Challenges, and Recommendations for Care Delivery among Partners of Breast Cancer Survivors: A Qualitative Study. *Int. J. Environ. Res. Public Health*. 2023; 20(4).
81. de Villiers L, Thomas A, Jivan D, et al. Stigma and HIV service access among transfeminine and gender diverse women in South Africa—a narrative analysis of longitudinal qualitative data from the HPTN 071 (PopART) trial. *BMC Public Health*. 2020; 20(1): 1898.
82. Banbury A, Chamberlain D, Nancarrow S, et al. Can videoconferencing affect older people's engagement and perception of their social support in long-term conditions management: A social network analysis from the Telehealth Literacy Project. *Health. Soc. Care. Community*. 2017, 25(3): 938–950.
83. Adie S, Harris I, Chuan A, et al. Selecting and optimising patients for total knee arthroplasty. *Med. J. Aust.* 2019; 210(3): 135–141.
84. Thabrew H, Ruppeldt P, Sollers 3rd JJ. Systematic Review of Biofeedback Interventions for Addressing Anxiety and Depression in Children and Adolescents with Long-Term Physical Conditions. *Appl. Psychophysiol. Biofeedback*. 2018; 43(3): 179–192.
85. Hughes L, Taylor RM, Beckett AE, et al. The Emotional Impact of a Cancer Diagnosis: A Qualitative Study of Adolescent and Young Adult Experience. *Cancers (Basel)*. 2024; 16(7).
86. Giallo R, Roberts R, Emerson E, et al. The emotional and behavioural functioning of siblings of children with special health care needs across childhood. *Res. Dev. Disabil.* 2014; 35(4): 814–825.
87. Brodie N, Keim JL, Silberholz EA, et al. Promoting resilience in vulnerable populations: Focus on opioid-exposed children, siblings of children with special healthcare needs and support for children through school-based interventions. *Curr. Opin. Pediatr.* 2019; 31(1): 157–165.
88. Rohan JM, Winter MA. Ethical considerations in pediatric chronic illness: The relationship between psychological factors, treatment adherence, and health outcomes. *Paediatr. Respir. Rev.* 2021; 39: 48–53.
89. Azevedo R, Rosário P, Martins J, et al. From the Hospital Bed to the Laptop at Home: Effects of a Blended Self-Regulated Learning Intervention. *Int. J. Environ. Res. Public Health*. 2019; 16(23).
90. Moffatt C, Aubeeluck A, Stasi E, et al. A Study Using Visual Art Methods to Explore the Perceptions and Barriers of Self-Management in Children and Adolescents with Lymphedema. *Lymphat. Res. Biol.* 2019; 17(2): 231–244.
91. Peng F, Li H, Zhang J, et al. Effects of different psychological interventions on quality of life and remission rate in patients with acute leukemia receiving chemotherapy: A randomized controlled trial. *Front. Psychol.* 2023; 14: 1045031.
92. O'Keefe K, Chen M, Lesser KJ, et al. Treating Mental Health and Quality of Life in Older Cancer Patients with Cognitive Behavioral Therapy: A Systematic Review and Meta-Analysis. *Int. J. Environ. Res. Public Health*. 2024; 21(7).
93. Buro AW, Sauls R, Stern M, et al. A qualitative study of stress experiences, health behaviors, and intervention preferences in young adult cancer survivors. *Support. Care. Cancer*. 2023; 31(5): 295.
94. Huffman JC, DuBois CM, Millstein RA, et al. Positive Psychological Interventions for Patients with Type 2 Diabetes: Rationale, Theoretical Model, and Intervention Development. *J. Diabetes. Res.* 2015; 2015: 428349.
95. El-Jawahri A, Lusk MR, Greer JA, et al. Psychological mobile app for patients with acute myeloid leukemia: A pilot randomized clinical trial. *Cancer*. 2023; 129(7): 1075–1084.
96. Breccia M, Alimena G. Firstline treatment for chronic phase chronic myeloid leukemia patients should be based on a holistic approach. *Expert. Rev. Hematol.* 2015; 8(1): 5–7.
97. Albrecht TA, Boyiadzis M, Elswick Jr RK, et al. Symptom Management and Psychosocial Needs of Adults with Acute Myeloid Leukemia During Induction Treatment: A Pilot Study. *Cancer Nurs.* 2017; 40(6): E31–E38.
98. Yan T, Chan CWH, Chow KM, et al. Experiences and perception of character strengths among patients with breast cancer in China: A qualitative study. *BMJ Open*. 2022; 12(10): e061994.
99. Gonul S, Namli T, Huisman S, et al. An expandable approach for design and personalization of digital, just-in-time adaptive interventions. *J. Am. Med. Inform. Assoc.* 2019; 26(3): 198–210.
100. Yeung NCY, Lee EKP, Kong APS, et al. “Shame on Me”: Exploring the Role of Self-Stigma in Psychological Outcomes Among Type 2 Diabetes Patients in Hong Kong. *Int. J. Behav. Med.* 2024; 31(2): 241–251.
101. van der Feltz-Cornelis CM, Elfeddali I, Werneke U, et al. A European Research Agenda for Somatic Symptom Disorders, Bodily Distress Disorders, and Functional Disorders: Results of an Estimate-Talk-Estimate Delphi Expert Study. *Front. Psychiatry*. 2018; 9: 151.

102. Malik S, Moloney C, Koledova E, et al. Designing a Personalized Digital Patient Support Program for Patients Treated with Growth Hormone: Key Design Considerations. *J. Med. Internet Res.* 2020; 22(7): e18157.
103. Lattie EG, Adkins EC, Winquist N, et al. Digital Mental Health Interventions for Depression, Anxiety, and Enhancement of Psychological Well-Being Among College Students: Systematic Review. *J. Med. Internet Res.* 2019; 21(7): e12869.
104. Thomson A, Lawrence EG, Oliver BR, et al. Self-directed digital interventions for the improvement of emotion regulation-effectiveness for mental health and functioning in adolescents: Protocol for a systematic review. *BMJ Open.* 2024; 14(4): e081556.
105. Rodriguez-Villa E, Naslund J, Keshavan M, et al. Making mental health more accessible in light of COVID-19: Scalable digital health with digital navigators in low and middle-income countries. *Asian J. Psychiatr.* 2020; 54: 102433.
106. Gibson DG, Tamrat T, Mehl G. The State of Digital Interventions for Demand Generation in Low- and Middle-Income Countries: Considerations, Emerging Approaches, and Research Gaps. *Glob. Health Sci. Pract.* 2018; 6(1): S49–S60.
107. Groot J, MacLellan A, Butler M, et al. The Effectiveness of Fully Automated Digital Interventions in Promoting Mental Well-Being in the General Population: Systematic Review and Meta-Analysis. *JMIR Ment. Health.* 2023; 10: e44658.
108. Lau CKY, Saad A, Camara B, et al. Acceptability of Digital Mental Health Interventions for Depression and Anxiety: Systematic Review. *J. Med. Internet Res.* 2024; 26: e52609.
109. Leung C, Pei J, Hudec K, et al. The Effects of Nonclinician Guidance on Effectiveness and Process Outcomes in Digital Mental Health Interventions: Systematic Review and Meta-analysis. *J. Med. Internet Res.* 2022; 24(6): e36004.
110. Fuller TE, Pong DD, Piniella N, et al. Interactive Digital Health Tools to Engage Patients and Caregivers in Discharge Preparation: Implementation Study. *J. Med. Internet Res.* 2020; 22(4): e15573.
111. McCaffrey RG, Hayes R, Stuart W, et al. A program to improve communication and collaboration between nurses and medical residents. *J. Contin. Educ. Nurs.* 2010; 41(4): 172–178.
112. Silver JK, Raj VS, Fu JB, et al. Cancer rehabilitation and palliative care: Critical components in the delivery of high-quality oncology services. *Support. Care. Cancer.* 2015; 23(12): 3633–3643.
113. Guzman D, Ann-Yi S, Bruera E, et al. Enhancing palliative care patient access to psychological counseling through outreach telehealth services. *Psychooncology.* 2020; 29(1): 132–138.
114. Shankar A, Dracham C, Ghoshal S, et al. Prevalence of depression and anxiety disorder in cancer patients: An institutional experience. *Indian J. Cancer.* 2016; 53(3): 432–434.
115. Jonas D, Scanlon C, Schmidt L, et al. Creating a Seat at the Table: How Family Meetings Elucidate the Palliative Care Social Work Role. *J. Palliat. Med.* 2020; 23(12): 1688–1691.
116. Pilling S, Fonagy P, Allison E, et al. Long-term outcomes of psychological interventions on children and young people's mental health: A systematic review and meta-analysis. *PLoS One.* 2020; 15(11): e0236525.
117. Kazak AE. Evidence-based interventions for survivors of childhood cancer and their families. *J. Pediatr. Psychol.* 2005; 30(1): 29–39.
118. Macía P, Barranco M, Gorbeña S, et al. Resilience and coping strategies in relation to mental health outcomes in people with cancer. *PLoS One.* 2021; 16(5): e0252075.



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