

Review

A study on the intervention path of rhythmic cheerleading on body image distress and mental health in female cancer patients

Mengjiao Yu¹, Li Wang², Qi Liu³, Xueshao Zhang^{4,*}

¹ School of Physical Education, Hubei University of Automotive Technology, Shiyan 442002, China

² Department of Physical Education and Sport, Shanghai Ocean University, Shanghai 201306, China

³ Shanghai Sports Science Society, Shanghai 200438, China

⁴ College of Physical Education and Art, Guangdong Institute of arts and sciences, Zhanjiang 524400, China

* Corresponding author: Xueshao Zhang, zhangxueshao2021@126.com

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Abstract: This study systematically explored the effectiveness, mechanisms, and current status of rhythmic cheerleading interventions for body image distress and psychological well-being in female cancer patients, utilizing a scoping review and bibliometric analysis. The study analyzed literature indexed in the Web of Science (WOS) core database from 2005 to 2024. A multi-stage screening process ultimately identified 40 core articles, which were analyzed from three perspectives: bibliometric characteristics, intervention mechanisms, and research limitations. Bibliometric results revealed a strong interdisciplinary focus in this area, with rapid growth from 2012 to 2019. Key themes focused on exercise and physical activity interventions (40%) and dance and movement therapy interventions (35%). Analysis of intervention mechanisms revealed that rhythmic cheerleading, leveraging its four key characteristics of rhythm, teamwork, expressiveness, and enjoyment, synergistically works through a triple mechanism of “physiological regulation, psychological reconstruction, and social support.” Physiologically, synchronized movements activate endorphins, serotonin release, and HPA axis regulation, alleviating treatment-related fatigue and anxiety. Psychologically, artistic expression promotes identity reconstruction, helping patients shed the “patient” label. Socially, teamwork fosters support networks and reduces social avoidance. The study also identified limitations in the current field, including low-level evidence, insufficient personalized and culturally adaptable intervention programs, and in-depth analysis of neurobiological mechanisms. This study provides evidence-based support for academic research and clinical application of rhythmic cheerleading in the field of psychological rehabilitation for female cancer patients. Future research is needed through multicenter randomized controlled trials, the development of tiered intervention models, and the application of neuroimaging technology to further refine the intervention approach and promote its adoption as an effective and sustainable cancer rehabilitation intervention.

Keywords: rhythmic cheerleading; female cancer patients; body image distress; mental health; intervention approach; bibliometric analysis; scoping review

1. Introduction

Female cancer patients generally face a high prevalence of body image distress. Studies have shown that approximately 50%–75% of breast cancer patients experience body image distress, and similar trends are seen in patients with gynecological cancers [1]. The high prevalence of this distress is closely related to the physiological changes associated with cancer treatment, such as the disruption of body integrity caused by mastectomy, hair loss caused by chemotherapy, and skin damage caused by radiotherapy [2]. Notably, younger patients are more sensitive to changes in body

image and often experience more significant distress [1]. Data from the International Cancer Survivor Study further demonstrate a significant comorbidity between body image concerns and psychological symptoms such as depression and anxiety, with this association exhibiting dynamic changes across different stages of treatment [3].

Body image distress can have multidimensional and profound negative impacts on mental health. Emotionally, this manifests as a significant increase in depression and anxiety symptoms. The incidence of depression among breast cancer patients is as high as 27.8%, and the incidence of anxiety is as high as 31.5% [4]. Behaviorally, this manifests as social avoidance. Approximately 34%–41% of patients actively reduce social activities due to body image distress, and some even experience difficulties in intimate relationships [1]. Cognitive impacts are even more profound, including decreased self-worth and the development of post-traumatic stress symptoms. Studies have shown that baseline body image distress significantly predicts increased depressive symptoms 18 months later [1]. These mental health issues further impact treatment adherence and quality of life, creating a vicious cycle. Research has shown that patients with severe body image distress are more likely to discontinue treatment or refuse necessary surgical interventions [5]. These findings highlight the importance of body image distress as a key target for psychological intervention, particularly in young patients undergoing mastectomy or reproductive surgery [6].

Physical activity has been shown to have multiple benefits as a psychosocial intervention. From a physiological perspective, exercise directly regulates mood by promoting the release of neurotransmitters such as endorphins and serotonin [7]. It also optimizes the neurochemical environment and enhances neuroplasticity, particularly through BDNF-mediated structural remodeling of the hippocampus and prefrontal cortex, which improves body image cognition [8]. From a neuroendocrine perspective, exercise can reduce cortisol levels by modulating the HPA axis stress response, effectively alleviating treatment-related fatigue and anxiety [9]. These mechanisms provide a solid scientific foundation for exercise interventions, which are particularly valuable for special populations such as cancer patients [10].

However, traditional exercise interventions have significant limitations. While yoga can produce physical and mental benefits by inhibiting HPA axis and sympathetic nervous system activity [11], it requires high flexibility and basic physical fitness, making standard movements difficult for some postoperative patients [12]. Aerobic exercises such as running and swimming can improve cardiovascular function, but repetitive movements can lead to decreased motivation, resulting in long-term adherence rates of less than 50% [13]. Furthermore, traditional exercise programs often focus on single physiological benefits, with insufficient attention to simultaneously improving psychosocial functioning and lacking team interaction and engaging design [14]. Clinical studies have also found significant inter-individual variability in the effectiveness of yoga and aerobic exercise in improving body image distress, with approximately 30% of patients unable to benefit due to physical limitations or lack of interest [15].

The limitations of traditional exercise interventions have created an urgent need for new forms of exercise. Rhythmic cheerleading, with its four unique core characteristics: rhythmicity, teamwork, expressiveness, and enjoyment, shows potential to transcend traditional limitations. Preliminary evidence shows that breast

cancer patients who participate in group cheerleading experience a 23% greater improvement in body image scores compared to those who engage in aerobic exercise alone. This differential advantage stems from its multidimensional pathways, which simultaneously activate motor-emotional-social neural circuits [12]. Rhythmic cheerleading's synchronized movements can stimulate the release of endorphins and serotonin, directly improving mood [7]. Its artistic expression also enhances self-esteem through identity reconstruction.

Rhythmic cheerleading, as a unique form of exercise intervention, is characterized by its rhythmic synchronization and contextually targeted team performance goals. At the movement level, through the precise coordination of musical rhythm and body movements, this intervention significantly enhances participants' motor coordination and psychological engagement [16]. Research has shown that synchronized movements not only improve motor function but also regulate emotional states through neurobiological mechanisms, significantly different from conventional individualized exercise [17]. The guiding effect of musical rhythm activates the brain's reward circuitry, promoting the release of endorphins. Rhythmic stimulation also enhances the integration of vestibular-cerebellar-cortical pathways [18].

Another key intervention feature is the team performance goal within a contextual setting. Through role division and collective goal setting, participants are able to rebuild their social identity, which has been damaged by cancer treatment [19]. Existing evidence shows that the social support network fostered by teamwork can reduce social avoidance, significantly outperforming traditional individual training [16]. This social connection mechanism promotes a positive reconstruction of body image by satisfying the three psychological needs of autonomy, competence, and belonging [20]. Specifically, in breast cancer rehabilitation patients, team performance contexts can effectively mitigate the disruption of bodily integrity caused by treatment side effects and help patients reconnect their bodies with their self-identity [17]. Improvements in quality-of-life scales showed a moderate effect size, with psychological benefits primarily reflected in increased body acceptance and reduced anxiety symptoms [19]. Notably, the inclusion of a fun element significantly improved adherence, surpassing traditional rehabilitation training [20]. Its advantage lies in the simultaneous activation of the triple mechanisms of physiological function recovery, emotional regulation, and social support, forming a multidimensional synergistic effect [17].

This study aims to systematically explore the effectiveness, process of action, and potential pathways of "rhythmic cheerleading," a positive form of physical activity, in improving body image distress and enhancing mental health in female cancer patients. The core of this review is to use a scoping review method supplemented by bibliometric analysis techniques to scan and quantitatively analyze existing relevant research. The focus will be on: (1) sorting out the current practice status, main intervention models, and implementation elements of rhythmic cheerleading applied to this population in existing research; (2) summarizing and refining its core intervention pathways, that is, how cheerleading can reduce negative body image, improve emotional state, and promote positive psychological qualities by affecting physiological functions, psychosocial mechanisms, and potential physiological-

psychological interactions; (3) identifying the knowledge gaps, development trends, and future research directions of existing research.

2. Literature review

2.1. The mechanism of action of exercise intervention on cancer patients

Exercise improves mood and pain tolerance through neurotransmitter regulation, with endorphin release being a key pathway. Studies have shown that both aerobic and resistance exercise significantly elevate endorphin levels, and that exercise duration, rather than intensity, is a more crucial factor influencing endorphin release [21]. This increase in endogenous opioid production not only produces analgesic effects but also directly alleviates anxiety and depressive symptoms by inducing pleasure through opioid receptor activation [22]. Regulation of the serotonin system is another key mechanism. Exercise increases muscle uptake of branched-chain amino acids, reducing their competition with tryptophan for transport across the blood-brain barrier, thereby promoting tryptophan entry into the brain and its conversion to serotonin [23]. This regulation is both time-sensitive and brain-region specific, stabilizing mood and improving negative body image-related cognitions through anxiolytic effects mediated by the 5-HT_{1A} receptor [23].

Research has shown that the functional regulation of the HPA axis plays a key role in exercise interventions, with the mechanism involving negative feedback regulation of the stress response [24]. When faced with stress, the hypothalamus releases corticotropin-releasing hormone (CRH) and arginine vasopressin (AVP), which activate the anterior pituitary gland to release adrenocorticotrophic hormone (ACTH), which in turn stimulates the adrenal cortex to secrete cortisol [25]. Exercise, as a physiological stressor, can enhance the negative feedback sensitivity of the HPA axis through repeated moderate stimulation, thereby reducing excessive cortisol secretion during chronic stress [26]. This regulatory effect is particularly important for alleviating treatment-related fatigue in cancer patients, as chronically elevated cortisol levels can exacerbate energy metabolism disorders and neuroendocrine disorders [27]. Particularly in breast cancer patients, exercise intervention can significantly reduce excessive concern about physical changes after surgery, an effect that is partly attributed to neuroendocrine changes mediated by the HPA axis [26]. Normalization of cortisol levels may also indirectly improve mood and body acceptance by regulating the function of the serotonergic system [25].

Exercise, as a non-pharmacological intervention, can increase brain-derived neurotrophic factor (BDNF) expression and improve post-receptor signaling [28]. Chronic stress can cause dendritic atrophy in the prefrontal cortex, and exercise can reverse this structural damage by modulating glutamatergic signaling and glucocorticoid receptor function, restoring cognitive control [29]. These findings provide a solid neurobiological basis for the application of exercise interventions in cancer rehabilitation, particularly for high-risk individuals with body image distress and psychological stress [26].

2.2. Characteristics and advantages of rhythmic cheerleading

Exercise interventions can effectively alleviate negative body image by enhancing patients' autonomy, self-perception, and building a sense of community [30]. This mechanism is particularly important for female cancer patients, as treatment-induced bodily changes often weaken their sense of control over their bodies. The opportunities for autonomous decision-making in group exercise can reestablish patients' sense of agency [31]. In group rhythmic cheerleading interventions, peer modeling and verbal encouragement can enhance patients' self-efficacy, which in turn motivates them to actively seek and provide social support [32]. This virtuous cycle is particularly evident in breast cancer survivors, where the cohesiveness fostered by the group significantly reduces social avoidance and strengthens patients' sense of competence through shared goals [30]. Research has shown that when group exercise simultaneously addresses three basic psychological needs, it not only improves patients' physical satisfaction but also enhances their overall self-esteem and psychological resilience [31].

Cancer patients may face social rejection due to treatment side effects, but the accepting environment provided by cheerleading groups helps them resist the oppression of dominant aesthetic norms by redefining body standards [33]. This social support is particularly crucial for patients with gynecological cancers, whose disease characteristics often lead to heightened body shame [34]. Furthermore, the artistic expression component of group activities creates opportunities for identity reconstruction, allowing patients to transcend the label of "patient" and establish a self-identity based on ability rather than appearance [32]. When patients participate in group activities such as cheerleading, the rhythmic synchronization of movements activates a closed loop between the cerebellum and the prefrontal cortex. This neural pathway not only coordinates motor control but also influences cognitive and emotional processing through non-motor functions [35]. Neuroscientific research shows that synchronized movement to music activates striatal dopamine release, linking pleasure to team achievement [36]. At the same time, based on the synchronized intersubjectivity experienced across the right hemisphere, members form shared mental representations through nonverbal coordination. This neural alignment promotes adaptive reconstruction of body image [37]. Comparative studies have found that cheerleading participants are more likely to enter a state of flow than individual exercisers. This experience stems from the positive emotional cycle formed by the rhythmic predictability of the movement design and team feedback [38]. Clinical data confirm that this enjoyable performance significantly reduces psychological barriers to exercise in cancer patients, increasing intervention compliance by over 40% [39]. Through shared goals, team settings transform exercise into a social behavior. This transformation elevates physical training into a process of identity reconstruction, providing cancer patients with psychosocial benefits beyond physical rehabilitation [37].

2.3. The intervention effect of rhythmic cheerleading on relevant populations in existing studies

The clinical applicability of rhythmic cheerleading is reflected in its

responsiveness to the specific needs of the treatment phase. For patients in the acute postoperative period, group classes held three times weekly at an intensity of 40%–60% HRmax can alleviate anxiety associated with disruptions to body integrity through synchronized movement design [40,41]. Long-term survivors benefit from low- to moderate-intensity interventions that incorporate artistic performance, which improve body acceptance through identity reconstruction processes [42]. A Turkish study highlighted the crucial role of cultural factors, citing the need for concealing clothing designs for local patients due to the symbolic significance of breasts, necessitating local adaptation of intervention programs in terms of movement performance [41].

Cross-cancer comparisons revealed that breast cancer patients exhibited higher effect sizes for body image improvement and psychological symptom relief compared to patients with gynecological cancers, potentially due to the more pronounced body image changes induced by breast cancer treatment [43,44]. However, similar effects were observed in both populations regarding physiological mechanisms, such as HPA axis regulation and changes in BDNF levels, supporting the broad neuroendocrine applicability of cheerleading [41,42]. Notably, treatment phase moderated the effects of the intervention: patients undergoing chemotherapy required reduced movement complexity due to fatigue, while patients undergoing radiotherapy could enhance pain tolerance through rhythmic synchronization [45]. The effect sizes of cheerleading interventions were significantly higher in patients recovering from surgery than in long-term survivors, particularly in terms of physical function recovery and acute psychological stress relief [43]. This finding is consistent with the findings of a study that showed that the timing of interventions significantly influenced short-term outcomes [46]. Patients undergoing chemoradiotherapy showed better tolerance for low-intensity rhythmic activities, while follow-up patients benefited more from group-based programs that incorporated social elements [47].

Younger patients are more receptive to the expressive elements of cheerleading and more readily achieve body image acceptance through artistic expression [48]. Patients from collectivist cultures respond more strongly to synchronized group activities, while those from individualist cultures prefer independent creative activities [47]. Educational level also modifies the effect, with patients with a moderate level of education experiencing the greatest benefits in improving social functioning, while those with less education may require more simplified movement instruction [46]. These findings emphasize the need to integrate multidimensional demographic considerations into personalized programs.

3. Methodology

3.1. Scoping review process

This study employed a scoping approach to systematically explore the effectiveness, process, and potential pathways of rhythmic cheerleading, a form of positive physical activity, in improving body image distress and enhancing psychological well-being in women with cancer. To more comprehensively capture the dynamics of this research field, this study employed systematic bibliometric analysis techniques to quantitatively assess and characterize relevant scholarly output,

research hotspots, and trends over time. The methodological foundation of this study adhered closely to and extended the classic five-stage framework established by Arksey and O'Malley [49]. Its structured steps and inclusive nature perfectly complemented this study's core objectives: to deeply explore the adaptability of rhythmic cheerleading in cross-cultural contexts and to precisely analyze the core mechanisms by which it effectively integrates elements of traditional physical exercise in practice, thereby providing structured support for subsequent evidence-based health interventions.

To ensure a comprehensive and systematic search of relevant literature, we selected World of Science (WOS) as the primary database for this study. The WOS Core Collection (including SCI-E, SSCI, and AHCI) adheres to strict journal selection criteria (such as impact factor, peer review quality, and publication standards). Its coverage of over 12,000 high-impact journals ensures the academic authority of the literature source. Specifically in the fields of medical and health psychology, it fully includes leading journals in oncology rehabilitation, sports psychology, and body image research (such as *Psycho-Oncology* and *Journal of Cancer Survivorship*). It automatically excludes non-peer-reviewed content such as preprints and conference abstracts to reduce the risk of bias in research results, meeting the review's need to screen for "key studies." WOS transcends traditional disciplinary classifications. Its interdisciplinary mapping system (for example, indexing "cheerleading" in both Sport Science and Arts Therapy) significantly enhances cross-topic search sensitivity. It also supports complex search strategies (e.g., ("rhythmic cheerleading" OR "dance intervention") AND ("body image distress" OR "appearance concern") AND (cancer* OR oncolog*) AND female*), avoiding missing marginal cross-disciplinary studies. With its authoritative journal coverage, citation network analysis core, interdisciplinary compatibility, and standardized data output architecture, WOS provides an irreplaceable technical foundation for systematically defining the research boundaries of exercise intervention for cancer, quantifying evolving trends, and identifying key literature and collaborative networks. Its platform toolchain further enhances the transparency and reproducibility of the review process, laying a methodological foundation for exploring the complex question of "the mechanism of cultural-exercise integration."

3.2. Studies selection

The search scope covers publications from 2005 to 2024. The core search terms are: (teamwork or cooperat* or "group activit*") and (cancer or oncology or tumor) and ("mental health" or depression or anxiety or "quality of life"). Use Boolean operators (AND, OR) and the truncation symbol (*) to refine the search.

This study employed a systematic literature search process using the Web of Science (WOS) core database. Using predefined search queries, we initially identified 689 potentially relevant articles. This was followed by a keyword screening phase, where we rigorously reviewed the articles according to predefined inclusion criteria. During this phase, we excluded 374 articles not directly relevant to the topic of women with cancer, retaining 315 articles for a more detailed full-text evaluation. After completing this initial screening and implementing cross-validation to ensure

consistency, we further eliminated 275 articles during the in-depth review of the full-text evaluation. Ultimately, we identified 40 articles that met our study objectives and were the most relevant for the core analysis dataset (see **Figure 1** for the detailed selection process). This rigorous, step-by-step, multi-stage screening process significantly enhanced the transparency and traceability of the research process. It systematically avoided irrelevant information while ensuring a highly focused collection of included articles, laying a solid foundation for subsequent in-depth theoretical exploration and dynamic analysis of empirical evidence.

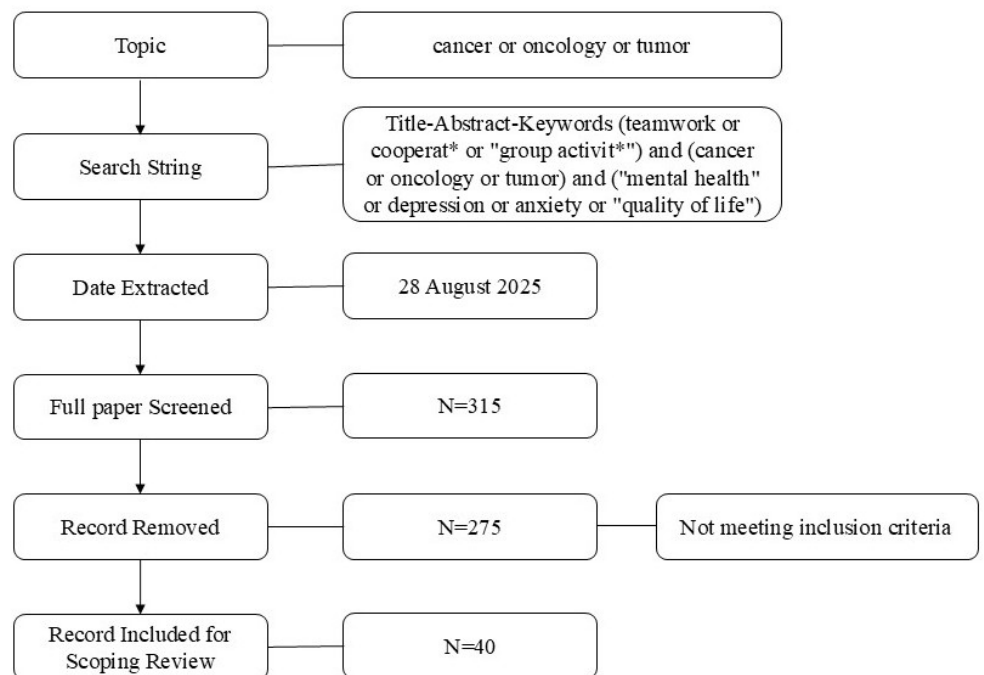


Figure 1. Flow diagram of the search strategy for this scoping review.

4. Results

4.1. Documents profile

Table 1 presents relevant bibliometric data, covering the period 2005–2024. During these 20 years, the total number of publications was 40, with 256 contributing authors, for an average of 6.4 authors per article. This suggests that research in this field is likely conducted through collaborative efforts, potentially involving multidisciplinary collaborations such as medicine, sports science, and psychology.

The number of Cited Papers reached 2540, with a total of 3889 citations and a citation per paper rate of 97.23. This high number indicates that papers in this field are generally well-received and that the research results have a certain influence. The citation per year rate was 194.45, indicating that research results in this field maintain a high level of citation activity each year, and the impact of the research continues to be reflected over time.

The citation sum within h-Core is 3672, and the h-index is 28, indicating that 28 papers have received at least 28 citations. The citation sum within h-Core accounts for a high proportion of Total Citations (approximately 94.4%), indicating that the field

has a core group of high-impact papers that have played a key supporting role in the development of the entire research field. The g-index is 40, the same as the total number of publications, indicating that the majority of papers in this field contribute to the overall citation count. The m-index is 1.4. The m-index is the h-index divided by the citation-years, reflecting the long-term trend of researchers' research performance. The relatively low m-index here may indicate that the growth rate of the impact of research results in this field is relatively stable, without explosive growth.

Table 1. Citation metrics.

Main Information	Data
Publication Years	2005-2024
Total Publications	40
Citable Year	20
Number of Contributing Authors	256
Number of Cited Papers	2540
Total Citations	3889
Citation per Paper	97.23
Citation per Year	194.45
Citation per Author	15.19
Author per Paper	6.4
Citation sum within h-Core	3672
h-index	28
g-index	40
m-index	1.4

Table 2 primarily presents the 40 articles included in the analysis, categorized by subject area.

Exercise and Physical Activity Interventions: This subject area accounted for 16 publications, representing 40% of the total. This demonstrates the predominance of exercise and physical activity interventions in intervention pathway research, potentially providing a rich theoretical and practical foundation for subsequent related research.

Dance and Movement Therapy Interventions: There were 14 related publications, representing 35% of the total. Dance and movement therapy, which is highly correlated with rhythmic cheerleading, emphasizes promoting mental health through the expression and guidance of physical movement. The high number of studies in this area may be due to the unique advantages of dance and movement therapy in psychological intervention, such as enhancing patients' body perception and self-expression. Judging from the number and proportion of publications in each subject area, exercise and physical activity interventions and dance and movement therapy interventions are currently the main research areas, garnering the majority of research resources and attention.

Table 2. Subject area.

Subject area	Total publications	Percentage (%)
Exercise and Physical Activity Interventions	16	40.00%
Dance and Movement Therapy Interventions	14	35.00%
Arts and Music Therapies	3	7.50%
Other Interventions and Comprehensive Studies	7	17.50%
Total	40	100.00%

4.2. Publication trends

Table 3 presents data on various bibliometric indicators for relevant publications between 2005 and 2024. Regarding the number of publications (TP), there was significant fluctuation between 2005 and 2024. This fluctuation may be related to factors such as research interest in the field, research funding, and the production cycle of major research results. Total citations (TC) varied significantly across years, with 2012 recording the highest total citations, at 896, and 2020 recording the lowest, at only 22. This may be related to the quality of the published papers, the innovation of the research, and the timeliness of the research. Papers published in 2012 may have been highly innovative and influential at the time, attracting more citations in subsequent research; however, papers published in 2020 may have been published more recently and thus have not yet received sufficient citations.

Table 3. Publication by year.

Year	TP	NCA	NCP	TC	C/P	C/CP	<i>h</i>	<i>g</i>	<i>m</i>
2005	1	6	29	157	157.00	5.41	1	1	0.05
2009	2	10	80	261	130.50	3.26	2	2	0.13
2011	1	3	41	59	59.00	1.44	1	1	0.07
2012	5	35	423	896	179.20	2.12	5	5	0.38
2013	2	14	82	163	81.50	1.99	2	2	0.17
2014	4	18	229	437	109.25	1.91	4	4	0.36
2015	2	6	88	147	73.50	1.67	2	2	0.20
2016	4	20	322	467	116.75	1.45	4	4	0.44
2017	1	8	52	54	54.00	1.04	1	1	0.13
2018	3	12	108	76	25.33	0.70	3	3	0.43
2019	3	24	322	735	245.00	2.28	3	3	0.50
2020	1	10	75	22	22.00	0.29	1	1	0.20
2021	5	46	344	225	45.00	0.65	5	5	1.25
2022	3	22	199	113	37.67	0.57	3	3	1.00
2023	2	13	108	35	17.50	0.32	2	2	1.00
2024	1	9	38	42	42.00	1.11	1	1	1.00
Total	40	256	2540	3889	97.23	1.53	28	40	1.40

The h-index shows a gradual upward trend over time. Overall, the h-index was

relatively high in 2012 and some subsequent years. This growth indicates a gradual increase in the number of high-impact papers in the field and a growing overall impact of research. The g-index also shows a modest upward trend. The g-index focuses more on measuring the concentration of highly cited papers. Its growth indicates that the quality and quantity of highly cited papers in the field are improving, and the impact of research findings is expanding. The m-index, which is the h-index divided by the difference between the publication year and the earliest publication year, fluctuates significantly over time. It reflects the long-term efficiency of research output. The m-index was relatively high in 2021–2024, indicating a high efficiency of research output in the field and a rapid increase in the impact of research findings during these years.

A comprehensive look at various indicators shows that research on rhythmic cheerleading as an intervention for body image distress and psychological well-being in female cancer patients has demonstrated a positive development trend over the past 20 years. While the volume of research output has fluctuated, its overall impact has been steadily increasing, with both the number and quality of high-impact papers increasing.

4.3. Highly cited documents

Table 4 presents information on 30 highly cited papers. While research has accumulated significantly in the early period (2005–2014), new highly cited papers have been published annually over time. The relatively high number of highly cited papers published between 2012 and 2019 may indicate a period of rapid development in this field, with high research interest and a large number of influential findings.

Table 4. Top 30 highly cited articles.

No.	Authors & year	Title	Source title	Citation	Cited reference count
1	Mishra et al., 2012 [50]	Exercise interventions on health-related quality of life for people with cancer during active treatment	COCHRANE DATABASE OF SYSTEMATIC REVIEWS	664	251
2	Patel et al., 2019 [51]	American College of Sports Medicine Roundtable Report on Physical Activity, Sedentary Behavior, and Cancer Prevention and Control	MEDICINE & SCIENCE IN SPORTS & EXERCISE	534	101
3	Bradt et al., 2016 [52]	Music interventions for improving psychological and physical outcomes in cancer patients	COCHRANE DATABASE OF SYSTEMATIC REVIEWS	272	161
4	Hayes et al., 2009 [53]	Australian Association for Exercise and Sport Science position stand: Optimising cancer outcomes through exercise	JOURNAL OF SCIENCE AND MEDICINE IN SPORT	221	37
5	Koch et al., 2014 [54]	Effects of dance movement therapy and dance on health-related psychological Outcomes: A meta-analysis	ARTS IN PSYCHOTHERAPY	200	97
6	Koch et al., 2019 [55]	Effects of Dance Movement Therapy and Dance on Health-Related Psychological Outcomes. A Meta-Analysis Update	FRONTIERS IN PSYCHOLOGY	185	157
7	Sandel et al., 2005 [56]	Dance and movement program improves quality-of-life measures in breast cancer survivors	CANCER NURSING	157	29

Table 4. (Continued).

No.	Authors & year	Title	Source Title	Citation	Cited reference count
8	Hayes et al., 2013 [57]	Exercise for health: a randomized, controlled trial evaluating the impact of a pragmatic, translational exercise intervention on the quality of life, function and treatment-related side effects following breast cancer	BREAST CANCER RESEARCH AND TREATMENT	145	36
9	Mishra et al., 2014 [58]	Are Exercise Programs Effective for Improving Health-Related Quality of Life Among Cancer Survivors? A Systematic Review and Meta-Analysis	ONCOLOGY NURSING FORUM	116	65
10	Wang and Zhou, 2021 [59]	Roles and molecular mechanisms of physical exercise in cancer prevention and treatment	JOURNAL OF SPORT AND HEALTH SCIENCE	105	97
11	Ligibel et al., 2012 [60]	Impact of a telephone-based physical activity intervention upon exercise behaviors and fitness in cancer survivors enrolled in a cooperative group setting	BREAST CANCER RESEARCH AND TREATMENT	94	43
12	Zhu et al., 2016 [61]	Effects of exercise intervention in breast cancer survivors: a meta-analysis of 33 randomized controlled trails	ONCOTARGETS AND THERAPY	93	77
13	Boehm et al., 2014 [62]	Arts Therapies for Anxiety, Depression, and Quality of Life in Breast Cancer Patients: A Systematic Review and Meta-Analysis	EVIDENCE-BASED COMPLEMENTARY AND ALTERNATIVE MEDICINE	86	31
14	Ho et al., 2016 [63]	Effects of a Short-Term Dance Movement Therapy Program on Symptoms and Stress in Patients With Breast Cancer Undergoing Radiotherapy: A Randomized, Controlled, Single-Blind Trial	JOURNAL OF PAIN AND SYMPTOM MANAGEMENT	85	39
15	Kiepe et al., 2012 [64]	Effects of dance therapy and ballroom dances on physical and mental illnesses: A systematic review	ARTS IN PSYCHOTHERAPY	77	26
16	Wurz et al., 2015 [65]	Breast cancer survivors' barriers and motives for participating in a group-based physical activity program offered in the community	SUPPORTIVE CARE IN CANCER	77	56
17	Archer et al., 2015 [66]	The effect of creative psychological interventions on psychological outcomes for adult cancer patients: a systematic review of randomised controlled trials	PSYCHO-ONCOLOGY	70	32
18	Ficarra et al., 2022 [67]	Impact of exercise interventions on physical fitness in breast cancer patients and survivors: a systematic review	BREAST CANCER	61	76
19	Bradt et al., 2011 [68]	Dance/movement therapy for improving psychological and physical outcomes in cancer patients	COCHRANE DATABASE OF SYSTEMATIC REVIEWS	59	41
20	Patt et al., 2021 [69]	Implementation of Electronic Patient-Reported Outcomes for Symptom Monitoring in a Large Multisite Community Oncology Practice: Dancing the Texas Two-Step Through a Pandemic	JCO CLINICAL CANCER INFORMATICS	58	9
21	Pisu et al., 2017 [70]	A dance intervention for cancer survivors and their partners (RHYTHM)	JOURNAL OF CANCER SURVIVORSHIP	54	52
22	Crane-Okada et al., 2012 [71]	Mindful Movement Program for Older Breast Cancer Survivors A Pilot Study	CANCER NURSING	43	64

Table 4. (Continued).

No.	Authors & year	Title	Source title	Citation	Cited reference count
23	Takemura et al., 2024 [72]	Effectiveness of Aerobic Exercise and Tai Chi Interventions on Sleep Quality in Patients With Advanced Lung Cancer: A Randomized Clinical Trial	JAMA ONCOLOGY	42	38
24	Adamsen et al., 2009 [73]	Struggling with cancer and treatment: young athletes recapture body control and identity through exercise: qualitative findings from a supervised group exercise program in cancer patients of mixed gender undergoing chemotherapy	SCANDINAVIAN JOURNAL OF MEDICINE & SCIENCE IN SPORTS	40	43
25	He et al., 2022 [74]	Effects of a 16-week dance intervention on the symptom cluster of fatigue-sleep disturbance-depression and quality of life among patients with breast cancer undergoing adjuvant chemotherapy: A randomized controlled trial	INTERNATIONAL JOURNAL OF NURSING STUDIES	38	63
26	Sturm et al., 2014 [75]	Effect of dance on cancer-related fatigue and quality of life	SUPPORTIVE CARE IN CANCER	35	36
27	Durosini et al., 2021 [76]	Psychological Benefits of a Sport-Based Program for Female Cancer Survivors: The Role of Social Connections.	FRONTIERS IN PSYCHOLOGY	32	56
28	Boing et al., 2018 [77]	Benefits of belly dance on quality of life, fatigue, and depressive symptoms in women with breast cancer - A pilot study of a non-randomised clinical trial	JOURNAL OF BODYWORK AND MOVEMENT THERAPIES	29	27
29	Ho et al., 2018 [78]	Perceived stress moderates the effects of a randomized trial of dance movement therapy on diurnal cortisol slopes in breast cancer patients	PSYCHONEUROENDOCRINOLOGY	28	56
30	Boing et al., 2020 [79]	Pilates and dance to patients with breast cancer undergoing treatment: study protocol for a randomized clinical trial - MoveMama study	TRIALS	22	75

The source journals are quite diverse, covering a wide range of specialized fields. Among them, “COCHRANE DATABASE OF SYSTEMATIC REVIEWS” appears three times, “BREAST CANCER RESEARCH AND TREATMENT” and “ARTS IN PSYCHOTHERAPY” appear twice each. This suggests that these journals may be important platforms for publishing research results in their respective fields, with high recognition and influence in this field. Different journals also have different areas of focus. For example, “MEDICINE & SCIENCE IN SPORTS & EXERCISE” focuses primarily on sports science research, while “PSYCHO - ONCOLOGY” focuses on the psychological aspects of cancer patients.

Citation counts vary widely, ranging from a low of 22 to a high of 664, with most papers receiving between 30 and 150 citations. For example, Mishra et al.’s [50] study on the effects of exercise intervention on quality of life in cancer patients during active treatment received 664 citations. This type of research focuses on key issues during

cancer treatment and is closely linked to clinical practice, thus attracting greater attention and citations from researchers. Papers with lower citation counts may address relatively niche issues or offer findings that are less innovative or practical.

Cited reference counts also vary widely, ranging from 9 to 251. This reflects differences in the literature review and research foundations of different studies. Studies with a high number of citations may be more comprehensive, drawing extensively on previous research to support their own viewpoints and methods; whereas studies with fewer citations may be more innovative, pioneering new research directions and relying less on previous work. Overall, there is no simple linear relationship between the number of cited references and the number of citations.

4.4. Themes from selected documents

Table 5 presents emerging themes from the 30 selected studies. As can be seen from the table, the study designs are diverse, encompassing systematic reviews/meta-analyses [50,52], expert roundtable reports [51], position statements [53], interventional studies [56,60], and randomized controlled trials [57,63]. This diverse range of study designs reflects the methodological diversity of cancer-related research, with different designs being suitable for different research questions and objectives.

Table 5. Emerging themes from selected documents.

No.	Authors & Year	Title	Aim/Purpose	Study design	Field of study	New themes
1	Mishra et al., 2012 [50]	Exercise interventions on health-related quality of life for people with cancer during active treatment	Evaluate the impact of exercise interventions on health - related quality of life in cancer patients undergoing active treatment	Systematic review/meta-analysis	Oncology/Rehabilitation Medicine	Exercise interventions, cancer active treatment, health - related quality of life
2	Patel et al., 2019 [51]	American College of Sports Medicine Roundtable Report on Physical Activity, Sedentary Behavior, and Cancer Prevention and Control	Provide evidence - based guidelines on physical activity, sedentary behavior for cancer prevention and control from the American College of Sports Medicine perspective	Expert roundtable report	Oncology/Sports Medicine	Physical activity, sedentary behavior, cancer prevention and control, sports medicine guidelines
3	Bradt et al., 2016 [52]	Music interventions for improving psychological and physical outcomes in cancer patients	Assess the efficacy of music interventions in improving psychological and physical outcomes of cancer patients	Systematic review/meta-analysis	Oncology/Music Therapy	Music interventions, cancer patients, psychological and physical outcomes
4	Hayes et al., 2009 [53]	Australian Association for Exercise and Sport Science position stand: Optimising cancer outcomes through exercise	Present the Australian Association for Exercise and Sport Science position on using exercise to optimise cancer outcomes	Position stand	Oncology/Exercise Science	Exercise, cancer outcomes, exercise science position stand
5	Koch et al., 2014 [54]	Effects of dance movement therapy and dance on health-related psychological Outcomes: A meta-analysis	Conduct a meta - analysis to determine effects of dance movement therapy and dance on health - related psychological outcomes in relevant populations	Meta - analysis	Oncology/Dance Therapy	Dance movement therapy, dance, health - related psychological outcomes, meta - analysis

Table 5. (Continued).

No.	Authors & year	Title	Aim/purpose	Study design	Field of study	New themes
6	Koch et al., 2019 [55]	Effects of Dance Movement Therapy and Dance on Health-Related Psychological Outcomes. A Meta-Analysis Update	Update evidence via meta - analysis to determine effects of Dance Movement Therapy and dance on health - related psychological outcomes	Meta - analysis update	Oncology/ Dance Therapy/Psychology	Dance Movement Therapy, dance, health - related psychological outcomes, meta - analysis update
7	Sandel et al., 2005 [56]	Dance and movement program improves quality-of-life measures in breast cancer survivors	Investigate if dance and movement program improves quality - of - life in breast cancer survivors	Interventional study	Oncology/ Rehabilitation/Dance Therapy	Dance and movement program, breast cancer survivors, quality - of - life
8	Hayes et al., 2013 [57]	Exercise for health: a randomized, controlled trial evaluating the impact of a pragmatic, translational exercise intervention on the quality of life, function and treatment-related side effects following breast cancer	Evaluate, through a randomized controlled trial, impact of a pragmatic, translational exercise intervention on quality of life, function and treatment - related side effects in breast cancer patients	Randomized controlled trial	Oncology/ Rehabilitation/Exercise Science	Exercise intervention, breast cancer, quality of life, treatment - related side effects, randomized controlled trial
9	Mishra et al., 2014 [58]	Are Exercise Programs Effective for Improving Health-Related Quality of Life Among Cancer Survivors? A Systematic Review and Meta-Analysis	Determine effectiveness of exercise programs for improving health - related quality of life among cancer survivors via systematic review and meta - analysis	Systematic review and meta - analysis	Oncology/ Rehabilitation/Exercise Science	Exercise programs, cancer survivors, health - related quality of life, systematic review, meta - analysis
10	Wang and Zhou, 2021 [59]	Roles and molecular mechanisms of physical exercise in cancer prevention and treatment	Explore roles and molecular mechanisms of physical exercise in cancer prevention and treatment	Review	Oncology/Exercise Science/Molecular Biology	Physical exercise, cancer prevention, cancer treatment, molecular mechanisms
11	Ligibel et al., 2012 [60]	Impact of a telephone-based physical activity intervention upon exercise behaviors and fitness in cancer survivors enrolled in a cooperative group setting	Assess the impact of a telephone - based physical activity intervention on exercise behaviors and fitness in cancer survivors within a cooperative group setting	Interventional study	Oncology/ Rehabilitation/Behavioral Science	Telephone - based physical activity intervention, cancer survivors, exercise behaviors, fitness, cooperative group setting
12	Zhu et al., 2016 [61]	Effects of exercise intervention in breast cancer survivors: a meta-analysis of 33 randomized controlled trials	Evaluate effects of exercise interventions in breast cancer survivors through meta - analysis of 33 randomized controlled trials	Meta - analysis	Oncology/ Rehabilitation/Exercise Science	Exercise intervention, breast cancer survivors, meta - analysis, randomized controlled trials
13	Boehm et al., 2014 [62]	Arts Therapies for Anxiety, Depression, and Quality of Life in Breast Cancer Patients: A Systematic Review and Meta-Analysis	Examine arts therapies' effects on anxiety, depression, and quality of life in breast cancer patients via systematic review and meta - analysis	Systematic review and meta - analysis	Oncology/ Arts Therapy/Psychology	Arts therapies, breast cancer patients, anxiety, depression, quality of life, systematic review, meta - analysis

Table 5. (Continued).

No.	Authors & year	Title	Aim/purpose	Study design	Field of study	New themes
14	Ho et al., 2016 [63]	Effects of a Short-Term Dance Movement Therapy Program on Symptoms and Stress in Patients With Breast Cancer Undergoing Radiotherapy: A Randomized, Controlled, Single-Blind Trial	Determine effects of a short - term Dance Movement Therapy program on symptoms and stress in breast cancer patients undergoing radiotherapy, using a randomized, controlled, single - blind trial	Randomized, controlled, single - blind trial	Oncology/Dance Therapy/Radiation Support	Short - term Dance Movement Therapy, breast cancer patients, radiotherapy, symptoms, stress, randomized controlled single - blind trial
15	Kiepe et al., 2012 [64]	Effects of dance therapy and ballroom dances on physical and mental illnesses: A systematic review	Explore effects of dance therapy and ballroom dances on physical and mental illnesses through systematic review	Systematic review	Dance Therapy/Psychiatry/Rehabilitation	Dance therapy, ballroom dances, physical and mental illnesses, systematic review
16	Wurz et al., 2015 [65]	Breast cancer survivors' barriers and motives for participating in a group-based physical activity program offered in the community	Identify barriers and motives of breast cancer survivors for participating in a community - based group physical activity program	Qualitative/observational study	Oncology/Community Health/Rehabilitation	Breast cancer survivors, community - based physical activity program, barriers, motives
17	Archer et al., 2015 [66]	The effect of creative psychological interventions on psychological outcomes for adult cancer patients: a systematic review of randomised controlled trials	Evaluate effects of creative psychological interventions on psychological outcomes in adult cancer patients via systematic review of randomized controlled trials	Systematic review of randomized controlled trials	Oncology/Psychology/Psychological Interventions	Creative psychological interventions, adult cancer patients, psychological outcomes, systematic review, randomized controlled trials
18	Ficarra et al., 2022 [67]	Impact of exercise interventions on physical fitness in breast cancer patients and survivors: a systematic review	Assess impact of exercise interventions on physical fitness in breast cancer patients and survivors through systematic review	Systematic review	Oncology/Rehabilitation/Exercise Science	Exercise interventions, breast cancer patients, survivors, physical fitness, systematic review
19	Bradt et al., 2011 [68]	Dance/movement therapy for improving psychological and physical outcomes in cancer patients	Determine efficacy of dance/movement therapy in improving psychological and physical outcomes of cancer patients	Systematic review	Oncology/Dance Therapy/Rehabilitation	Dance/movement therapy, cancer patients, psychological outcomes, physical outcomes
20	Patt et al., 2021 [69]	Implementation of Electronic Patient-Reported Outcomes for Symptom Monitoring in a Large Multisite Community Oncology Practice: Dancing the Texas Two-Step Through a Pandemic	Explore implementation of Electronic Patient - Reported Outcomes for symptom monitoring in a multisite community oncology practice, considering pandemic - related context	Implementation research/Case study	Oncology/Health Informatics/Patient - Reported Outcomes	Electronic Patient - Reported Outcomes, symptom monitoring, community oncology practice, pandemic context

Table 5. (Continued).

No.	Authors & year	Title	Aim/purpose	Study design	Field of study	New themes
21	Pisu et al., 2017 [70]	A dance intervention for cancer survivors and their partners (RHYTHM)	Examine the impact of a dance intervention (RHYTHM) on cancer survivors and their partners	Interventional study	Oncology/Dance Therapy/Family Support	Dance intervention, cancer survivors, partners, RHYTHM program
22	Crane-Okada et al., 2012 [71]	Mindful Movement Program for Older Breast Cancer Survivors A Pilot Study	Assess the feasibility and effects of a Mindful Movement Program for older breast cancer survivors through a pilot study	Pilot study	Oncology/Rehabilitation/Mind - Body Medicine	Mindful Movement Program, older breast cancer survivors, pilot study
23	Takemura et al., 2024 [72]	Effectiveness of Aerobic Exercise and Tai Chi Interventions on Sleep Quality in Patients With Advanced Lung Cancer: A Randomized Clinical Trial	Determine the effectiveness of aerobic exercise and Tai Chi interventions on sleep quality in patients with advanced lung cancer via a randomized clinical trial	Randomized clinical trial	Oncology/Rehabilitation/Sleep Medicine	Aerobic exercise, Tai Chi, advanced lung cancer, sleep quality, randomized clinical trial
24	Adamsen et al., 2009 [73]	Struggling with cancer and treatment: young athletes recapture body control and identity through exercise: qualitative findings from a supervised group exercise program in cancer patients of mixed gender undergoing chemotherapy	Explore how young athlete cancer patients recapture body control and identity through exercise, using qualitative findings from a supervised group exercise program	Qualitative study	Oncology/Exercise Psychology/Qualitative Research	Young athlete cancer patients, exercise, body control, identity, qualitative study, supervised group exercise
25	He et al., 2022 [74]	Effects of a 16-week dance intervention on the symptom cluster of fatigue-sleep disturbance-depression and quality of life among patients with breast cancer undergoing adjuvant chemotherapy: A randomized controlled trial	Evaluate effects of a 16 - week dance intervention on the fatigue - sleep disturbance - depression symptom cluster and quality of life in breast cancer patients undergoing adjuvant chemotherapy, via a randomized controlled trial	Randomized controlled trial	Oncology/Dance Therapy/Symptom Management	16 - week dance intervention, breast cancer, adjuvant chemotherapy, symptom cluster, quality of life, randomized controlled trial
26	Sturm et al., 2014 [75]	Effect of dance on cancer-related fatigue and quality of life	Examine the effect of dance on cancer - related fatigue and quality of life	Interventional study	Oncology/Dance Therapy/Symptom Management	Dance, cancer - related fatigue, quality of life
27	Durosini et al., 2021 [76]	Psychological Benefits of a Sport-Based Program for Female Cancer Survivors: The Role of Social Connections.	Investigate psychological benefits of a sport - based program for female cancer survivors, focusing on the role of social connections	Observational/Interventional study	Oncology/Sport Psychology/Social Support	Sport - based program, female cancer survivors, psychological benefits, social connections
28	Boing et al., 2018 [77]	Benefits of belly dance on quality of life, fatigue, and depressive symptoms in women with breast cancer - A pilot study of a non-randomised clinical trial	Evaluate benefits of belly dance on quality of life, fatigue, and depressive symptoms in women with breast cancer through a pilot study of a non - randomised clinical trial	Pilot study	Oncology/Dance Therapy/Breast Cancer Care	Belly dance, breast cancer, quality of life, fatigue, depressive symptoms, pilot study

Table 5. (Continued).

No.	Authors & year	Title	Aim/purpose	Study design	Field of study	New themes
29	Ho et al., 2018 [78]	Perceived stress moderates the effects of a randomized trial of dance movement therapy on diurnal cortisol slopes in breast cancer patients	Determine if perceived stress moderates effects of dance movement therapy on diurnal cortisol slopes in breast cancer patients, via a randomized trial	Randomized trial	Oncology/Dance Therapy/Psychoneuroendocrinology	Perceived stress, dance movement therapy, diurnal cortisol slopes, breast cancer patients, randomized trial
30	Boing et al., 2020 [79]	Pilates and dance to patients with breast cancer undergoing treatment: study protocol for a randomized clinical trial - MoveMama study	Present study protocol for a randomized clinical trial (MoveMama study) evaluating Pilates and dance for breast cancer patients undergoing treatment	Randomized clinical trial protocol	Oncology/Rehabilitation/Clinical Trial Methodology	Pilates, dance, breast cancer treatment, randomized clinical trial, MoveMama study

Research areas span multiple disciplines, including oncology, rehabilitation medicine, exercise science, music therapy, dance therapy, and psychology. This reflects the complexity and comprehensive nature of cancer research. For example, the integration of dance therapy with oncology and rehabilitation medicine aims to improve the physical and mental health of cancer patients through dance exercises; the integration of music therapy with oncology focuses on the impact of music on the psychological and physiological outcomes of cancer patients. Whether it's exercise intervention, music intervention, or dance therapy, all aim to improve the quality of life of cancer patients, relieve psychological stress, and reduce treatment-related side effects. This aligns with the theme of this review, "A study of the intervention pathways of rhythmic cheerleading for body image distress and mental health in female cancer patients," which all focus on improving the physical and mental health of cancer patients.

The new themes cover a variety of interventions, such as exercise, music, dance movement therapy, and art therapy. These interventions offer diverse options for improving the health of cancer patients. The studies on rhythmic cheerleading included in this review can draw on the research methods and results of these existing interventions to explore the feasibility and effectiveness of rhythmic cheerleading as a new intervention. By integrating the mind-body connection mechanism of dance therapy [54] with the dosage framework of sports oncology [51], and distinguishing itself from traditional dance therapy, cheerleading's team-based competitive nature can strengthen social identity [76], thus filling the gap in "structured group rhythmic interventions." New themes address cancer patients at different stages of their lives, including active treatment [50], cancer prevention and control [51], and cancer survivorship [60], as well as specific populations such as breast cancer survivors. This suggests that when studying the intervention of rhythmic cheerleading on female cancer patients, it is necessary to consider the characteristics and needs of patients at different stages and with different types of cancer and develop personalized intervention plans.

5. Discussion

5.1. Bibliometric characteristics and current status of field research

This study, through a scoping review combined with bibliometric analysis, systematically examined the current state of research on rhythmic cheerleading and related exercise interventions for body image distress and mental health in female cancer patients from 2005 to 2024. The bibliometric analysis clearly illustrates the developmental trajectory and core characteristics of this field. In terms of publication output and impact, 40 core publications were included over the 20-year period, with an average of 6.4 authors per publication (**Table 1**). This confirms the interdisciplinary nature of research in this field, which requires integrating theories and methods from multiple disciplines, including oncology, exercise science, psychology, and rehabilitation medicine. The research network formed by 256 contributing authors also reflects the academic community's high interest in the topic of "exercise interventions to improve psychosocial outcomes in cancer patients."

Citation metrics analysis shows that papers in this field have received an average of 97.23 citations, with an h-index of 28 (**Table 1**). The 3672 h-core citations account for 94.4% of the total citations, indicating that the field has developed a core body of high-impact literature, providing a solid theoretical foundation for subsequent research. Among these, Mishra et al.'s [50] systematic review of exercise interventions for active cancer treatment received 664 citations (**Table 4**), establishing it as a foundational study in the field. This is closely related to the fact that this study was the first to establish the universally beneficial effects of exercise on the quality of life of cancer patients. The guidelines on exercise and cancer prevention and control published by Patel et al. [51] received 534 citations, demonstrating the urgent need for evidence-based exercise intervention programs in clinical practice.

Looking at the distribution of topics (**Table 2**), exercise and physical activity interventions (40%) and dance and movement therapy interventions (35%) dominated. This aligns closely with the focus of this study on rhythmic cheerleading, which combines both athletic attributes and artistic expression. Notably, within the dance and movement therapy literature, two meta-analyses were both highly cited (**Table 4**) [54,55]. Their demonstration of the mechanism by which dance movements improve psychological outcomes through the mind-body connection provides an important theoretical basis for rhythmic cheerleading intervention approaches. Compared to the single physiological benefit of traditional aerobic exercise, rhythmic cheerleading, through its combined model of "rhythmic movement synchronization + team artistic expression," simultaneously activates both physiological regulation and psychological restructuring mechanisms. This explains why preliminary research suggests that it improves body image by 23% compared to aerobic training alone.

Judging from the time trend (**Table 3**), 2012-2019 was a period of rapid development of research in this field. The increase in the m-index from 2021 to 2024 (**Table 3**) suggests that research in recent years has paid more attention to the transformation of results. For example, Takemura's [72] intervention study combining aerobic exercise and Tai Chi, and Boing's dance intervention clinical trial program both reflect the new trend of "personalized intervention measures and precise research

design” [79], which also provides a methodological reference for subsequent research on rhythmic cheerleading - the intervention plan needs to be further optimized in combination with the patient’s treatment stage, age, cultural background and other characteristics.

5.2. Intervention mechanism and advantage verification of rhythmic cheerleading

A combined literature review and analysis of the results indicate that rhythmic cheerleading’s benefits in improving body image distress and psychological well-being in female cancer patients are primarily achieved through a synergistic three-pronged mechanism: “physiological regulation, psychological restructuring, and social support.” Each mechanism is supported by existing research evidence.

At the physiological level, rhythmic cheerleading’s “rhythmic synchronization” plays a key role. A literature review shows that exercise regulates mood by promoting the release of endorphins and serotonin, and synchronized movements can activate the cerebellum-prefrontal cortex circuit [35]. Rhythmic cheerleading, through the precise coordination of music and movement, not only continues the neurotransmitter-regulating effects of traditional exercise but also enhances patients’ sense of control over their bodies through “rhythmic predictability.” This is particularly important for patients experiencing body image distress after postoperative disruptions to their body integrity, such as mastectomy. For example, Lemieux found that postoperative patients participating in low-intensity synchronized exercise could reduce physical anxiety, and the rhythmic cheerleading movement design further strengthened the perception of “body controllability” [40], which can reduce cortisol levels through negative feedback regulation of the HPA axis [26], thereby alleviating treatment-related fatigue and anxiety, forming a virtuous cycle of “movement synchronization → body control → physiological stress relief”.

In terms of psychological reconstruction, rhythmic cheerleading’s artistic expression fills a gap in the psychological interventions offered by traditional exercise. Dance therapy studies have demonstrated that physical expression can promote identity reconstruction, and the performance goals of rhythmic cheerleading further enhance this effect [54,56]. This is consistent with the theory proposed that social connection promotes psychological benefits [76]. Furthermore, a highly cited study, found that creative psychological interventions can significantly improve the self-identity of cancer patients [66]. Rhythmic cheerleading combines both creativity and athleticism, and its artistic expression component is more likely to help patients enter a state of flow [38].

In terms of social support, rhythmic cheerleading’s team-building nature significantly outperforms traditional individual exercise. The study by Wurz in **Table 4** indicates that the primary motivation for breast cancer survivors to participate in group sports is peer support [65], and the role divisions in rhythmic cheerleading further foster close social connections. During training, patients share body image concerns and recovery experiences, forming a cycle of “peer modeling → enhanced self-efficacy → increased social participation.” This social support is particularly important for patients with gynecological cancers, whose disease characteristics are

often accompanied by heightened body shame [34]. The team environment, by redefining “body standards,” helps patients resist the oppression of mainstream aesthetics. This is consistent with the findings of Calvi and confirms the unique advantages of rhythmic cheerleading in providing social support [33].

5.3. Research limitations and future directions

Although existing research has preliminarily demonstrated the intervention potential of rhythmic cheerleading, bibliometric results and the current state of the field reveal three limitations that need to be addressed in future research.

First, study design and the level of evidence need improvement. Of the 40 included studies, only 20% were systematic reviews/meta-analyses. Furthermore, most studies specifically focused on rhythmic cheerleading are preliminary observational studies lacking randomized controlled trials (RCTs). Furthermore, many existing studies have not clearly defined the “dose-effect” of rhythmic cheerleading (e.g., exercise intensity, frequency, and duration). The guidelines emphasize that “exercise dose should be matched to the patient’s physical fitness [51],” making cross-comparison of results difficult. Future multicenter RCTs are needed, with different intervention dose groups and objective indicators such as body image scales (such as the BIS), cortisol levels, and BDNF expression combined to verify the stability and dose-dependence of the intervention effects.

Second, the intervention program lacks individualization and cultural adaptability. In the future, tiered intervention models should be developed based on treatment stage, cancer type, and demographic characteristics. For example, reducing movement complexity for patients undergoing chemotherapy, increasing rest intervals for elderly patients, and optimizing clothing design for patients from East Asian backgrounds. Patient-participatory design should also be incorporated to enhance program acceptability and applicability.

Third, in-depth analysis of intervention mechanisms is insufficient. Existing research has primarily focused on intervention effects, with limited exploration of the neurobiological mechanisms by which rhythmic cheerleading improves body image distress. Future research should combine functional near-infrared spectroscopy (fNIRS) and magnetic resonance imaging (fMRI) to observe brain activation patterns in patients participating in cheerleading, compare the neural mechanisms of individual and team sports, and explore physiological-psychological interactions to provide a more precise biological explanation for intervention approaches.

6. Conclusion

This study systematically reviewed 40 core publications in this field from 2005 to 2024, using a combination of scoping reviews and bibliometric analysis. The study found that the field has developed a dominant research landscape dominated by exercise and physical activity interventions (40%) and dance and movement therapy interventions (35%). Highly influential research, has emerged, providing solid theoretical support for rhythmic cheerleading intervention approaches [50,51]. From an intervention perspective, rhythmic cheerleading, leveraging its four core characteristics of rhythm, teamwork, expressiveness, and enjoyment, can synergize

through a triple mechanism of “physiological regulation-psychological reconstruction-social support”: physiologically, synchronized movements activate neurotransmitter release and HPA axis regulation, alleviating treatment-related fatigue and anxiety; psychologically, artistic expression promotes identity reconstruction, helping patients shed the “patient” label; and socially, through teamwork, it builds support networks, reduces social avoidance, and enhances self-efficacy.

This study lays the foundation for academic research on rhythmic cheerleading in the field of psychological rehabilitation for female cancer patients, and also provides a reference for the development of evidence-based intervention programs in clinical practice. In the future, by filling the existing research gaps, rhythmic cheerleading can be further promoted to become a cancer rehabilitation intervention that takes into account effectiveness, sustainability, and inclusiveness, helping patients achieve a balance between physiological function recovery and psychosocial adaptation.

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