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REVIEW

Symptoms Experienced by Breast Cancer Patients Before, During and After Chemotherapy: A Systematic Review

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Introduction: Breast cancer is the most prevalent cancer among women worldwide. Chemotherapy remains a key element of treatment for a large proportion of breast cancer patients. Breast cancer patients undergoing chemotherapy often experience multiple symptoms that can impact their quality of life. This systematic review aimed to identify the symptoms experienced by breast cancer patients before, during and after chemotherapy treatment along with associated factors, to provide an evidence base for healthcare providers.

Methods: Five electronic databases were searched from January 2015 to September 2025 encompassing observational studies. Two researchers independently screened the studies and extracted data. The Standard Quality Assessment Criteria for Evaluating Primary Research Papers was used to evaluate the quality of included studies.

Results: Out of 5,588 records, 37 studies met the inclusion criteria. Majority of studies were conducted in Asia and the most common study type was cross-sectional studies (n=18, 48.6%). Anxiety, depression, chemotherapy-induced nausea and vomiting (CINV), fatigue and sleep problems were the most common symptoms observed in these studies. The factors reported were divided into non-modifiable factors (sociodemographic and disease related) and modifiable factors (physiological, psychological, lifestyle, nutritional and other related). Younger age was the most frequently reported risk factor for increased anxiety, depression, fatigue, nausea, and menopausal symptoms, followed by having children, greater number of chemotherapy cycles, higher BMI, lower performance status, and limited social support.

Conclusion: Breast cancer patients undergoing chemotherapy experience a variety of symptoms. These findings underscore the importance of routine symptom screening and baseline risk assessment to enable early identification of high-risk patients and implementation of targeted interventions to optimize quality of life. Future research should prioritize identifying high-risk populations and implementing targeted early preventive interventions to enhance patient quality of life.

Keywords: breast cancer, chemotherapy, symptoms, risk factors, systematic review

Introduction

Breast cancer (BC) was the most prevalent malignancy among women globally. In 2022, 2.3 million women worldwide were diagnosed with breast cancer, comprising 11.6% of all cancer cases.[1] Notably, despite constituting a substantial global health burden, breast cancer related mortality represents merely 6.9% of cancer deaths.[2,3] The latest clinical research data showed that under a standardized diagnosis and treatment system, the 5-year relative survival rate of breast cancer patients can reach 90% and the 10-year relative survival rate remains above 80%, gradually presenting the characteristics of "chronic disease" management.[4]

Adjuvant chemotherapy is an important treatment method for breast cancer patients. Neoadjuvant chemotherapy, administered prior to surgery to shrink tumors and improve surgical outcomes, is also a key approach in breast cancer

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treatment. Although chemotherapy can effectively eliminate malignant cells, it may also have an impact on normal healthy cells, thereby causing side effects and leading to various symptoms in patients during chemotherapy. These can have a negative impact on their quality of life.[5]

Despite increasing research attention on symptoms experienced by breast cancer patients undergoing chemotherapy, a comprehensive synthesis focusing on individual symptoms remains absent. Although So et al[6] and Qi et al[7] conducted a systematic review on symptom clusters during chemotherapy, they prioritized concurrent symptoms with shared underlying mechanisms while providing limited insight into the prevalence, severity, symptom changes, as well as demographic, clinical, and psychosocial predictors of individual symptoms. This systematic review fills these gaps by comprehensively appraising individual symptoms across the chemotherapy stages, thereby establishing a robust evidence foundation for precision symptom assessment, timely intervention, and the development of tailored supportive care strategies to improve patient-reported outcomes.

The primary aim of this systematic review is to identify the symptoms experienced by breast cancer patients before, during, and after chemotherapy. The secondary aim is to identify risk factors associated with these symptoms among breast cancer patients. Specifically, this review addresses the following research questions: (1) What symptoms do breast cancer patients experience across chemotherapy stages? (2) What factors are associated with these symptoms among breast cancer patients?

Materials and Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[8] and was registered in PROSPERO (registration number: CRD42024545463) to ensure transparency and minimize duplication.

Search Strategy

A comprehensive literature search was performed across five databases (PubMed, Scopus, Cochrane Library, Embase and ProQuest), from January 2015 to September 2025. No date restrictions were applied initially, but studies published before 2015 were excluded during screening to focus on contemporary chemotherapy regimens. The search strategy combined Medical Subject Headings (MeSH) terms with free-text keywords. Search strategy in PubMed as shown in Table S1. In addition, a hand-search was conducted on the reference lists of related systematic reviews to identify additional relevant studies, thereby reducing publication bias.

Eligibility Criteria

Studies were eligible for inclusion if they met the following criteria: (1) involved adult patients (≥18 years old) diagnosed with breast cancer who received chemotherapy as part of treatment; (2) regardless of breast cancer stage, encompassing both early-stage and metastatic cases; (3) reported symptoms experienced before, during or after chemotherapy; (4) examined factors associated with these symptoms; (5) original research studies, including observational studies (such as cohort, cross-sectional and case-control studies); (6) studies with English version.

Exclusion criteria included: (1) studies focusing solely on non-chemotherapy treatments (such as surgery, radiotherapy alone); (2) pediatric or adolescent populations; (3) studies not reporting symptoms across chemotherapy stages (before, during, and after) or lacking data on associated factors; (4) other type of publications, such as books, government reports, and short communications that lack original data; (5) study that is not available in full text; (6) duplicate publications.

Study Selection

All retrieved records were imported into EndNote for deduplication. Two researchers (YC and LL) screened titles and abstracts for relevance, followed by full-text assessment according to the inclusion and exclusion criteria. Disagreements were resolved through discussion or consultation with a third reviewer (PYL). The selection process was documented using a PRISMA flow diagram.

Data Extraction

Data were extracted independently by two researchers (YC and LL) using a standardized extraction form. Extracted information included: study characteristics (author, year, country, study population, sample size, time of data collection, total time point and study design); symptoms reported at each stage (before, during, and after chemotherapy); prevalence or severity score of symptoms and instrument used for symptom assessment; factors associated with symptoms. Any discrepancies in extraction were resolved by consensus.

Quality Assessment

The quality of the included studies was assessed using The Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields developed by Kmet et al,[9] which is suitable for evaluating studies of various designs. The specific items assessed are presented in Table S2. This tool comprises 14 items scored independently (2 points for "yes", 1 for "partial", and 0 for "no"), with the total score calculated as a percentage of applicable items. The studies were categorized according to Lee et al's guidelines,[10] with classifications ranging from limited (50%) to adequate (50–70%), good (70–80%) and strong (80%). Two researchers (YC and LL) independently assessed the quality of the included studies and crosschecked their evaluation results. Discussed the inconsistencies with the third reviewer (PYL) until a consensus reached.

Results

Study Selection

A total of 5,588 records were initially identified through systematic literature searches across five electronic databases. Of these, 526 duplicates were removed, leaving 5,062 records for title and abstract screening. Following this, 117 records were selected for full-text evaluation. Records were excluded for the following reasons: six that lacked full-text availability, four that were not published in English, 18 that involved irrelevant study populations, 15 that did not report symptom prevalence or scores, 10 that did not report associated factors, 13 that were not observational studies and 14 that were not related to chemotherapy. Ultimately, 37 studies met the inclusion criteria and were included in the review, as illustrated in Figure 1.

Quality of Studies

The present review encompassed exclusively observational studies. Items 5 to 7 and item 9 are applicable solely to randomized controlled trials (RCTs) and were therefore designated as "NA (not applicable)." Item 12 pertains only to specific types of cohort studies, for studies to which it is not applicable, it was marked as "NA." The quality scores of the included studies ranged from 11 to 19, with corresponding percentage scores ranging from 61.1% to 95.0%. Thirty-one studies were assessed as strong, five studies were rated as good, one study was considered adequate and no study was assessed as limited. The quality assessment of the included studies is shown in Table 1.

Study Characteristics

A total of 37 studies met the inclusion criteria and were incorporated into this systematic review. These studies were published between 2015 and 2025, with the majority (n=25) appearing from 2021 onward, reflecting a growing interest in symptom experiences among breast cancer patients undergoing chemotherapy. Geographically, studies originated predominantly from Asia (n=26, 70.3%),[11,13,14,16,18,20–23,25,26,28,30–38,41,43,44,46,47] including China (n=12),[14,26,28,31,32,34–37,41,43,44] Korea (n=5),[13,16,18,22,38] Iran (n=3),[20,21,23] India (n=1),[46] Indonesia (n=1),[33] Singapore (n=1),[11] The Sultanate of Oman (n=1),[47] Lebanon (n=1),[30] and Taiwan (n=1).[25] North America contributed seven studies (18.9%), all from the United States.[12,15,17,24,27,29,42] Europe accounted for three studies (8.1%, France, Norway and Slovenia),[19,40,45] while one from Africa (2.7%, Tunisia),[39] and other regions had minimal representation.

The included studies encompassed a total of 11,461 participants, with sample sizes ranging from 30 to 1,237 (median=256). The majority of studies focused on patients with early-stage or non-metastatic breast cancer undergoing adjuvant or neoadjuvant chemotherapy, often involving taxane-based or anthracycline-based chemotherapy regimens. Study designs

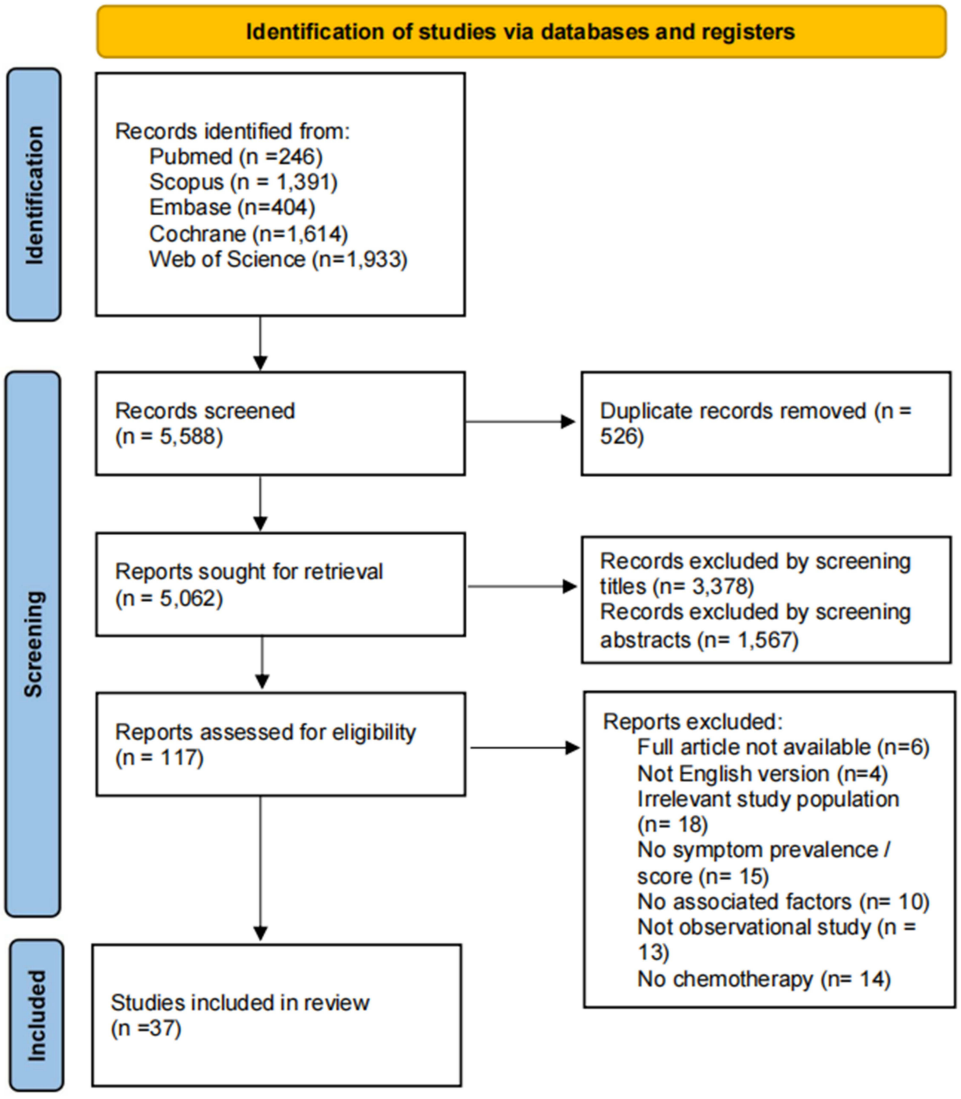

Figure 1 Flowchart of the systematic review process.

varied, with cross-sectional studies being the most common (n=18, 48.6%),[12,16,20,23,25,29,30,32,33,35,37–42,46,47] followed by prospective observational studies (n=8, 21.6%),[13–15,18,24,28,34,36] as well as cohort studies (n=6, 16.2%),[11,17,19,26,27,31] longitudinal studies (n=3, 8.1%),[21,22,45] and other designs such as case-control (n=1, 2.7%)[43] or retrospective observational studies (n=1, 2.7%).[44] Data collection timing relative to chemotherapy included assessments before treatment (n=10),[11,13,19,21,22,24,27,28,31,35] during cycles (n=32),[11–21,23–26,28–39,41,43,44,46,47] and after completion (n=13).[11,12,17,19,21,22,27,31,35,38,40,42,45] The measurement time points of these studies ranged from one to five.

Symptom assessment utilized a diverse array of validated instruments. The common instruments included Pittsburgh Sleep Quality Index (PSQI, n=4),[20,22,23,35] Brief Fatigue Inventory (BFI, n=3),[15,20,25] Hospital Anxiety and Depression Scale (HADS, n=3)[28,31,40] and Functional Assessment of Cancer Therapy-Cognitive Function (FACT-Cog, n=2).[11,41] Some studies relied on medical records,[44,45] WHO grades,[39,43] and physicians' judgments for the measurement of symptoms.[46] Four studies reported multiple symptoms.[33,37,39,47] Symptoms measured were multifaceted, with anxiety (n=8),[22,24,27,28,31,32,40,47] depression (n=8),[22–24,28,31,32,37,40] chemotherapy-induced nausea and vomiting (CINV, n=7),[13,14,18,26,29,39,44] fatigue (n=7),[15,19,20,25,27,30,47] and sleep problems (sleep disturbance and drowsiness, n=6),[20,22,23,35,37,47] which were the top five symptoms reported. Characteristics of included studies are shown in Table 2.

Table 1 The Result of Quality Assessment of the Included Studies (n=37)

Author/Year	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Quality Score (% score)
Cheung et al, 2015[11]	2	2	2	1	NA	NA	NA	1	NA	2	2	NA	2	2	16 (88.9%)
Bao et al, 2016[12]	2	2	2	2	NA	NA	NA	1	NA	2	2	NA	2	2	17 (94.4%)
Jung et al, 2016[13]	2	2	2	2	NA	NA	NA	1	NA	1	2	NA	2	2	16 (88.9%)
Liu et al, 2016[14]	2	2	2	1	NA	NA	NA	1	NA	2	2	NA	2	2	16 (88.9%)
Peoples et al, 2017[15]	2	2	2	0	NA	NA	NA	2	NA	2	1	NA	2	2	15 (83.3%)
Kim et al, 2017[16]	2	2	2	2	NA	NA	NA	0	NA	2	2	NA	2	2	16 (88.9%)
Greenlee et al, 2017[17]	2	2	2	1	NA	NA	NA	2	NA	2	2	NA	2	2	17 (94.4%)
Lee et al, 2017[18]	2	2	1	1	NA	NA	NA	1	NA	2	2	NA	2	2	15 (83.3%)
Reinertsen et al, 2017[19]	2	2	2	1	NA	NA	NA	0	NA	2	2	NA	2	2	15 (83.3%)
Imanian et al, 2019[20]	2	2	1	2	NA	NA	NA	1	NA	2	2	NA	2	2	16 (88.9%)
Hormozi et al, 2019[21]	2	0	2	1	NA	NA	NA	1	NA	0	2	NA	1	2	11 (61.1%)
Kim et al, 2019[22]	2	2	1	1	NA	NA	NA	2	NA	1	2	NA	1	1	13 (72.2%)
Shorofi et al, 2021[23]	2	2	2	2	NA	NA	NA	2	NA	2	1	NA	2	2	17 (94.4%)
Nakamura et al, 2021[24]	2	2	1	2	NA	NA	NA	2	NA	2	2	NA	2	2	17 (94.4%)
Deng et al, 2021[25]	2	2	1	2	NA	NA	NA	1	NA	2	1	NA	2	2	15 (83.3%)
Huang et al, 2021[26]	2	1	1	2	NA	NA	NA	2	NA	2	2	0	1	2	15 (75.0%)
Williams et al, 2021[27]	2	2	1	2	NA	NA	NA	1	NA	2	1	2	2	1	16 (80.0%)
Lv et al, 2022[28]	2	2	1	2	NA	NA	NA	2	NA	2	2	NA	2	2	17 (94.4%)
Singh et al, 2022[29]	2	2	1	1	NA	NA	NA	2	NA	2	1	NA	2	1	14 (77.8%)
Hajj et al, 2022[30]	2	2	2	2	NA	NA	NA	1	NA	2	2	NA	1	2	16 (88.9%)
Lan et al, 2022[31]	2	2	1	2	NA	NA	NA	1	NA	2	2	NA	2	2	16 (88.9%)
Guo et al, 2023[32]	2	2	2	2	NA	NA	NA	2	NA	2	1	NA	2	2	17 (94.4%)
Haris et al, 2023[33]	2	2	1	2	NA	NA	NA	1	NA	2	1	NA	2	2	15 (83.3%)
Zhai et al, 2023[34]	2	2	1	1	NA	NA	NA	0	NA	2	2	NA	2	2	14 (77.8%)
Zhu et al, 2023[35]	2	2	2	2	NA	NA	NA	1	NA	2	2	NA	2	2	17 (94.4%)
Liang et al, 2024[36]	2	2	1	2	NA	NA	NA	1	NA	1	2	NA	2	2	15 (83.3%)
Zhao et al, 2024[37]	2	2	1	1	NA	NA	NA	2	NA	2	2	NA	2	2	16 (88.9%)
Yang et al, 2024[38]	2	2	2	2	NA	NA	NA	2	NA	2	1	NA	1	2	16 (88.9%)
Olfa et al, 2024[39]	2	1	2	2	NA	NA	NA	1	NA	1	2	NA	2	2	15 (83.3%)
Miroševič et al, 2024[40]	2	2	2	2	NA	NA	NA	1	NA	2	2	NA	2	2	17 (94.4%)
Liu et al, 2024[41]	2	2	2	2	NA	NA	NA	1	NA	2	1	NA	2	2	16 (88.9%)
Winschel et al, 2025[42]	2	2	2	1	NA	NA	NA	2	NA	2	2	NA	2	2	17 (94.4%)
Ou et al, 2025[43]	2	2	2	2	NA	NA	NA	2	NA	1	2	NA	1	2	16 (88.9%)
Jiang et al, 2025[44]	2	2	2	1	NA	NA	NA	2	NA	2	2	NA	2	2	17 (94.4%)
His et al, 2025[45]	2	2	2	2	NA	NA	NA	2	NA	1	2	NA	2	2	17 (94.4%)
Chandrasekaran et al, 2025[46]	2	2	2	1	NA	NA	NA	1	NA	2	1	NA	1	2	14 (77.8%)
Alawi et al, 2025[47]	2	2	2	1	NA	NA	NA	2	NA	2	2	NA	2	2	17 (94.4%)

Abbreviation: NA, Not applicable.

Table 2 Characteristics of Included Studies (n=37)

Author & Year	Country	Study Population & Sample Size	Time of Data Collection	Total Time Point	Instrument Used for Symptom Assessment	Symptom Studied	Study Design
Peoples et al, 2017[15]	United States	Breast cancer patients undergoing chemotherapy (N=548)	Before and after the first cycle of chemotherapy	2	BFI	Fatigue	Prospective observational study
Reinertsen et al, 2017[19]	Norway	Breast cancer patients undergoing neoadjuvant chemotherapy (N=84)	Before treatment, 12 (at change from FEC100 to taxane-based therapy), and 25 weeks (before surgery), and two years after the first measurement	4	FQ	Fatigue	Cohort study
Deng et al, 2021[25]	Taiwan	Breast cancer patients undergoing neoadjuvant or adjuvant chemotherapy (N=110)	During chemotherapy	1	BFI	Fatigue	Cross-sectional study
Hajj et al, 2022[30]	Lebanon	Breast cancer patients undergoing chemotherapy (N=67)	During chemotherapy	1	EORTC QLQ-C30	Fatigue	Cross-sectional study
Jung et al, 2016[13]	Korea	Breast cancer undergoing adjuvant chemotherapy (N=198)	Before and after the first cycle of chemotherapy	2	0-10 numerical rating scale	Chemotherapy-induced nausea and vomiting (CINV)	Prospective observational study
Liu et al, 2016[14]	China	Breast cancer patients undergoing adjuvant chemotherapy (N=612)	Before and after each chemotherapy cycle	NR	VAS	Chemotherapy-induced nausea and vomiting (CINV)	Prospective observational study
Lee et al, 2017[18]	Korea	Breast cancer patients undergoing neoadjuvant chemotherapy (N=134)	Before and after the first cycle of chemotherapy	2	MAT	Chemotherapy-induced nausea and vomiting (CINV)	Prospective observational study
Huang et al, 2021[26]	China	Breast cancer patients undergoing chemotherapy (N=400)	Second and sixth day after chemotherapy	2	MAT	Acute CINV Delayed CINV	Cohort study
Singh et al, 2022[29]	United States	Breast cancer patients undergoing chemotherapy (N=532)	In the week prior to the second or third cycle of chemotherapy	1	MSAS	Chemotherapy-induced nausea (CIN)	Cross-sectional study
Jiang et al, 2025[44]	China	Breast cancer patients undergoing chemotherapy (N=113)	During chemotherapy	1	Medical records	Chemotherapy-induced nausea and vomiting (CINV)	Retrospective observational study
Bao et al, 2016[12]	United States	Breast cancer with taxane based chemotherapy (N=296)	During and after chemotherapy	1	0-10 numerical rating scale	Chemotherapy-induced peripheral neuropathy (CIPN)	Cross-sectional study
Greenlee et al, 2017[17]	United States	Breast cancer with taxane based chemotherapy (N=1237)	Baseline (two months postdiagnosis), six and 24 months	3	FACT-NTX	Chemotherapy-induced peripheral neuropathy (CIPN)	Cohort study
Zhai et al, 2023[34]	China	Breast cancer with taxane based neoadjuvant or adjuvant chemotherapy (N=873)	Before and after every cycle	NR	EORTC-CIPN20	Chemotherapy-induced peripheral neuropathy (CIPN)	Prospective observational study
Liang et al, 2024[36]	China	Breast cancer with taxane based chemotherapy (N=268)	From the beginning until three months after the end of taxane chemotherapy	NR	Functional Assessment of Cancer Therapy/Gynecologic Oncology Group-Neurotoxicity questionnaire	Chemotherapy-induced peripheral neuropathy (CIPN)	Prospective observational study

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Imanian et al, 2019[20]	Iran	Breast cancer patients undergoing chemotherapy (N=150)	Four days after chemotherapy cycle	1	PSQI BFI	Sleep disturbance Fatigue	Cross-sectional study
Zhu et al, 2023[35]	China	Breast cancer patients undergoing chemotherapy (N=329)	Before the first chemotherapy, before the fifth chemotherapy and one month after the chemotherapy	1	PSQI	Sleep disturbance	Cross-sectional study
Kim et al, 2017[16]	Korea	Breast cancer patients undergoing neoadjuvant or adjuvant chemotherapy (N= 265)	During chemotherapy	1	Computerized hand-held USB camera PT system	Chemotherapy irreversible induced alopecia (CIIA)	Cross-sectional study
His et al, 2025[45]	France	Breast cancer patients undergoing adjuvant chemotherapy (N= 267)	Before initiation of chemotherapy, at 1, 5, 10 and 13 years	5	Medical records	Weight change	Longitudinal study
Chandrasekaran et al, 2025[46]	India	Breast cancer patients undergoing chemotherapy (N=97)	During chemotherapy	1	Physician	Cardiotoxicity	Cross-sectional study
Haris et al, 2023[33]	Indonesia	Breast cancer patients undergoing neoadjuvant, adjuvant or palliative chemotherapy (N=135)	During chemotherapy	1	CTCAE	Multiple sexual dysfunction symptoms	Cross-sectional study
Zhao et al, 2024[37]	China	Breast cancer patients undergoing chemotherapy (N=423)	During chemotherapy	1	MRS	Multiple menopause symptoms	Cross-sectional study
Olfa et al, 2024[39]	Tunisia	Breast cancer patients undergoing sequential chemotherapy (Anthracyclines-Taxanes) (N=107)	During chemotherapy	1	WHO grades	Multiple digestive symptoms	Cross-sectional study
Ou et al, 2025[43]	China	Breast cancer receiving docetaxel-based chemotherapy (N=119)	During chemotherapy	NR	WHO grades	Bone marrow suppression	Case-control study
Kim et al, 2019[22]	Korea	Breast cancer patients undergoing adjuvant chemotherapy (N=52)	At the time of surgery, at the beginning of chemotherapy, and at the end of chemotherapy.	3	PSQI BAI BDI	Sleep disturbance Anxiety Depression	Longitudinal study
Shorofi et al, 2021[23]	Iran	Breast cancer undergoing adjuvant chemotherapy (N=120)	During chemotherapy	1	PSQI BDI	Sleep disturbance Depression	Cross-sectional study
Williams et al, 2021[27]	United States	Breast cancer patients undergoing chemotherapy (N=580)	Before (seven days prior to chemotherapy), one month and six months after chemotherapy completion	3	STAI MFSI	Fatigue Anxiety	Cohort study
Nakamura et al, 2021[24]	United States	Breast cancer patients undergoing adjuvant or neoadjuvant chemotherapy (N=256)	Before and after chemotherapy	2	PRSM	Anxiety Depression	Prospective observational study
Lv et al, 2022[28]	China	Breast cancer patients undergoing adjuvant chemotherapy (N=290)	Before and after two cycles of chemotherapy	2	HADS	Anxiety Depression	Prospective observational study

(*Continued*)

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Table 2 (Continued).

Author & Year	Country	Study Population & Sample Size	Time of Data Collection	Total Time Point	Instrument Used for Symptom Assessment	Symptom Studied	Study Design
Lan et al, 2022[31]	China	Breast cancer patients undergoing adjuvant chemotherapy (N=290)	Before, after two cycles of chemotherapy, and after the entire course of chemotherapy	3	HADS	Anxiety Depression	Cohort study
Guo et al, 2023[32]	China	Breast cancer patients undergoing chemotherapy (N=176)	During chemotherapy	1	DASS-21	Anxiety Depression Stress	Cross-sectional study
Miroševič et al 2024[40]	Slovenia	Breast cancer patients after adjuvant or neoadjuvant chemotherapy (N= 430)	One to five years after receiving post-local treatment and (neo)adjuvant chemotherapy	1	HADS	Anxiety Depression	Cross-sectional study
Cheung et al, 2015[11]	Singapore	Breast cancer patients undergoing adjuvant chemotherapy (N=741)	Before chemotherapy, 6 and 12 weeks after chemotherapy initiation	3	FACT-Cog	Cognitive impairment (CI)	Cohort study
Hormozi et al, 2019[21]	Iran	Breast cancer patients undergoing chemotherapy (N=100)	Before chemotherapy and 1, 3, and 6 months after chemotherapy	4	MMSE	Cognitive impairment (CI)	Longitudinal study
Yang et al, 2024[38]	Korea	Breast cancer patients undergoing chemotherapy (N=186)	During and after chemotherapy	1	CFQ	Cognitive impairment (CI)	Cross-sectional study
Liu et al, 2024[41]	China	Breast cancer patients undergoing chemotherapy (N=741)	During and after chemotherapy	1	FACT-Cog	Cognitive impairment (CI)	Cross-sectional study
Winschel et al, 2025[42]	United States	Breast cancer patients after chemotherapy (N=30)	Within one year of completing chemotherapy	1	Global cognitive score	Cognitive impairment (CI)	Cross-sectional study
Alawi et al, 2025[47]	The Sultanate of Oman	Breast cancer patients undergoing chemotherapy (N=105)	During chemotherapy	1	ESAS	Multiple symptoms	Cross-sectional study

Abbreviations: NR, Not reported; FACT-Cog, Functional assessment of cancer Therapy-Cognitive function; VAS, Visual Analog Scale; BFI, Brief Fatigue Inventory; FACT-NTX, 11-item neurotoxicity component of the Functional Assessment of Cancer Therapy-Taxane; MAT, Multinational Association of Supportive Care in Cancer Antiemesis Tool; FQ, Fatigue Questionnaire; PSQI, Pittsburgh Sleep Quality Index; MMSE, Mini-Mental State Examination; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; PRSM, Patient-Reported Symptom Monitoring; MFSI, Multidimensional Fatigue Symptom Inventory; STAI, Spielberger State/Trait Anxiety Inventory; HADS, Hospital Anxiety and Depression Scale; MSAS, Memorial Symptom Assessment Scale; EORTC QLQ-C30, European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire; DASS-21, Depression Anxiety Stress Scale-21; MRS, Menopause Rating Scale; CTCAE, Common Toxicity Criteria for Adverse Events; EORTC-CIPN20, European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-TIPN 20-item scale; CFQ, Cognitive Failure Questionnaire; ESAS, Edmonton Symptom Assessment System.

Prevalence and Severity of Symptoms

Symptoms reported in the 37 studies can be classified into physical (such as fatigue, chemotherapy-induced nausea and vomiting [CINV], chemotherapy-induced peripheral neuropathy [CIPN], sleep problems, alopecia, digestive issues, menopausal/sexual symptoms, bone marrow suppression, weight change, and cardiotoxicity), psychological (such as anxiety, depression, and stress), and cognitive domains (such as cognitive impairment [CI]). Due to heterogeneity in timing, regimens and reporting formats, meta-analysis was not performed. Instead, a systematic review was employed, focusing on prevalence and severity scores.

Anxiety was reported in eight studies.[22,24,27,28,31,32,40,47] Before chemotherapy, the prevalence ranged from 21.0% to 35.0% and severity scores ranged from 6.00 ± 3.60 to 36.00 ± 10.16. During treatment, the prevalence varied from 21.9% to 60.2%, while the scores ranged from 1.76 ± 2.51 to 10.64 ± 8.06, indicating a peak during the treatment period. After chemotherapy, the prevalence and severity scores varied from 29.3% to 34.2% and from 5.80 ± 3.60 to 32.91 ± 10.62, respectively.

Depression was reported in eight studies.[22–24,28,31,32,37,40] Pre-chemotherapy prevalence was ranged from 12.0% to 20.0% and severity scores ranged from 4.00 ± 3.60 to 9.86 ± 8.61. During chemotherapy, the prevalence and scores ranged from 25.2% to 52.3% and from 0.80 ± 1.00 to 13.40 ± 6.51, respectively. This indicated moderate escalation. Post-treatment, the prevalence ranged from 24.8% to 30.2% and severity scores ranged from 4.90 ± 3.60 to 8.97 ± 7.31.

CINV (including nausea/vomiting, acute/delayed) was assessed in seven studies.[13,14,18,26,29,39,44] Before chemotherapy, limited data from one study showed low prevalence, with nausea at 11.1% and vomiting at 13.6%. During treatment, the prevalence was notably higher. The overall prevalence ranging from 23.0% to 92.2% and no severity scores were reported. After chemotherapy, no specific data for CINV were available.

Fatigue was one of the most commonly reported symptoms, assessed in seven studies.[15,19,20,25,27,30,47] Before chemotherapy, prevalence was reported in one study at 8.0%, with a severity score of 9.42 ± 8.31 in another, indicating generally low baseline levels. During chemotherapy, prevalence ranged from 11.0% to 75.0%, with scores varying from 2.50 ± 2.61 (for tiredness) to 5.59 ± 1.67, reflecting moderate severity. After chemotherapy, the prevalence ranging from 13.0% to 36.0% and severity scores ranging from 9.19 ± 9.05 to 17.70 ± 8.83, respectively. This indicates an ongoing burden in a subset of patients.

Sleep problems, encompassing sleep disturbance and drowsiness, were reported in six studies.[20,22,23,35,37,47] Before chemotherapy, prevalence was reported in one study at 27.0%, with severity scores between 5.66 ± 3.21 and 6.38 ± 4.24 in another, indicating mild to moderate sleep problems at baseline. During chemotherapy, prevalence increased, ranging from 27.6% to 50.8%, with severity scores from 1.05 ± 1.00 to 14.06 ± 3.06, reflecting a significant escalation in sleep problems. One study specifically reported drowsiness during chemotherapy, with a prevalence of 27.6% and a severity score of 1.95 ± 2.21, suggesting a related but distinct manifestation of sleep problems. Post-chemotherapy, prevalence was 39.2% and severity score was 6.21 ± 3.70, indicating persistent sleep issues in a notable proportion of patients.

Cognitive impairment (CI, n=5) was reported with a prevalence of 18.2% in one study and a severity score of 25.02 ± 4.02 in another before chemotherapy.[11,21] The prevalence reported was 23.6% in one study, with severity scores from 23.60 ± 16.32 to 97.21 ± 23.75 during treatment, highlighting worsening cognitive function during treatment.[11,21,38,41] After chemotherapy, prevalence was reported 15.0% in one study, with the scores of 0.15 ± 0.54 to 23.60 ± 16.32, implying the impact on some patients is still ongoing.[11,21,38,42]

Chemotherapy-induced peripheral neuropathy (CIPN, n=4) showed the prevalence ranging from 31.7% to 58.4% during chemotherapy, with severity scores ranging from 24.80 ± 4.80 to 39.50 ± 5.20.[12,17,34,36] Post-chemotherapy, the scores were 33.80 ± 8.30 to 35.50 ± 7.70, suggesting persistent effects.[12,17]

Other symptoms, including stress, permanent chemotherapy-induced alopecia, menopausal symptoms, sexual dysfunction, digestive issues, bone marrow suppression, cardiotoxicity and weight change, were less consistently reported but typically emerged or intensified during chemotherapy, with some persisting post-treatment. Prevalence and severity scores of symptoms included in the study are shown in Table 3.

Table 3 Prevalence and Severity Scores of Symptoms Included in the Study (n=37)

Author & Year	Symptom Studied	Prevalence / Severity Scores of Symptoms		
		Before Chemotherapy	During Chemotherapy	After Chemotherapy
Peoples et al, 2017[15]	Fatigue		75.0%	
Reinertsen et al, 2017[19]	Fatigue	T1: 8.0%	T2: 11.0%	T3: 13.0% T4: 36.0%
Deng et al, 2021[25]	Fatigue		42.7%	
Hajj et al, 2022[30]	Fatigue		46.3%	
Jung et al, 2016[13]	Chemotherapy-induced nausea and vomiting (CINV)	Nausea (11.1%) Vomiting (13.6%)	Nausea (35.4%) Vomiting (31.3%)	
Liu et al, 2016[14]	Chemotherapy-induced nausea and vomiting (CINV)		92.2%	
Lee et al, 2017[18]	Chemotherapy-induced nausea and vomiting (CINV)		CINV (48.5%) Delayed CINV (42.5%) Acute CINV (39.6%)	
Huang et al, 2021[26]	Acute CINV Delayed CINV		Acute CINV (29.8%) Delayed CINV (23.5%)	
Singh et al, 2022[29]	Chemotherapy-Induced Nausea (CIN)		47.2%	
Jiang et al, 2025[44]	Chemotherapy-induced nausea and vomiting (CINV)		23.0%	
Bao et al, 2016[12]	Chemotherapy-induced peripheral neuropathy (CIPN)		58.4%	
Greenlee et al, 2017[17]	Chemotherapy-induced peripheral neuropathy (CIPN)		T1: 39.50± 5.20	T2: 33.80± 8.30 T3: 35.50± 7.70
Zhai et al, 2023[34]	Chemotherapy-induced peripheral neuropathy (CIPN)		24.80±4.80	
Liang et al, 2024[36]	Chemotherapy-induced peripheral neuropathy (CIPN)		31.7%	
Imanian et al, 2019[20]	Sleep disturbance Fatigue		Sleep disturbance (14.06±3.06) Fatigue (5.59±1.67)	
Zhu et al, 2023[35]	Sleep disturbance	27.0%	32.5%	39.2%
Kim et al, 2017[16]	Permanent chemotherapy-induced alopecia (PCIA)		46.0%	
His et al, 2025[45]	Weight change			T2: 34.6% T3: 37.1% T4: 41.6% T5: 37.4%
Chandrasekaran et al, 2025[46]	Cardiotoxicity		13.4%	
Haris et al, 2023[33]	Multiple sexual dysfunction symptoms		Vaginal dryness (45.9%) Decreased libido (45.2%) Dyspareunia (13.3%) Delayed orgasm (11.1%) Anorgasmia (8.9%)	
Zhao et al, 2024[37]	Multiple menopause symptoms		Muscle and joint discomfort (1.08 ± 1.15) Sleep problems (1.05 ± 1.00) Vasomotor symptoms (0.92 ± 0.87) Physical/mental exhaustion (0.87 ± 0.82) Depression (0.80 ± 1.00)	
Olfa et al, 2024[39]	Multiple digestive symptoms		Constipation (80.0%) Diarrhea (73.0%) Nausea (70.0%) Vomiting (63.4%)	
Ou et al, 2025[43]	Bone marrow suppression		47.9%	
Kim et al, 2019[22]	Sleep disturbance Anxiety Depression	T1: Sleep disturbance (6.38±4.24) Anxiety (8.90±7.75) Depression (9.86±8.61) T2:Sleep disturbance (5.66±3.21) Anxiety (10.34±7.89) Depression (10.21±8.00)		T3: Sleep disturbance (6.21 ±3.79) Anxiety (9.21±7.59) Depression (8.97±7.31)
Shorofi et al, 2021[23]	Depression Sleep disturbance		Sleep disturbance (6.48±2.62, 50.8%) Depression (13.40±6.51, 44.2%)	

(*Continued*)

Table 3 (Continued).

Author & Year	Symptom Studied	Prevalence / Severity Scores of Symptoms		
		Before Chemotherapy	**During Chemotherapy**	**After Chemotherapy**
Williams et al, 2021[27]	Fatigue Anxiety	T1: Fatigue (9.42 ± 8.31) Anxiety (36.00 ± 10.16, 35.0%)		T2: Fatigue (17.70 ± 8.83) Anxiety (32.91 ± 10.62, 31.0%) T3: Fatigue (9.19 ± 9.05) Anxiety (31.72 ± 10.62, 30.0%)
Nakamura et al, 2021[24]	Anxiety Depression	Anxiety (21.0%) Depression (12.0%)	Anxiety (41.0%) Depression (26.0%)	
Lv et al, 2022[28]	Anxiety Depression	Anxiety (31.4%) Depression (20.0%)	Anxiety (29.0%) Depression (25.2%)	
Lan et al, 2022[31]	Anxiety Depression	T1: Anxiety (6.00±3.60, 31.4%) Depression (4.00±3.60, 20.0%)	T2: Anxiety (5.70±3.50, 29.0%) Depression (5.10±3.80, 25.2%)	T3: Anxiety (5.80±3.60, 29.3%) Depression (4.90±3.60, 24.8%)
Guo et al, 2023[32]	Anxiety Depression Stress		Anxiety (10.64 ± 8.06, 60.2%) Depression (12.07 ± 10.69, 52.3%) Stress (13.49 ± 9.97, 36.9%)	
Mirošević et al, 2024[40]	Anxiety Depression			Anxiety (34.2%) Depression (30.2%)
Cheung et al, 2015[11]	Cognitive impairment (CI)	18.2%	24.2%	29.3%
Hormozi et al, 2019[21]	Cognitive impairment (CI)	T1: 25.02±4.02	T2: 24.92±3.36 T3: 23.80±4.04	T4: 22.80±4.22
Yang et al, 2024[38]	Cognitive impairment (CI)		23.60 ± 16.32	
Liu et al, 2024[41]	Cognitive impairment (CI)		97.21 ± 23.75	
Winschel et al, 2025[42]	Cognitive impairment (CI)			0.15 ± 0.54
Alawi et al, 2025[47]	Multiple symptoms		Tiredness (2.50±2.61, 37.1%) Poor Well-being (2.29 ± 2.89, 30.5%) Drowsiness (1.95±2.21, 27.6%) Anxiety (1.76 ±2.51, 21.9%) Pain (1.70± 2.15, 19.0%)	

Factors Associated with Each Symptom

All factors associated with symptoms were divided into seven categories, including sociodemographic factors, disease related factors, physiological factors, psychological factors, lifestyle factors, nutritional factors and other related factors. Based on the seven categories of reported factors, associated factors for the reported symptoms were categorized into non-modifiable (sociodemographic and disease related) and modifiable (physiological, psychological, lifestyle, nutritional, and other related factors) domains, as detailed in Table 4. Several factors recurred across multiple symptoms. Younger age was associated with increased anxiety, depression, fatigue, nausea, and menopausal symptoms.[15,23,29,37,40] Having children was associated with increased fatigue, pain, and anxiety.[31,47] A higher number of chemotherapy cycles was associated with worsened fatigue, CINV, sleep disturbances, CIPN, menopausal symptoms, sexual dysfunction, and CI.[23,25,30,41,44] Higher body mass index (BMI) was associated with increased fatigue and CIPN.[27,36] Lower Karnofsky Performance Status (KPS) score were associated with increased nausea, anxiety, and depression,[24,29] whereas limited social support was associated with heightened anxiety and depression.[24,31,40] These findings underscore the complex interplay between patient characteristics and symptom burden, highlighting the importance of targeted risk stratification and personalized symptom management in clinical practice.

Discussion

This systematic review of 37 studies synthesizes evidence on the dynamic symptom burden experienced by breast cancer patients across chemotherapy stages. The included studies encompassed both early-stage and metastatic disease, as well as adjuvant, neoadjuvant, and palliative treatment settings, thereby providing healthcare providers with a comprehensive overview of multiple symptoms prevalence, severity, and duration across chemotherapy phases. Our findings reveal that

Table 4 Factors Associated with Each Symptom

Symptom Studied	Factors	Result (High Risk Symptoms Group)
Fatigue	**Sociodemographic factors**	
	Age	Younger age[15]
	Have children	Yes[47]
	Menopausal status	Yes[27]
	Disease related factors	
	Duration of disease	Longer duration of disease[25]
	Metastasis site	Bone metastasis[30]
	Chemotherapy type	Palliative chemotherapy[30]
	Capecitabine treatment	Use capecitabine-based regimen[30]
	Chemotherapy cycle	More chemotherapy cycle[25,30]
	Surgery prior to chemotherapy	Mastectomy (vs none)[27]
	Physiological factors	
	BMI	Higher BMI[27]
	Pain score	Higher pain score[25]
	Sleep quality	Poor sleep quality[15,20,25]
	Pretreatment CRF	Higher pretreatment CRF[15]
	Nausea	Higher occurrence of nausea[15]
	Traditional Chinese medicine body constitution	Yang-Qi deficiency, Yin-Xue deficiency, Phlegm-Stasis syndrome[25]
	Hemoglobin, leukocytes, platelets	Lower blood cell count[30]
	Psychological factors	
	Psychological distress	Less psychological distress[19]
Nausea	**Sociodemographic factors**	
	Age	Younger age[29]
	Income	Lower annual income[29]
	Disease related factors	
	Chemotherapy cycle length	14 day cycle (vs 21 day cycle)[29]
	Emetogenicity of chemotherapy	Highly emetogenic chemotherapy[29]
	Antiemetic regimens	NK-1 receptor antagonist and two other antiemetics[29]
	Pretreatment nausea	Yes[13]
	Physiological factors	
	Number of comorbidities	More number of comorbidities[29]
	Hypertension	Yes[29]
	Back pain	Yes[29]
	Change in the way food tastes	Higher occurrence of change in the way food tastes[29]
	Dry mouth	Higher occurrence of dry mouth[29]
	Lack of appetite	Higher occurrence of lack of appetite[29]
	Constipation	Higher occurrence of constipation[29]
	Feeling bloated	Higher occurrence of feeling bloated[29]
	Diarrhea	Higher occurrence of diarrhea[29]
	Mouth sores	Higher occurrence of mouth sores[29]
	Weight loss	Higher occurrence of weight loss[29]
	Abdominal cramps	Higher occurrence of abdominal cramps[29]
	Difficulty swallowing	Higher occurrence of difficulty swallowing[29]
	Vomiting	Higher occurrence of vomiting[29]
	Sleep quality	Poor sleep quality[13]
	Psychological factors	
	Depression	Yes[29]

(*Continued*)

Table 4 (Continued).

Symptom Studied	Factors	Result (High Risk Symptoms Group)
	Lifestyle factors	
	Karnofsky Performance Status (KPS) score	Lower KPS score[29]
	Self-Administered Comorbidity Questionnaire (SCQ) score	Higher SCQ score[29]
	Nutritional factors	
	Mediterranean Diet Score (MDS)	Lower MDS score[39]
	Malnutrition	Higher malnutrition score[39]
Vomiting	**Disease related factors**	
	Pretreatment nausea	Yes[13]
	Sarcopenia	Yes[39]
	Physiological factors	
	Sleep quality	Poor sleep quality[13]
	Nutritional factors	
	Malnutrition	Higher malnutrition score[39]
Chemotherapy-induced nausea and vomiting (CINV)	**Disease related factors**	
	Chemotherapy type	Palliative chemotherapy[44]
	Chemotherapy cycle	> 8 chemotherapy cycle (vs ≤ 8)[44]
	Chemotherapy stage	Early stage (vs later stage)[26]
	History of nausea and vomiting	Yes[26,44]
	Underlying disease	Yes[44]
	Chemotherapy regimens	High and moderate emetogenic chemotherapy regimen (vs low)[26]
	History of motion sickness	Yes[26]
	Physiological factors	
	Wetness-heat score	Higher wetness-heat score[14]
	Bitter taste/smelly mouth	Yes[14]
	Progesterone receptor	Positive (vs negative)[14]
	Vomiting history	No[14]
		Yes[18]
	Chronotypes	Late chronotypes (vs intermediate)[18]
	Pain/insomnia	Yes[26]
Sleep disturbance	**Sociodemographic factors**	
	Age	45-65 (vs < 45)[35]
	Disease related factors	
	Chemotherapy cycle	More chemotherapy cycles[23]
	Breast surgery type	Breast-conserving surgery (vs total mastectomy)[22]
	Psychological factors	
	Depression	Higher depression score[23]
	Anxiety	Significant anxiety (HADS anxiety score > 8)[35]
	Emotional/Informational support	More emotional/informational support[35]
Chemotherapy-induced peripheral neuropathy (CIPN)	**Disease related factors**	
	Chemotherapy dose	Higher cumulative chemotherapy dose[34]
	Docetaxel cumulative dose	Higher cumulative dose[36]
	Body surface area (BSA)	More BSA[36]
	Hypocalcemia	Yes[36]

(*Continued*)

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Table 4 (Continued).

Symptom Studied	Factors	Result (High Risk Symptoms Group)
	Physiological factors	
	BMI	Obese (vs normal)[12]
		Overweight and obese (vs normal weight)[17]
		High BMI[36]
	Sodium ions	Lower sodium ions[34]
	Chloride ions	Higher chloride ions[34]
	Nutritional factors	
	Antioxidant dietary supplement use	Yes[17]
Bone marrow suppression	**Physiological factors**	
	Lymphocyte count	Low lymphocyte count[43]
	White blood cell (WBC) count	Lower WBC count[43]
	Prealbumin level	Lower prealbumin level[43]
Weight change	**Physiological factors**	
	BMI	< 25 kg/m^2 (between 25 and 30 kg/m^2)[45]
Cardiotoxicity	**Physiological factors**	
	Receptor distribution	Estrogen receptor (ER) positive[46]
Pain	**Sociodemographic factors**	
	Have children	Yes[47]
Multiple menopause symptoms	**Sociodemographic factors**	
	Age	Younger age[37]
	Occupational status	Yes[37]
	Disease related factors	
	Chemotherapy-induced amenorrhea	No[37]
	Chemotherapy stage	Later stage (vs early stage)[37]
	Family history of cancer	Yes[37]
	Psychological factors	
	Mindfulness	Lower mindfulness score[37]
	Resiliency	Lower resiliency score[37]
	Illness perception	Higher illness perception score[37]
Constipation	**Nutritional factors**	
	Mediterranean Diet Score (MDS)	Lower MDS score[39]
	Malnutrition	Higher malnutrition score[39]
Diarrhea	**Nutritional factors**	
	Malnutrition	Higher malnutrition score[39]
Permanent chemotherapy-induced alopecia (PCIA)	**Disease related factors**	
	Chemotherapy regimen	AC-T (vs AC)[16]
Sexual dysfunction	**Sociodemographic factors**	
	Spouse age	< 55 years old (vs ≥ 55 years old)[33]
	Disease related factors	
	Chemotherapy duration	>120 days (vs ≤ 120 days)[33]
	Comorbidities	No[33]
	Physiological factors	
	BMI	< 23 kg/m^2 (vs ≥ 23 kg/m^2)[33]
Anxiety	**Sociodemographic factors**	
	Age	Younger age[40]
	Marry status	Unmarried[24]
	Have children	Yes[31]

(*Continued*)

Table 4 (Continued).

Symptom Studied	Factors	Result (High Risk Symptoms Group)
	Disease related factors	
	Breast surgery	Breast-conserving surgery (vs total mastectomy)[22]
	Physiological factors	
	Bone marrow suppression	Bone marrow suppression ≥ Grade 2[28]
	Psychological factors	
	Depression	Depression diagnosis[24]
	Mental health specialty care	No[24]
	Fear of cancer recurrence (FCR)	Higher FCR score[40]
	Resilience	Diminished resilience[40]
	Psychosocial and emotional needs	Unmet psychosocial and emotional needs[40]
	Lifestyle factors	
	Karnofsky Performance Status (KPS) score	Lower KPS score[24]
	Other related factors	
	Social support	Limited social support[40]
		More social activity limitations[24]
	Coping style	Self-blame, behavioral disengagement[32]
	Quality of life	Lower quality of life[40]
Depression	**Sociodemographic factors**	
	Age	Younger age[23]
		Older age[31]
	Marry status	Unmarried[24]
	Marriage quality	Poor marriage quality[32]
	Number of children	Fewer number of children[23]
	Income	Lower household gross income[23]
	Employment	Less than 32 (vs 32 or more)[24]
	Disease related factors	
	Type of mastectomy procedure	Total and radical mastectomy (vs partial)[23]
	Chemotherapy regimen	Single chemotherapy regimen (vs combine)[32]
	Metastasis site	Bone metastasis[32]
	Family history of chronic disease	Yes[47]
	Family history of breast cancer	No[31]
	Breast surgery type	Breast conserving surgery (vs mastectomy)[31]
	Physiological factors	
	Sleep quality	Higher sleep quality[23]
	Myelosuppression	Myelosuppression ≥ Grade 2[28]
	Psychological factors	
	Anxiety	Yes[24]
	Mental health specialty care	No[24]
	Fear of cancer recurrence (FCR)	Higher TCR score[40]
	Resilience	Diminished resilience[40]
	Lifestyle factors	
	Karnofsky Performance Status (KPS) score	Lower KPS score[24]
	Other related factors	
	Social support	Lower social support[31,40]
		More social activity limitations[24]
	Coping style	Venting, self-blame, denial[32]
	Quality of life	Lower quality of life[40]
Stress	**Sociodemographic factors**	
	Marriage quality	Poor marriage quality[32]
	Chemotherapy regimen	Single chemotherapy regimen (vs combine)[32]

(*Continued*)

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Table 4 (Continued).

Symptom Studied	Factors	Result (High Risk Symptoms Group)
Cognitive impairment (CI)	**Other related factors**	
	Coping styles	Venting, self-blame, behavioral disengagement[32]
	Sociodemographic factors	
	Educational level	Higher education level[41]
	Disease related factors	
	Chemotherapy type	Postoperative chemotherapy (vs neoadjuvant chemotherapy)[41]
	Chemotherapy cycle	More chemotherapy cycle[41]
	Cyclophosphamide drug	Yes[41]
	Physiological factors	
	Interleukin (IL)-1β	Higher concentrations of IL-1β[11]
	IL-6	Higher concentrations of IL-6[11]
	IL-4	Lower concentrations of IL-4[11]
	Psychological factors	
	Depression	Higher occurrence of depression[21,38,41]
	Anxiety	Higher occurrence of anxiety[21,41]
	Pain	Higher occurrence of pain[38]
	Lifestyle factors	
	Physical activity	Less physical activity[41]
	Nutritional factors	
	Adherence to the MIND diet pattern	Not adherence to the MIND diet pattern[42]

symptoms are generally mild or infrequent at baseline, escalate significantly during chemotherapy phase and often persist into the post-treatment. The most commonly reported symptoms including anxiety, depression, CINV, fatigue and sleep problems, which align with established symptom clusters among breast cancer chemotherapy patients, such as fatigue-sleep disturbance cluster and psychological cluster.[7] Associated factors can be classified into non-modifiable and modifiable factors. This review enables healthcare providers to more accurately identify high-risk patient groups prone to severe or persistent symptoms. Ultimately, these insights can guide the development of personalized, evidence-based interventions, such as tailored symptom management protocols, supportive care strategies and multidisciplinary approaches, thereby enhancing treatment adherence, improving quality of life and reducing long-term morbidity risks in breast cancer survivors.

The prevalence of common symptoms during chemotherapy was notably high, with fatigue affecting up to 75.0% of patients, sleep problems up to 50.8%, CINV up to 92.2%, and psychological symptoms like anxiety and depression ranging from 21.9% to 60.2% and 25.2% to 52.3%, respectively. These findings align with previous studies, which identify fatigue as one of the most prevalent and impactful symptoms among cancer patients, persisting in 30% to 50% of breast cancer survivors.[48,49] Similarly, CINV, despite advancements in antiemetic therapies, continues to affect 50–60% of cancer patients.[50] The significant increase in symptom prevalence during chemotherapy reflects the toxicological mechanisms of chemotherapeutic agents, such as the disruption of the central nervous system, gastrointestinal tract and autonomic nervous system by cytotoxic drugs.[51] Some symptoms, including anxiety (29.3–34.2%), fatigue (13.0–36.0%) and sleep problems (39.2%), persist even after the completion of chemotherapy. These symptoms significantly impair patients' daily functioning and treatment adherence.[52,53] For high-risk patients, mitigation strategies should be prioritized for these symptoms to improve long-term quality of life.[54]

Beyond the five common symptoms mentioned above, other symptoms are equally noteworthy. CI commonly referred to as "chemo brain," persists throughout the chemotherapy process,[11,21] manifesting as declines in memory, attention, and executive function post-chemotherapy.[55] These cognitive deficits can persistently impair patients' daily decision-making abilities and work efficiency, thereby reducing their quality of life and social engagement.[56] CIPN remains highly severe post-chemotherapy,[17] often presenting as numbness, tingling and sensory abnormalities, which lead to difficulties in

walking, impaired fine motor skills, and an increased risk of falls, significantly affecting patients' functional independence and sense of safety.[12] Additionally, some patients experience sexual dysfunction due to the disease or chemotherapy, such as vaginal dryness (45.9%) and decreased libido (45.2%).[33] These symptoms not only compromise patients' sexual quality of life but may also trigger strained intimate relationships and psychological distress, particularly among younger patients.[57,58] The breadth and persistence of these symptoms underscore the complex supportive care needs of breast cancer patients undergoing chemotherapy, necessitating multidisciplinary interventions to comprehensively address their physiological, psychological and social impacts.

The classification of factors associated with these symptoms into modifiable and non-modifiable categories facilitates targeted interventions for modifiable risks while enabling risk stratification to identify high-risk individuals for enhanced monitoring and prevention strategies. Researchers can identify high-risk groups through known non-modifiable factors and develop comprehensive interventions to mitigate symptom occurrence. For instance, screening younger patients for anxiety and depression could prompt early referral to evidence-based mitigation strategies, including cognitive-behavioral therapy, supportive care programs, or physical activity interventions to alleviate psychological distress.[59–61] For modifiable factors, tailored approaches can enhance the applicability and effectiveness of nursing interventions. For instance, addressing modifiable factors like low Karnofsky Performance Status or inadequate adherence to healthful diets (such as Mediterranean or MIND patterns) through relevant interventions, such as multidisciplinary supportive care or exercise programs, could reduce persistent post-treatment symptom burden and improve quality of life.[42,62,63]

Strengths and Limitations

This systematic review provides a comprehensive synthesis of observational studies encompassing multiple symptom domains, chemotherapy phases, and associated factor categories. By adopting this broad scope, it offers a holistic perspective on symptom experiences in breast cancer patients undergoing chemotherapy, which is lacking in prior reviews focused on narrower aspects, such as cardiotoxicity alone.

Several limitations should be acknowledged. Firstly, the reliance on self-reported data may introduce recall bias and subjective bias, potentially affecting the accuracy of symptom prevalence and severity estimates. Secondly, the exclusion of non-English language studies limits the inclusion of diverse global perspectives, possibly underrepresenting variations in symptom profiles across cultural or regional contexts. Finally, substantial heterogeneity among the included studies arising from differences in chemotherapy regimens (such as adjuvant versus neoadjuvant settings), assessment timing (before, during, and after chemotherapy), and measurement instruments. This poses challenges for data standardization and quantitative synthesis. Future research should prioritize standardized protocols for regimens, timing, and tools to facilitate meta-analyses and improve clinical applicability.

Conclusion

Breast cancer patients undergoing chemotherapy experience a variety of symptoms. The most common symptoms identified in this review include anxiety, depression, CINV, fatigue, and sleep problems. The factors reported were divided into non-modifiable and modifiable factors. Younger age was the most frequently reported risk factor for increased anxiety, depression, fatigue, nausea, and menopausal symptoms, followed by having children, greater number of chemotherapy cycles, higher BMI, lower performance status, and limited social support. These findings highlight the necessity of early symptom screening in clinical practice, particularly baseline assessments to identify high-risk patients and inform comprehensive management strategies that optimize outcomes and quality of life. Future research should prioritize identifying high-risk groups, developing personalized interventions to enhance treatment adherence, and validating standardized symptom assessment tools alongside patient-directed approaches to address current evidence gaps.

Statement of Ethics Approval

As this is a systematic review, ethical approval was not required.

Consent to Participate Declaration

This systematic review does not require a consent to participate declaration, as it analyzes data from published studies.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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