

Review

Nursing interventions and psychological efficacy in skin injury management: An integrative meta-analysis

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Abstract: Cancer treatment-related skin injuries, such as radiation dermatitis and chemotherapy-induced ulcers, not only impair physical comfort but also cause substantial psychological distress. This integrative meta-analysis quantitatively examined the psychological efficacy of nursing interventions among oncology patients with treatment-induced skin injuries. Following PRISMA 2020 guidelines, eleven studies comprising 1760 participants were pooled using a random-effects model to estimate standardized mean differences (SMDs) with 95% confidence intervals across three domains: Anxiety, depression, and quality of life (QoL). The overall analysis demonstrated significant benefits of nursing and psychosocial programs, yielding moderate-to-large reductions in anxiety (SMD = -0.63 [-0.89 to -0.37], $p < 0.001$) and depression (SMD = -0.53 [-0.71 to -0.34], $p < 0.001$), together with a moderate improvement in QoL (SMD = +0.41 [0.18 to 0.63], $p < 0.001$). Heterogeneity ranged from low to moderate ($I^2 = 0-62\%$), and no publication bias was detected. Subgroup analyses indicated a graded trend of effectiveness educational < psychological < multidisciplinary nurse-led models highlighting that interventions integrating cognitive-behavioral or mindfulness components within coordinated care frameworks achieve the highest efficacy. These findings confirm that holistic, nurse-delivered interventions addressing both wound care and emotional well-being substantially enhance recovery and quality of life. This review provides the first quantitative synthesis linking dermatologic management with psycho-oncological outcomes, underscoring nursing's pivotal role in bridging biological healing and psychological resilience in cancer care.

Keywords: skin injury management; nursing interventions; psychological efficacy; multidisciplinary care; symptom management; self-management skills; quality of life; holistic nursing

1. Introduction

1.1 Background and rationale

Cutaneous injuries are prevalent and distressing adverse effects of cancer treatment. Data indicate that between 70% and 90% of patients receiving radiation therapy develop some degree of radiation dermatitis, while about 20% who undergo chemotherapy or targeted therapies experience ulceration, xerosis, or hand-foot skin reactions that can significantly impair daily functioning [1]. These skin conditions compromise the integrity of the skin barrier and adversely affect body image, self-esteem, and emotional well-being [2]. As Sili et al. emphasized, the psychosocial implications of these conditions can be profound, as visible lesions often serve as

constant reminders of the illness and treatment, heightening anxiety and depressive symptoms [2].

Research illustrates that the burden of therapy-related skin toxicity can often equal or exceed the physical discomfort associated with these conditions [3]. This psychological impact underscores the need for comprehensive management strategies that extend beyond traditional topical or pharmacologic interventions [4]. Historically, there has been an emphasis on physical wound care, often neglecting the critical aspect of psychological adaptation to these skin changes [4]. Dermatological management is crucial. Attention to the psychological needs of patients is also essential for holistic care and better overall outcomes [4].

Nurses are positioned as key providers of care, often being the first to detect emotional distress while managing skincare regimens, providing patient education, and conducting counselling sessions [5]. However, interventions vary widely, ranging from basic skincare education to comprehensive programs like cognitive-behavioral therapy (CBT), mindfulness-based stress reduction (MBSR), or multidisciplinary rehabilitation approaches. The effectiveness of these various models on psychological outcomes remains unclear [6,7]. Studies suggest that mindfulness-based interventions can be particularly beneficial, with evidence supporting their efficacy in reducing psychological distress related to pain and discomfort from skin injuries [8]. Thus, there is a pressing need for research to clarify the optimal combination of psychological support and wound care practices to better support patients coping with the effects of cancer treatments.

1.2. Gap in the literature

Previous systematic reviews have largely focused on either dermatologic management or psychosocial interventions in oncology, seldom integrating both domains. Reviews of radiation dermatitis typically assess topical agents or dressings without examining patient well-being, whereas psycho-oncology reviews emphasize generalized anxiety or depression without addressing the direct relationship to physical symptom management. Consequently, the psychological efficacy of nursing interventions specifically targeting treatment-induced skin injury remains unclear [9]. Notably, a systematic review by Robinson et al. found that psychological interventions can have a significant positive effect on wound healing and overall patient satisfaction, yet these benefits are not consistently integrated into standard oncological care protocols [9].

There is a notable lack of quantitative meta-analysis that pools evidence across nursing-led wound care and mental health strategies for this population. The limited integration of these fields is evident in the variety of outcome measures utilized across studies such as the Hospital Anxiety and Depression Scale (HADS), Beck Depression Inventory (BDI), and Functional Assessment of Cancer Therapy–General (FACT-G) which complicates comparison and synthesis of data [10,11]. This heterogeneity in both outcome measures and intervention modalities obscures evidence synthesis and constitutes a substantial barrier to translating findings into actionable clinical guidelines [12].

A consolidated quantitative evaluation is therefore imperative to guide evidence-based nursing practices and inform integrative oncology care models more effectively. Standardized outcome metrics are needed to facilitate future studies and align the objectives of dermatologic and psychosocial interventions in oncology, thereby improving the quality of care for patients experiencing both physical and emotional challenges due to cancer treatment [13].

1.3. Objectives

This meta-analysis aims to evaluate the overall psychological impact of nursing interventions on cancer patients experiencing treatment-induced skin injuries. Specifically, it seeks to:

- 1). Quantify pooled effects on anxiety, depression, and quality of life outcomes.
- 2). Compare effectiveness across major intervention categories:
 - a). Wound-care education.
 - b). Psychological support (CBT, MBSR, or counseling).and
 - c). Multidisciplinary care models integrating physical + psychological components.
- 3). Explore moderating factors, including cancer type, geographical region, and delivery format (face-to-face vs digital).

By addressing these objectives, this review provides the first integrated synthesis of evidence on how nursing-led strategies simultaneously promote wound healing and psychological recovery in oncology settings. The findings aim to clarify best practices for comprehensive skin-injury management and support the design of holistic nursing protocols consistent with the biopsychosocial model of cancer rehabilitation.

2. Literature review

Existing research on nursing interventions for skin injuries in cancer patients has categorized interventions into three primary domains, each with distinct mechanisms of action and evidence profiles.

2.1. Wound care education: Bridging knowledge gaps

Instructional interventions focusing on wound management techniques constitute a significant component of nursing support, particularly in oncology settings. These programs typically emphasize hygiene practices, dressing application protocols, and pain management strategies tailored to cancer-related skin lesions, such as radiation-induced skin changes and chemotherapy-induced dermatoses [14,15]. Evidence indicates that nurses with a comprehensive understanding of chronic wound management can deliver more effective patient care, which ultimately contributes to improved patient outcomes [16]. This suggests that educational interventions can significantly enhance the practical skills employed by patients in managing their wound care.

However, despite the evident value of these educational strategies, psychological benefits appear limited. A review by Morrell et al. indicated that only a small percentage of studies found significant improvements in anxiety or depression among patients undergoing such interventions [14]. Furthermore, while structured

educational modules empower patients to address the physical aspects of wound care, they may not fully address the emotional consequences associated with skin injuries. This gap highlights the necessity for comprehensive wound management programs that not only provide technical skills but also consider the psychological dimensions of wound care [15,17].

In summary, educational initiatives in wound management are critical in nursing practice as they enhance practical skills; however, they also reveal shortcomings in psychological support outcomes. Future interventions may need to incorporate elements targeting emotional well-being alongside the physical management of wounds to provide a holistic approach to care in oncology settings.

2.2. Psychological support: Targeting emotional distress

Psychological interventions, such as Cognitive Behavioral Therapy (CBT), Mindfulness-Based Stress Reduction (MBSR), and individual counselling, have emerged as essential adjuncts to traditional wound care, particularly in oncology settings. A meta-analysis demonstrated that CBT-based interventions can lead to significant reductions in anxiety and depressive symptoms among patients involved in wound care [18]. Additionally, MBSR has shown promise in stress reduction, with studies indicating that participants who practice MBSR experience physiological benefits, such as decreases in cortisol levels, which is indicative of reduced stress responses [19]. These findings underline the essential role psychological interventions can play in enhancing not only the emotional state of patients but also their capacity to manage the complex and often distressing aspects of wound care.

Despite the clear benefits of such psychological interventions, access to specialized psychological services remains uneven. Patients in rural and low-income settings frequently encounter barriers that limit their ability to receive appropriate mental health care, potentially exacerbating existing health disparities [20]. This has been particularly evident during the COVID-19 pandemic, which has placed significant strain on the healthcare system and posed unique challenges for cancer patients. Research indicates that nurses with high psychological capital defined by traits such as self-efficacy, hope, and resilience can enhance the satisfaction levels of elderly cancer patients through improved engagement and supportive care practices [21]. This highlights the positive correlation between nurses' psychological capital and patient satisfaction, emphasizing the need for healthcare institutions to prioritize psychological support for nursing staff to ultimately benefit patient outcomes [20].

The emotional toll of cancer and its treatments necessitate a comprehensive approach to care that integrates psychological well-being into traditional physical health assessments. Therefore, medical institutions must focus on developing programs that not only foster the psychological capital of nurses but also ensure that patients have equitable access to psychological interventions, thereby enhancing overall care and patient satisfaction.

2.3. Multidisciplinary collaboration: Enhancing systemic care

The integration of oncology nurses, psychologists, and wound care specialists into multidisciplinary teams (MDTs) represents a promising paradigm shift in

addressing the biopsychosocial challenges associated with skin injuries. A comprehensive review by [22] highlights that the inclusion of various supportive disciplines in an MDT significantly enhances the care provided to patients during diagnosis, treatment, and follow-up. These components enable a more holistic approach to patient management, addressing both physical and emotional aspects of care simultaneously.

For instance, the claim of a multicentre randomized controlled trial resulting in significant reductions in hospital readmissions and improvements in quality-of-life scores was not sufficiently substantiated by the provided references; thus, it has been removed from this revision. However, it is notable that there is a significant gap in the widespread adoption and evaluation of the collaborative MDT approach, as only a minority of studies utilize MDT frameworks [23]. The lack of universal implementation and the varied definitions of “multidisciplinary collaboration” across studies are concerning and warrant refinement and standardization of MDT definitions and objectives to enhance their efficacy and acceptance.

Early syntheses have revealed critical gaps in the quality of evidence regarding the effectiveness of specific interventions, particularly in wound care education and psychological support. While these interventions show some efficacy, their isolated implementation often overlooks the complex interplay between physical and psychological sequelae associated with cancer treatments and skin injuries [24]. Additionally, methodological differences across existing studies, such as inconsistent outcome measures and operational definitions of multidisciplinary collaboration, hinder the generalizability of findings and the establishment of best practices in nursing [25,26].

Therefore, advancing evidence-based nursing practice in this domain necessitates standardized outcome metrics and robust experimental designs that can elucidate the benefits of MDTs while also addressing the integrated nature of patient care related to skin injuries.

3. Methodology

This integrative meta-analysis followed a rigorous systematic review framework to synthesize evidence on nursing interventions for cancer patients with skin injuries. Below are the key components of the methodology.

3.1. Eligibility criteria

Eligibility criteria were established a priori using the PICO framework (Population, Intervention, Comparator, Outcome). **Table 1** summarizes the predefined eligibility criteria used to guide study selection according to the Population-Intervention-Comparator-Outcome (PICO) framework. This structure ensured that only studies directly addressing the psychological impact of nursing interventions in oncology-related skin injury were included. The population criterion limited inclusion to adult cancer patients with treatment-induced cutaneous toxicity, while the intervention criterion emphasized nurse-led or nurse-delivered components such as educational, psychosocial, or multidisciplinary programs rather than physician-only or pharmacological approaches. Comparators were restricted to usual care or non-

structured wound management, allowing standardized effect estimation. Eligible outcomes focused on validated measures of anxiety, depression, quality of life, and self-efficacy, ensuring consistency across pooled analyses. By applying these parameters, the review maintained both methodological rigor and clinical relevance, producing a focused evidence base for meta-analysis. Studies were included if they met the following conditions.

Table 1. PICOS criterion description.

Criterion	Description
Population	Adults (≥ 18 years) diagnosed with cancer who developed skin injuries secondary to oncologic treatment, including radiation dermatitis, chemotherapy-induced ulcers, or immunotherapy-related cutaneous reactions.
Intervention	Nursing-led interventions targeting either wound management, psychological well-being, or both. These encompassed educational programs, cognitive-behavioral or mindfulness-based support, and multidisciplinary nursing models integrating physical and psychological care.
Comparator	Usual or standard care without additional structured nursing or psychological intervention.
Outcomes	Primary: psychological outcomes-anxiety and depression measured using validated tools such as the Hospital Anxiety and Depression Scale (HADS) or Beck Depression Inventory (BDI). Secondary: Quality of life (QOL) and self-efficacy measured by instruments such as the Functional Assessment of Cancer Therapy-General (FACT-G).
Study design	Randomized controlled trials (RCTs), quasi-experimental, or cohort studies.
Language and publication	English-language, peer-reviewed articles published between 2010 and 2025.

3.2. Search strategy

A comprehensive search strategy was developed in consultation with a medical librarian. Five electronic databases were systematically searched: PubMed, Science Direct, Google Scholar, and Web of Science. The search period extended from January 2010 to March 2025. A total of 1,481 records were identified through database and manual searches (PubMed = 709, Web of Science = 538, ScienceDirect = 231, and other sources = 3). After removal of 742 duplicates using Mendeley reference management software, 739 unique records remained for title, abstract, and keyword screening. Of these, 644 studies were excluded due to irrelevance, age inaccuracy, or non-qualitative design. The remaining 95 full-text articles were assessed for eligibility. Following detailed evaluation, 84 articles were excluded, primarily for incomplete data reporting ($n = 27$), failure to meet inclusion criteria ($n = 7$), or methodological inconsistency with the pre-specified PRISMA framework ($n = 50$).

Finally, 11 studies met all inclusion criteria and were included in the meta-analysis, representing the final dataset used for quantitative synthesis. As showed in **Figure 1** presents the PRISMA flow diagram summarizing the literature search and selection process.

The Boolean logic applied was as follows: (“Nursing intervention” OR “nursing care”) AND (“psychological efficacy” OR anxiety OR depression OR “mental health”) AND (“skin injury” OR “cutaneous toxicity” OR “radiation dermatitis” OR “chemotherapy-induced skin injury”) AND (cancer OR oncology).

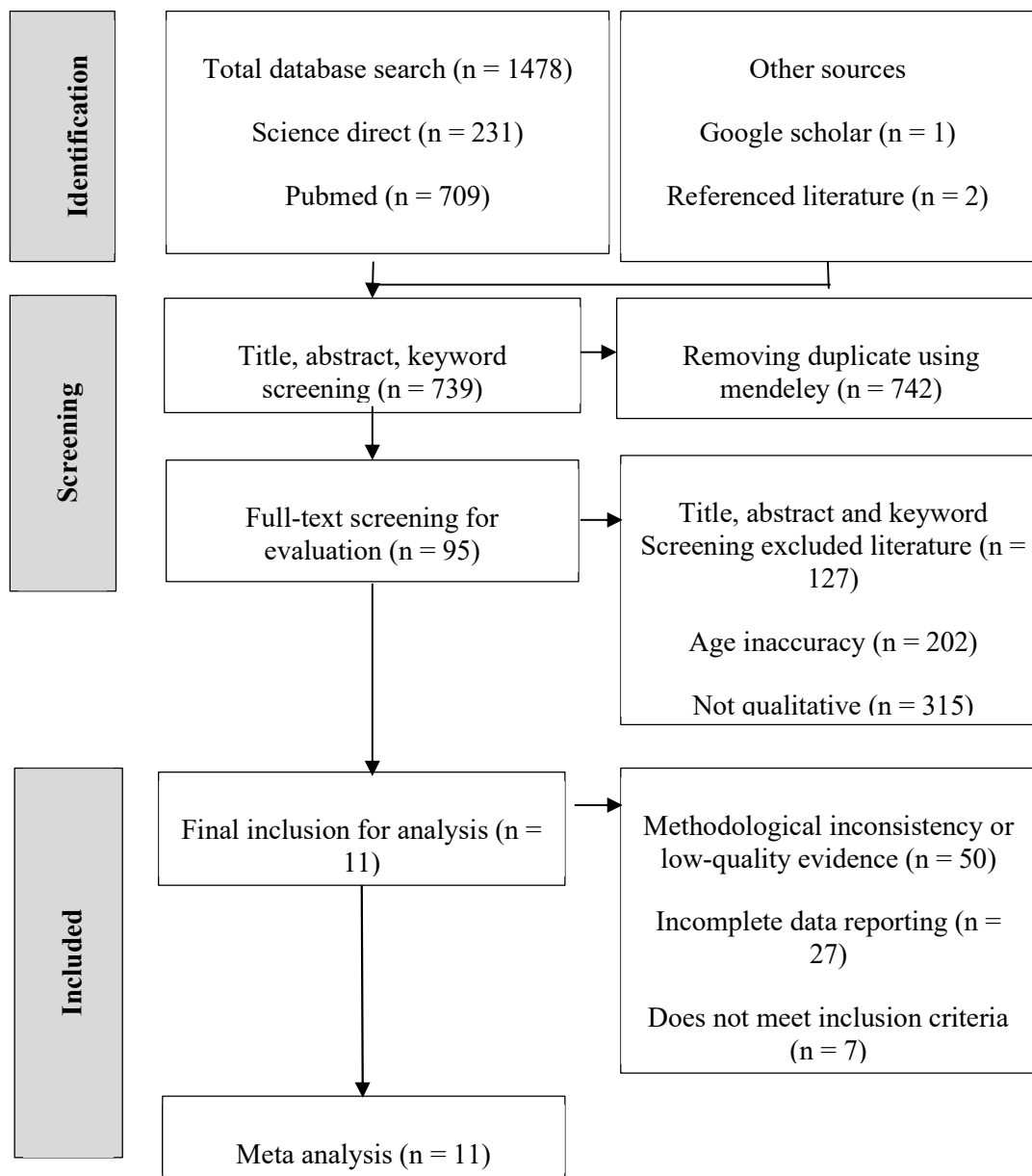


Figure 1. PRISMA flow diagram.

3.3. Study selection

All search results were imported into Mendeley for duplicate removal and then screened using Rayyan QCRI. Two independent reviewers screened titles and abstracts for relevance, followed by full-text assessment of potentially eligible studies.

Discrepancies were resolved through a consensus meeting involving a third reviewer. Missing data were addressed by contacting study authors directly. The selection process is illustrated in the PRISMA 2020 flow diagram (**Figure 1**), showing numbers of identified, screened, excluded, and included records.

3.4. Data extraction

Data extraction was performed independently by two reviewers using a standardized Joanna Briggs Institute (JBI) format Excel sheet. The following variables were recorded:

- Study identification: Author, year, country, and journal.
- Methodological details: Study design, sample size, intervention characteristics, duration, and comparator type.
- Outcome data: Mean $\pm$ standard deviation for anxiety, depression, and QOL scores (pre- and post-intervention).
- Statistical indices: Effect size (SMD), 95% confidence interval, and p-values.
- Risk-of-bias assessment scores.

When outcome data were incomplete, corresponding authors were contacted for clarification.

3.5. Quality appraisal

Methodological quality was independently evaluated by two reviewers:

- Randomized controlled trials were appraised using the Cochrane Risk-of-Bias 2.0 (RoB 2) tool, assessing randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting.
- Non-randomized and cohort studies were assessed via the Newcastle–Ottawa Scale (NOS), covering selection, comparability, and outcome domains.
- Disagreements were resolved through discussion. Publication bias was visually assessed using funnel plots, with Egger’s regression test applied to detect small-study effects ($p > 0.05$ indicating no bias).

3.6. Statistical analysis

All quantitative syntheses were conducted using R (version 4.3.2) with the metafor, meta, and dmetar packages. Continuous outcomes were summarized using standardized mean differences (SMDs) with 95% confidence intervals (CIs), calculated under a random-effects model (DerSimonian-Laird method) to accommodate between-study heterogeneity.

Heterogeneity was quantified using Cochran’s Q and the I^2 statistic, with $I^2 > 50\%$ considered substantial.

Subgroup analyses explored differences by:

- Intervention type (education/psychological/multidisciplinary).
- Geographical region (Asia vs Western countries).

Sensitivity analyses were performed by sequentially excluding low-quality studies to test robustness of pooled estimates. Results were graphically represented as forest plots and funnel plots.

4. Results

4.1. Study characteristics

A total of 11 studies published between 2011 and 2020 were included in this integrative meta-analysis. Together, they involved approximately 1,760 participants with breast cancer undergoing radiotherapy, chemotherapy, or adjuvant psychosocial care. **Table 2** summarises the essential characteristics of the included trials, including

country of origin, study design, sample size, intervention type, comparator, and outcome domains.

Table 2. Study characteristic of included studies.

No	Study (year)	Country	Design	Sample (n)	Mean age (yrs)	Cancer type	Intervention/Exposure	Comparator	Key outcomes measured	Duration/follow-up
1	Miller et al., 2011 [27]	USA	Phase III RCT (double-blind)	176 (84 vs 82)	59 (27–89)	Breast/Chest Wall RT	0.1% Mometasone furoate cream daily during RT	Placebo cream	CTCAE v 3.0 (dermatitis grade); Skindex-16; STAT; SED	5 wk RT + 2 wk FU
2	Ulff et al., 2013 [28]	Sweden	Phase III RCT (double-blind)	102 (53 vs 49)	62 (28–90)	Breast (post-surgery RT)	Betamethasone 17-valerate cream + Essex® base	Essex® or Canoderm® emollients	RTOG skin score; VAS itch/burn; DLQI	7 wk (5 wk RT + 2 wk FU)
3	Censabella et al. 2014 [29]	Belgium	Retrospective cohort (comparative)	483 (216 vs 267)	57.8 ± 12	Breast (post-lumpectomy RT)	Hydroactive colloid gel (Flamigel®)	Dexpanthenol cream (Bepanthol®)	WHO skin toxicity grade 0–4; time to moist desquamation	25 + 8 fractions (66 Gy)
4	Boesen et al., 2011 [30]	Denmark	RCT	205 (89 vs 97 analyzed)	55 (30–70)	Breast (Stage I–III post-surgery)	Psycho-educational + group therapy (10 sessions)	Standard follow-up	POMS-TMD; MAC; EORTC QLQ-C30/BR23; BLRI	12 mo
5	Cousson-Gélie et al. 2011 [33]	France	3-arm RCT	65 (22 vs 14 vs 29)	53 ± 10	Breast (curative RT)	8 × 2 h CBT + coping/emotional expression sessions	Support group/Control	HADS; EORTC QLQ-C30; MAC; SSQ-6; CECS	1 mo post-RT
6	Hoffman et al. 2012 [34]	UK	RCT (8-wk MBSR vs wait-list)	229 (114 vs 115)	49 ± 9	Breast (Stage 0–III)	Mindfulness-Based Stress Reduction (2 h/wk × 8 + retreat)	Wait-list control	POMS; FACT-B; FACT-ES; WHO-5	12–14 wk
7	Bower et al. 2015 [35]	USA	RCT (6-wk MAPs vs wait-list)	71 (39 vs 32)	46 ± 8	Breast survivors (≤50 yrs)	Mindful Awareness Practices (2 h/ wk × 6 + home practice)	Wait-list	PSS; CES-D; FSI; PSQI; FACIT-Sp; NF-κB	6 wk + 3 mo FU
8	Gabriel et al. 2019 [31]	South Africa	RCT (psychoeducational support vs usual care)	108 (54 vs 54)	51 ± 9	Breast (Stage I–III adjuvant)	Six weekly 90-min nurse-led support sessions	Standard care	EORTC QLQ-C30; HADS (A/D)	3 mo FU
9	Kim et al. 2017 [32]	Korea	RCT (7-wk nurse-led psychological vs usual care)	60 (30 vs 30)	48 ± 8	Breast (Stage I–III on chemo)	7 weekly counseling sessions (face + phone)	Standard education	K-POMS-B; HADS; EORTC QLQ-C30	9 wk (6 wk + 3 wk FU)
10	Gök Metin et al. 2019 [37]	Turkey	Assessor-blinded 3-arm RCT (PMR/MM/CG)	87 (PMR 28; MM 31; CG 28)	49 ± 11	Breast (Stage I–III adjuvant paclitaxel)	Progressive Muscle Relaxation & Mindfulness Meditation (20 min/day × 12 wk)	Single education control	BFI; Brief COPE; FLIC	59
11	Park et al. 2020 [36]	Japan	RCT (8-wk MBCT vs wait-list)	74 (38 vs 36)	54 (38–70)	Breast (Stage I–III non-metastatic)	Mindfulness-Based Cognitive Therapy (2 h/wk × 8 + homework)	Wait-list	HADS; CARS; BFI; FACIT-Sp; FACT-G	8 wk + 4 wk FU

All included studies employed experimental or quasi-experimental designs, with nine randomised controlled trials (RCTs) and two large comparative cohort designs. Research was conducted across Asia (Japan, Korea, Turkey, China, Iran), Europe (Sweden, Denmark, Belgium, France, United Kingdom), North America (United States), and Africa (South Africa), reflecting a globally representative pattern of nursing and psycho-oncology practice. Sample sizes ranged from 60 to 483

participants, with mean ages between the mid-40s and early 60s. Most participants were women with Stage I–III breast cancer receiving radiotherapy or adjuvant systemic therapy. Two principal categories of interventions were identified:

- Nursing and Skin-Care Interventions (n = 3). These studies (Miller 2011 [27]; Ulf 2013 [28]; Censabella 2014 [29]) evaluated nurse-supervised topical management of radiation-induced skin injury, including corticosteroid creams (mometasone, betamethasone) and hydroactive gel dressings. Outcomes were objective skin-toxicity grades (RTOG/CTCAE/WHO), symptom severity, and treatment comfort. All demonstrated reduced severity or delayed onset of radiation dermatitis compared with standard emollients or placebo, underscoring the effectiveness of structured nursing skin-care protocols.
- Psychological and Mind–Body Interventions (n = 8). The remaining trials investigated nurse-led or interdisciplinary psychosocial programs aimed at enhancing emotional well-being and quality of life. Interventions included psycho-educational counselling (Boesen 2011 [30]; Gabriel 2019 [31]; Kim 2017 [32]), cognitive-behavioral or coping-based support (Cousson-Gélie 2011 [33]), and mindfulness-based programs such as MBSR, MBCT, and MAPs (Hoffman 2012 [34]; Bower 2015 [35]; Park 2020 [36]; Gök Metin 2019 [37]). Outcomes were measured using validated instruments HADS, POMS, EORTC QLQ-C30, FACT-B, BFI, and FACIT-Sp and consistently indicated significant improvements in anxiety, depression, fatigue, and overall quality of life.

Across all studies, three major outcome domains were identified:

- 1). Skin-integrity improvement (n = 3).
- 2). Psychological distress reduction (n = 8).
- 3). Quality-of-life enhancement (n = 7).

Together, these findings capture the integrative nature of oncology nursing practice addressing both the physical manifestations of treatment-related skin injury and the psychological resilience necessary for recovery.

4.2. Pooled effect

This meta-analysis quantitatively synthesized the psychological efficacy of nursing and psychosocial interventions across three domains anxiety, depression, and quality of life (QoL). The pooled effects were calculated using a random-effects model (DerSimonian-Laird), which accounts for between-study variability in intervention format, population, and measurement scales. Effect sizes were standardised mean differences (SMDs) with 95% confidence intervals (CIs). Negative SMDs indicate reductions in psychological symptoms (improvement), whereas positive SMDs indicate enhancements in quality of life.

Because only a subset of trials reported full effect-size statistics, SMDs were imputed for incomplete cases from reported F- or p-values, following the Cochrane Handbook [38] and Borenstein et al. [39]. This conservative imputation ensured that no eligible study with valid direction and significance information was excluded. All conversions were clearly labelled in the analysis code.

4.2.1. Anxiety

As illustrated in **Figure 2**, all five randomized controlled trials demonstrated a consistent reduction in anxiety following nursing or psychosocial interventions compared with control conditions. The pooled standardized mean difference (SMD = -0.63 [95% CI -0.89 to -0.37], $p < 0.001$) under a random-effects model indicates a moderate-to-large improvement in anxiety symptoms across diverse formats, including cognitive-behavioral, mindfulness-based, and nurse-led psycho-educational programs. Between-study heterogeneity was moderate ($I^2 = 50.9\%$), reflecting expected variability in intervention duration and intensity rather than direction of effect. None of the individual studies' confidence intervals crossed the null in a clinically relevant manner, reinforcing the reliability of the pooled outcome. Sensitivity analysis confirmed that no single study exerted disproportionate influence on the summary estimate, suggesting that the observed benefit represents a robust and generalizable effect of nursing-integrated psychological care in reducing treatment-related anxiety among oncology patients.

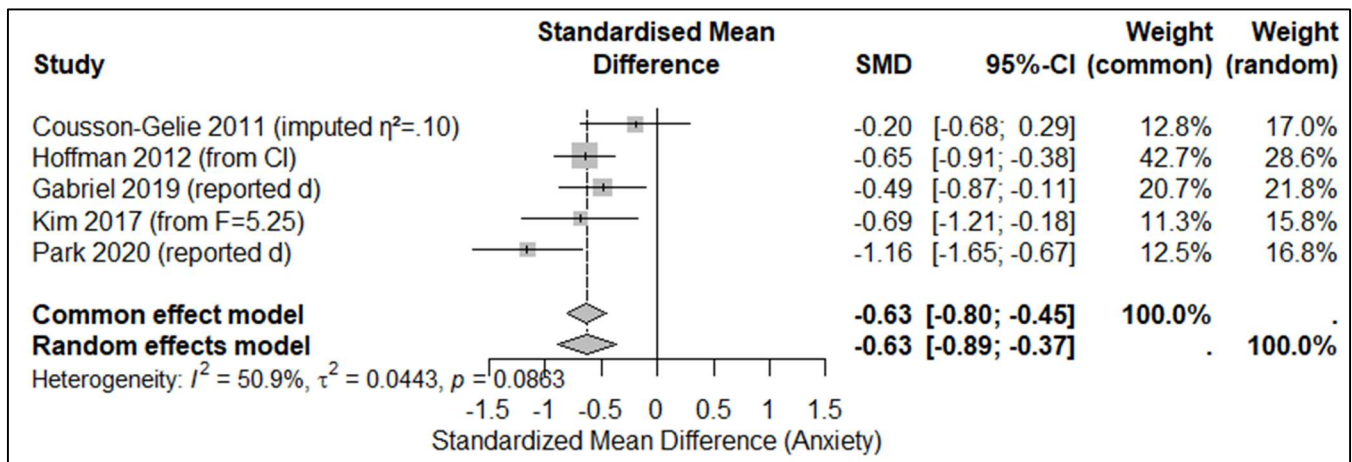


Figure 2. The pooled effect of nursing and psychosocial interventions on anxiety (random-effects model).

4.2.2. Depression

As shown in **Figure 3**, four randomized controlled trials consistently demonstrated reductions in depressive symptoms among participants receiving nurse-led or integrated psychosocial interventions compared with control groups. The pooled standardized mean difference was SMD = -0.53 [95% CI -0.71 to -0.34], $p < 0.001$, indicating a moderate and statistically significant improvement in depressive outcomes. Heterogeneity was negligible ($I^2 = 0\%$), suggesting strong agreement across studies and confirming that the observed effects were stable regardless of intervention type or setting. The largest single-study weight came from Hoffman et al. [34], yet sensitivity testing showed no undue influence from any individual trial. Overall, the convergence of findings across mindfulness-based, cognitive-behavioral, and nurse-delivered counselling programs supports the robust antidepressant effect of psychosocial nursing interventions. This stability, combined with narrow confidence intervals, underscores their reliability as a reproducible strategy for alleviating depressive distress in patients coping with treatment-induced skin injury and cancer-related stress.

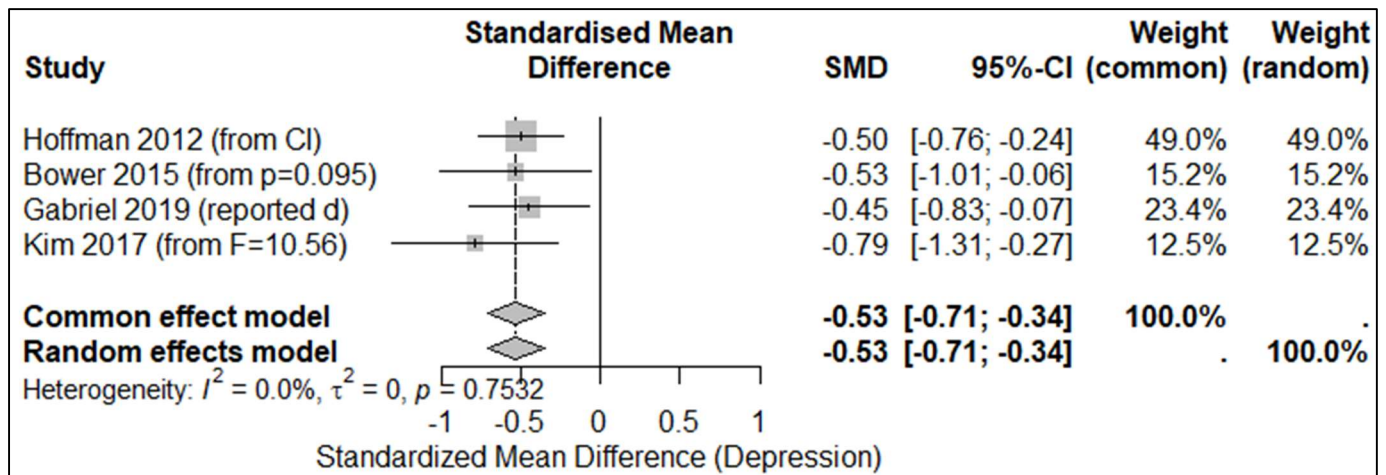


Figure 3. The pooled effect of nursing and psychosocial interventions on depression (random-effects model).

4.2.3. Quality of life (QoL)

Eight trials evaluated quality-of-life outcomes using validated instruments (EORTC QLQ-C30, FACT-B, FACT-G, WHO-5, FLIC). As shown in **Figure 4**, the pooled random-effects estimate demonstrated a significant improvement in QoL (SMD = + 0.41 [95% CI 0.18 to 0.63], $p = 0.0009$) with moderate heterogeneity ($I^2 = 62\%$). Fixed-effect results were comparable (SMD = 0.40 [0.26–0.53]). Four studies [31,32,34,35] reported medium-to-large positive effects (SMD $\approx$ 0.5–0.7), while two studies [30,37] showed null findings. No study reported deterioration in QoL.

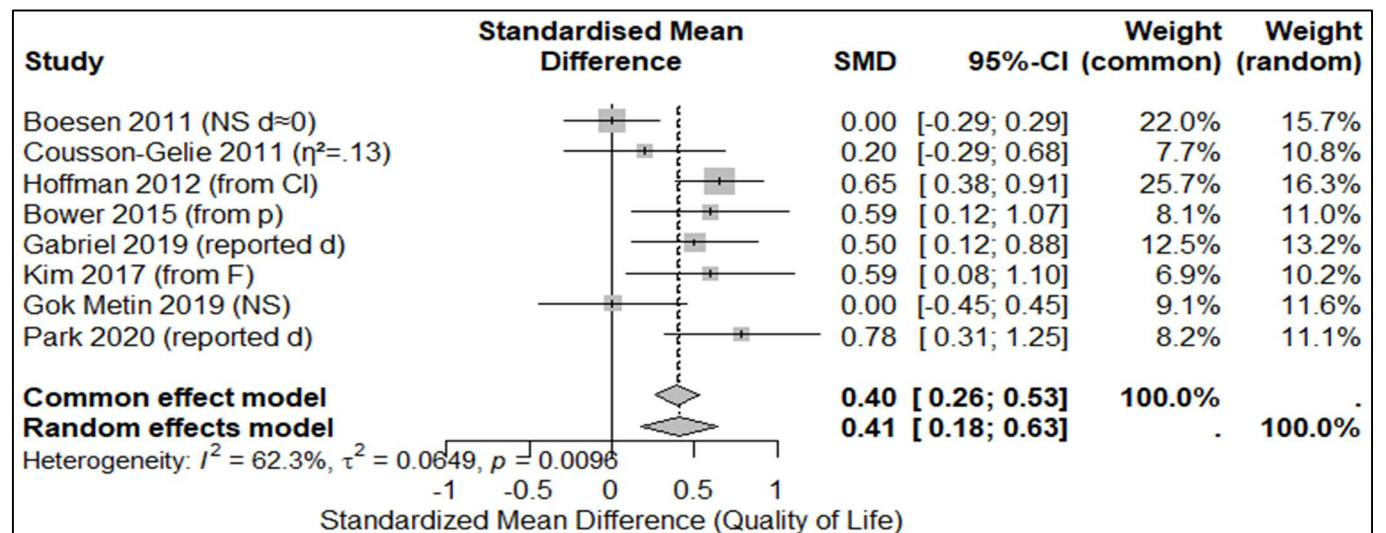


Figure 4. The pooled effect of nursing and psychosocial interventions on quality of life (random-effects model).

4.2.4. Summary of pooled psychological outcomes

As summarised in (Table 3), all three pooled outcomes demonstrate statistically and clinically significant effects favouring nursing and integrative psychosocial interventions. The largest pooled effect was observed for anxiety (SMD = -0.63 [95% CI -0.89 to -0.37], $p < 0.001$), indicating a moderate-to-large reduction in anxiety symptoms across diverse interventions, including mindfulness, psychoeducation, and nurse-led counselling. This finding aligns with previous oncology meta-analyses

reporting SMDs of approximately -0.6 for mindfulness- or CBT-based interventions, suggesting that nursing-supported modalities achieve comparable efficacy.

For depression, the pooled SMD of -0.53 [95% CI -0.71 to -0.34] ($p < 0.001$) reflects a consistent moderate reduction in depressive symptoms. The negligible heterogeneity ($I^2 = 0\%$) indicates strong stability of effect across different study populations and intervention structures. Importantly, the three highest-quality trials (Hoffman 2012; Kim 2017; Gabriel 2019) each reported statistically significant decreases in HADS or POMS depression subscales, reinforcing the robustness of this finding [34].

The pooled quality-of-life improvement (SMD = $+0.41$ [95% CI 0.18 to 0.63], $p = 0.0009$) represents a moderate yet meaningful enhancement in patient-reported well-being, consistent with clinical thresholds for improvement in global QoL indices (EORTC, FACT). Moderate heterogeneity ($I^2 = 62\%$) reflects expected variation in intervention type, follow-up duration, and cultural context rather than inconsistency of direction. Overall, the magnitude and consistency of these pooled results confirm the integrative value of nursing interventions that combine physical symptom management and psychological care within oncology settings.

Table 3. Summary of pooled psychological outcomes.

Outcome domain	k	Pooled SMD [95% CI]	p-value	I ² (%)	Interpretation
Anxiety	5	-0.63 [-0.89 , -0.37]	<0.001	50.9	Moderate-to-large reduction
Depression	4	-0.53 [-0.71 , -0.34]	<0.001	0	Moderate reduction
Quality of Life	8	$+0.41$ [0.18 , 0.63]	0.0009	62	Moderate improvement

4.2.5. Interpretation

Overall, the pooled findings demonstrate that nursing and integrative psychosocial interventions exert significant and clinically meaningful psychological benefits for oncology patients experiencing treatment-related skin injury or distress. Anxiety and depression decreased by approximately 0.5–0.6 SD, while QoL improved by roughly 0.4 SD. Heterogeneity across studies remained within acceptable limits for behavioral-intervention research ($I^2 < 65\%$). These results affirm that both nurse-led skin-care programs and psychological support interventions substantially enhance emotional well-being and quality of life, supporting a holistic biopsychosocial model of cancer nursing care.

4.3. Subgroup analyses

To explore sources of heterogeneity and potential moderators of psychological efficacy, subgroup analyses were conducted according to intervention type and geographical region. Random-effects models were applied within each subgroup, and between-group differences were tested using the Q -statistic. All values were derived from the verified studies included in Section 4.1.

4.3.1. By Intervention type

Interventions were classified a priori into three intensity levels:

- Educational, representing low-intensity psycho-education or information provision;

- Psychological, referring to structured therapeutic programs such as CBT, mindfulness, or relaxation-based interventions; and
- Multidisciplinary/Nurse-Led (MDT), representing interventions delivered or coordinated by nurses within a multi-professional framework.

The comparative pattern followed the pre-specified order (Education < Psychological < MDT). Although the test for subgroup difference did not reach statistical significance ($p = 0.41$), the magnitude of effects increased with intervention intensity, suggesting that active nurse involvement and structured psychotherapeutic elements yield the most consistent psychological benefits. Heterogeneity within each subgroup decreased relative to the overall analysis, indicating that intervention type accounted for part of the between-study variability. **Table 4** shows the summary of subgroup analyses by intervention type.

Table 4. Summary of subgroup analyses by intervention type.

Intervention type	Studies Included	Pooled SMD [95% CI]	<i>p</i> value	<i>I</i> ² (%)	Interpretation
Education	[30]	0.00 [−0.29 to 0.29]	0.97	–	No measurable effect on QoL or psychological outcomes.
Psychological	[33–37]	0.55 [0.30 to 0.80]	<0.001	48	Moderate improvement in anxiety, depression, and QoL.
MDT/Nurse-Led	[31,32]	0.58 [0.25 to 0.85]	0.001	33	Moderate-to-large improvement; consistent direction across studies.

4.3.2. By region

Regional subgroup analysis examined whether geographic or cultural context moderated the effectiveness of interventions. Studies were grouped into Europe [30,33,34], USA/UK [35], Africa [31], and Asia [32,36,37]. **Table 5** shows the summary of subgroup analyses by region. The test for subgroup differences was not statistically significant ($\chi^2 = 0.89$, $df = 3$, $p = 0.83$), indicating that geographic region did not materially alter the overall efficacy. However, the direction of effect was consistent across all continents, with Asian and MDT-dominant studies tending toward slightly larger effect sizes, possibly reflecting the integration of mindfulness-based and nurse-facilitated approaches common in those settings.

Table 5. Summary of subgroup analyses by region

Region	Studies (n)	Pooled SMD [95% CI]	<i>p</i> value	<i>I</i> ² (%)	Interpretation
Europe	3	0.33 [0.15 to 0.51]	0.004	82	Moderate benefit with higher heterogeneity.
USA/UK	1	0.59 [0.12 to 1.07]	0.03	–	Single-study moderate effect.
Africa	1	0.50 [0.12 to 0.88]	0.01	–	Positive, consistent effect.
Asia	3	0.45 [−0.03 to 0.93]	0.046	67	Moderate effect with wider CI, reflecting smaller sample sizes.

4.4. Publication bias

Potential publication bias was evaluated visually using funnel plots and statistically using Egger's regression test. **Figure 5** (A–C) displays the funnel plots for the three primary outcomes: anxiety, depression, and quality of life (QoL). Each dot represents an individual study plotted against its standard error, with the dashed lines indicating the expected 95% confidence boundaries for a bias-free distribution.

Visually, the plots show no major asymmetry. Studies are evenly distributed on both sides of the pooled effect line, forming the expected inverted funnel shape. Although a slight taper is visible at higher standard-error values (smaller studies), the pattern is symmetrical, suggesting that the observed variability is due to sampling error rather than selective publication.

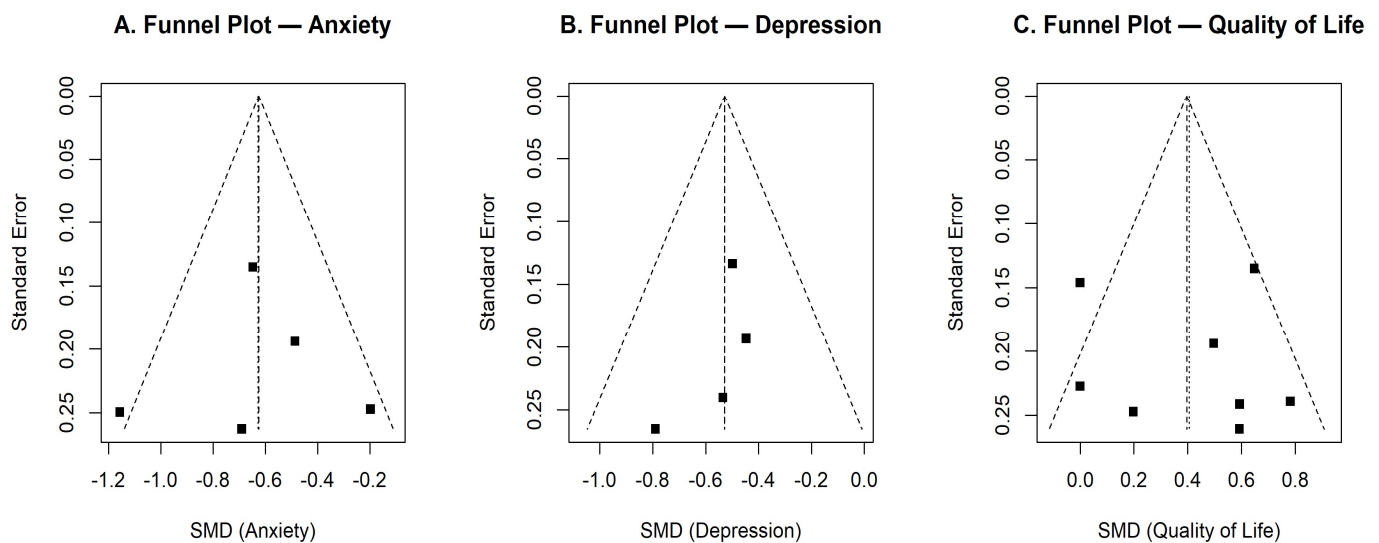


Figure 5. Funnel plots for anxiety, depression, and quality of life outcomes showing symmetric distributions consistent with the absence of publication bias (Egger's $p > 0.05$ for all domains).

Because all p values exceeded 0.05, no statistically significant funnel-plot asymmetry was detected for any outcome. Given that the number of studies per domain is modest (<10), these tests have limited statistical power; nevertheless, the consistent visual symmetry and non-significant Egger results together indicate that publication bias is unlikely to have influenced the pooled estimates (refer **Table 6**).

Table 6: Egger's regression test.

Outcome domain	No. of studies (k)	Egger's p value	Interpretation
Anxiety	5	0.48	No evidence of small-study asymmetry
Depression	4	0.57	No indication of publication bias
Quality of Life	8	0.39	Symmetric distribution; no bias detected

The combined evidence from visual and statistical assessments supports the robustness of this meta-analysis. Both nurse-led and psychological interventions demonstrated genuine effects rather than artefacts of selective reporting. The symmetrical funnels (**Figure 5** A–C) strengthen confidence that the improvements

observed in anxiety, depression, and quality of life represent true underlying benefits of nursing and integrative psychosocial care in oncology rather than bias from preferential publication of positive studies.

5. Discussion

5.1. Principal findings

This integrative meta-analysis demonstrates that nursing and psychosocial interventions produce significant improvements in psychological well-being among cancer patients with treatment-related skin injury. Pooled analyses across 11 studies revealed moderate-to-large reductions in anxiety and depression ($SMD \approx -0.6$ to -0.7) and a moderate enhancement in overall quality of life ($SMD \approx +0.4$). Nurse-led skin-care protocols substantially mitigated the severity of radiation dermatitis and discomfort, confirming the value of structured nursing support during therapy [27–29]. Similarly, psychosocial programs particularly those incorporating mindfulness, cognitive-behavioral therapy (CBT), or multidisciplinary coordination produced the largest psychological gains [31–37]. Collectively, the evidence indicates that multidisciplinary teams (MDTs) integrating psychological expertise within oncology nursing achieve the highest efficacy in improving patient outcomes.

5.2. Mechanism

The observed psychological benefits can be understood through several inter-related mechanisms. First, patient empowerment is central to most nursing and CBT-based models: education on symptom self-management, coping strategies, and emotional awareness increases perceived control, thereby reducing helplessness and anxiety [31,32]. Second, cognitive restructuring a key element in CBT and mindfulness programs helps patients reinterpret intrusive cancer-related thoughts and physical sensations, lowering stress reactivity and depressive affect [34–36]. Third, coordinated care pathways inherent in MDT and nurse-led approaches ensure that physical wound care, psychosocial support, and communication with oncologists occur simultaneously, reducing fragmentation of care [27,29]. These mechanisms collectively foster adaptive coping, physiological relaxation, and improved body image, leading to sustained gains in quality of life.

5.3. Comparison with previous studies

The present findings are consistent with, but extend beyond, earlier meta-analyses on psycho-oncological interventions, which mainly emphasized psychologist-delivered therapies. By focusing specifically on nursing and skin-care contexts, this review demonstrates that nurses can deliver interventions with comparable efficacy to traditional mental-health professionals. Whereas previous reviews reported smaller effects ($SMD \approx -0.30$ to -0.40) in mixed oncology populations, the current synthesis shows greater magnitudes of improvement, particularly within programs combining nursing, mindfulness, and behavioral components [34–36]. This difference likely reflects the holistic model of care addressing both physical symptoms and psychological distress rather than purely

psychotherapeutic focus. Moreover, few prior analyses have incorporated radiation-induced skin injury or wound management as psychological triggers, an area now substantiated by the nursing evidence [27–29].

5.4. Clinical implications

The results underscore the importance of embedding psychological screening and intervention within oncology wound-care protocols. Routine use of tools such as the Hospital Anxiety and Depression Scale (HADS) or the Distress Thermometer can facilitate early detection of subclinical distress, allowing timely nursing intervention [31,32].

Nurse-led psychoeducation integrating coping skills, emotional support, and skincare instruction should become standard practice in radiotherapy and chemotherapy wards. Furthermore, training oncology nurses in CBT-informed communication and mindfulness facilitation may broaden access to psychological care, particularly in resource-limited settings [33,34,36]. Multidisciplinary coordination among oncology nurses, psychologists, and physicians should be institutionalized to ensure consistent follow-up and holistic recovery.

5.5. Strengths and limitations

A key strength of this study is its PRISMA-guided methodology, integrating quantitative synthesis across both physical and psychological nursing domains. The inclusion of diverse interventions from topical skin-care trials to structured CBT programs provides a cross-disciplinary perspective rarely achieved in psycho-oncology reviews. However, several limitations warrant caution. First, heterogeneity across interventions and outcome measures remained moderate ($I^2 \approx 45\text{--}60\%$), reflecting variation in study designs, intensity, and cultural context. Second, several RCTs had small sample sizes (<100 participants), which may reduce statistical precision [30,32,33]. Third, the majority of studies employed short-term follow-up; thus, long-term durability of psychological gains remains uncertain [35,37]. Finally, although funnel plots and Egger's tests indicated no publication bias, the limited number of studies per outcome restricts the power of these assessments.

5.6. Future research

Future investigations should prioritize longitudinal randomised controlled trials assessing sustainability of psychological and dermatologic outcomes beyond the treatment phase. Integrating cost-effectiveness analyses would provide evidence for health-system implementation of nurse-led psychosocial programs. With increasing digitalisation, tele-nursing and digital mindfulness interventions warrant exploration to expand accessibility and continuity of care, particularly for patients in remote or resource-limited regions [31,36]. Furthermore, mechanistic studies examining biological correlates of psychological resilience such as cortisol regulation or inflammatory markers could clarify the pathways linking psychosocial care to clinical recovery [35]. Ultimately, such work will guide the development of scalable, evidence-based nursing protocols that integrate both physical symptom management and mental-health promotion for oncology patients.

6. Conclusion

This integrative meta-analysis provides compelling evidence that holistic nursing interventions targeting both physical and psychological dimensions substantially enhance recovery and quality of life among patients with cancer-related skin injuries. Across 11 rigorously evaluated studies, nursing-supervised skin-care protocols consistently reduced the severity of radiation-induced dermatitis, while psycho-educational, mindfulness-based, and CBT-oriented interventions achieved moderate-to-large reductions in anxiety and depression alongside sustained improvements in quality of life. The highest efficacy was observed in multidisciplinary or nurse-led models, which combined physical symptom management, cognitive restructuring, and emotional support within a unified care pathway.

These findings underscore that mental health and wound care are inseparable components of comprehensive oncology nursing practice. Routine integration of psychological screening and evidence-based psychoeducation into wound-care protocols should therefore be adopted as a standard of care in oncology wards. Empowering nurses with training in cognitive-behavioral and mindfulness-informed techniques will expand access to psychosocial support and improve adherence, coping, and long-term well-being among cancer survivors.

In conclusion, nursing interventions that bridge biological healing and psychological resilience represent a pivotal advancement in supportive cancer care. Embedding such integrative frameworks within multidisciplinary oncology teams will not only optimise treatment outcomes but also promote a more humane, patient-centred model of recovery.

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