

**REVIEW**

# A systematic review of factors affecting quality of life after postmastectomy breast reconstruction in women with breast cancer

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**Abstract**

**Objective:** The aim of this study is to present a broader perspective of factors affecting the quality of life after postmastectomy breast reconstruction in women with breast cancer by considering these patients' self-reported outcomes.

**Methods:** The search was performed from 29 March to 19 April 2019, on the following databases: PsycInfo; Web of Science Core Collection, Current Contents Connect, Derwent Innovations Index, KCI-Korean Journal Database, Russian Science Citation Index, SciELO Citation Index, and MEDLINE. The studies were included if they identified factors affecting self-reported quality of life after breast reconstruction, in women with breast cancer.

**Results:** One hundred and twenty-two records were identified. After quality assessment, 44 studies were included for qualitative synthesis. This review comprised a total of 16 683 women who underwent breast reconstruction. The results identified a broad collection of 32 empirically based variables associated with several domains of quality of life. These variables were grouped into four categories: (a) surgical, (b) clinical, (c) psychosocial, and (d) sociodemographic variables.

**Conclusions:** This systematic review goes beyond surgical factors of morbidity and uses patient-reported outcomes to scope wider issues that influence quality of life, such as psychosocial and sociodemographic variables. It sustains the need to adopt a more holistic approach and advises the consideration of preoperative psychosocial factors to better understand these patients' quality of life after breast reconstruction and to implement future preventive measures.

**KEYWORDS**

breast cancer, breast reconstruction, cancer, oncology, patient-reported outcomes, quality of life

## 1 | INTRODUCTION

Previous research has sustained the important role of breast reconstruction after breast cancer mastectomy.<sup>1</sup> However, recent studies suggested that quality of life improvements after this procedure are not as expected since, for some patients, quality of life after breast

reconstruction was unchanged,<sup>2,3</sup> worse,<sup>4-6</sup> or similar to the quality of life of women with mastectomy alone.<sup>4,7-9</sup>

Understanding which factors are more likely to affect the quality of life after this procedure is of great clinical importance to help prevent postreconstruction adjustment problems and decisional regret.<sup>10</sup> Previous reviews discussed the role of surgical variables as possible risk

factors.<sup>11,12</sup> Results revealed similar outcomes for immediate and delayed procedures, except for sexual function favoring immediate reconstruction.<sup>13,14</sup> Autologous reconstruction was also related to higher levels of psychosocial and sexual well-being, compared with implant-based procedures.<sup>15</sup> The integration of postreconstruction radiation has also been suggested since the overall quality of life, evaluated from the patient's perspective, does not seem to be compromised.<sup>16,17</sup> However, the assessment of surgical-related variables is no longer sufficient to understand the multidimensional construct of quality of life which refers to a combination of physical, psychological, social, and spiritual domains.<sup>18,19</sup> According to the World Health Organization, quality of life can be defined as the perception of individuals about their place in the culture and value system in relation to their aims, expectations, standards, and concerns.<sup>20</sup>

Considering the definition of quality of life, and that the ultimate goal of breast reconstruction is the improvement of quality of life, the patients' perception must be considered.<sup>15</sup> However, few patient characteristics have been discussed in the literature, such as breast characteristics, age, and comorbidities.<sup>21</sup> One narrative review pointed to the importance of exploring the patients' unrealistic expectations towards this procedure, suggesting that patient education could improve quality of life outcomes.<sup>22</sup> To our knowledge, only one integrative review discussed a broader range of variables that have been found to influence patient satisfaction, body image and quality of life in this population, suggesting pre-morbid influences, disease, and treatment-related factors as possible risk factors.<sup>23</sup>

Therefore, the aim of this study is to present a broader perspective of factors affecting quality of life after breast reconstruction in women with breast cancer by considering studies which included patients' self-reported outcomes.

## 2 | METHODS

This review was conducted following the principles of a systematic search.<sup>24,25</sup> For a more detailed presentation of all of the PRISMA 2009 checklist items, see Appendix 1 (section A).

### 2.1 | Eligibility criteria

Studies were included if the sample consisted of women with breast cancer exposed to postmastectomy breast reconstruction. Exclusions were made when the sample included only patients with prophylactic reconstructions due to gene mutation, if patient-reported outcome measures (PROMs) of quality of life after breast reconstruction were not assessed, and if they did not identify factors affecting self-reported quality of life.

### 2.2 | Search

Studies were identified by searching PsycInfo and Web of Science Core Collection, Current Contents Connect, Derwent Innovations

Index, KCI-Korean Journal Database, Russian Science Citation Index, SciELO Citation Index, and MEDLINE. The search was performed by one author (HS) from 29 March to 19 April 2019.

For more information regarding the full electronic search strategy and the keywords applied, see Appendix 1 (section B).

### 2.3 | Study selection

Eligibility assessment was performed independently by two authors (H.S. and S.C.), with an interrater agreement of 97.7%. Discrepancies were resolved by discussion and consensus. Study selection ended with 44 full-text articles.

### 2.4 | Data collection

The data collection process was performed independently by one author (H.S.) and confirmed by a second author (S.C.). Data were collected for the following items: studies characteristics (date and design), sample characteristics (size, country, age, type and timing of reconstruction, and adjuvant treatments), and outcome variables (quality of life tools, factors affecting quality of life, statistics used, and major results).

### 2.5 | Critical appraisal

Critical appraisal was performed with the Joanna Briggs Institute Checklists for Cross-sectional and for Cohort Studies. These checklists aim to assess the methodological quality of a study regarding the possibility of bias in its design, conduct, and analysis.

## 3 | RESULTS

### 3.1 | Study selection

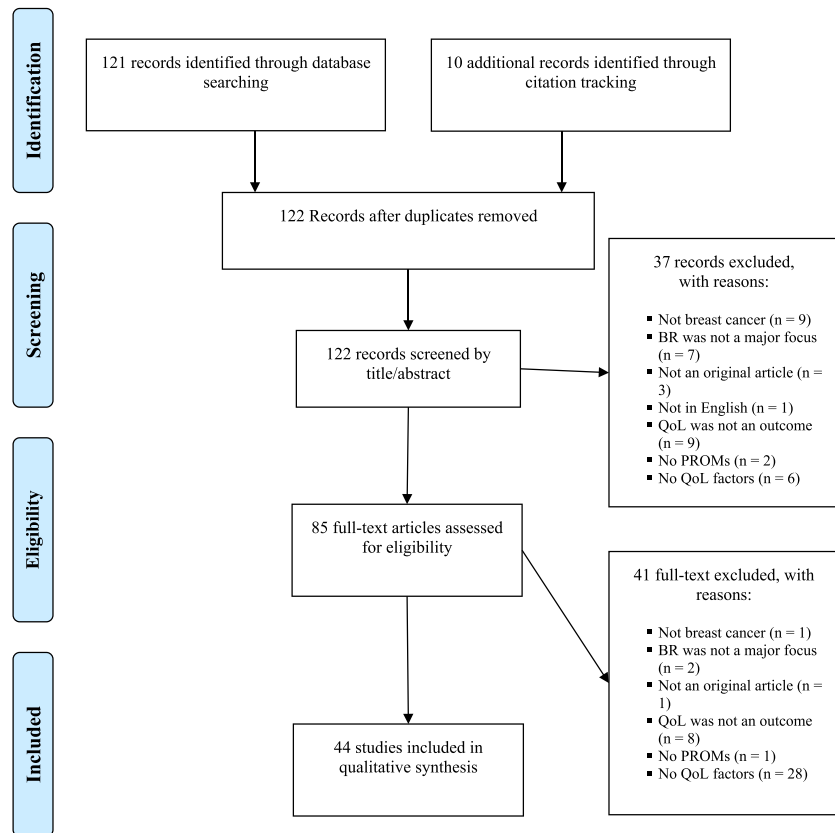
Figure 1 presents the PRISMA flow diagram with the different stages of study selection.

### 3.2 | Studies characteristics

The 44 included papers were published from 2000 to 2018. Most studies had a retrospective cross-sectional design ( $n = 31$ ), 12 studies were prospective, and one was ambispective. All of the included studies performed quantitative analysis.

### 3.3 | Critical appraisal

Two reviewers conducted the appraisal and its ratification (H.S. and S.C.) with an interrater agreement of 93.2%. Discrepancies were solved by discussion and consensus. Studies were rated as good ( $n = 16$ ), fair ( $n = 16$ ), poor ( $n = 9$ ), and very poor ( $n = 3$ ) regarding their quality. Most studies relied on medical records to assess clinical variables, which may introduce some bias as reliability was not assured. Most studies (56.8%) did not adjust for possible confounding factors, which



**FIGURE 1** PRISMA flow diagram with the different stages of study selection

is likely to introduce bias. One study did not apply a valid PROM to assess quality of life, considering the norms of the European Organization for Research and Cancer Treatment for the application of quality of life questionnaires.

For detailed information regarding critical appraisal, see Appendix 1 (section C).

### 3.4 | Patient characteristics

This review comprised a total of 16 683 women, who were on average 50.9 years old at study enrollment. Sixty-six percent underwent immediate reconstruction, while 32.7% underwent a delayed procedure. Less than 1% performed both procedures, due to immediate reconstruction failure. Fifty percent underwent autologous reconstruction, while 47.9% underwent an implant-based procedure. The remaining 2% had both surgical types, due to surgical complications. Patients were assessed on average 28.8 months after reconstruction, ranging from a minimum of 3 to a maximum of 88.8 months postoperatively. One study included patients ranging from a minimum of 15 to a maximum of 94 months after this procedure.<sup>26</sup>

For more information regarding the patients' characteristics, see Appendix 2 (Section A).

### 3.5 | Patient-reported outcome measures

Regarding quality of life assessment, 13 different PROMs were applied. The most commonly used was the BREAST-Q (n = 25).

For supporting information on these measures, see Appendix 2 (Section B).

From preconstruction to postreconstruction, five studies reported overall improvement,<sup>14,27-30</sup> while four studies failed to sustain these findings.<sup>3,31-33</sup> Three studies reported decreased physical and social functionality.<sup>5,6,34</sup>

### 3.6 | Factors affecting quality of life after breast reconstruction

Of the 44 included studies, 29 variables presented statistically significant associations with quality of life dimensions ( $P < .05$ ). Effect sizes (Cohen's d and f) were calculated for all outcomes if the necessary information was provided by the included studies. Other analyses have resulted in the transformation of these statistics into odds ratio (OR), to help compare the magnitude of the different variables in the main outcome. Next, three nonstatistically significant variables were included for qualitative analysis, since they presented medium to large OR.<sup>35</sup>

Table 1 presents all of the 32 factors affecting quality of life after breast reconstruction and the number of appearances across studies. Two authors (H.S. and S.C.) independently grouped each of these variables into the following categories: (a) surgical-related variables, (b) patients' clinical characteristics, (c) psychosocial variables, and (d) patients' sociodemographic characteristics. Inter-rater reliability resulted in a 96% agreement between raters. Disagreements were discussed, and a third author was consulted (M.G.P.).

**TABLE 1** Factors affecting quality of life after postmastectomy breast reconstruction in breast cancer women, grouped by category type. Number of appearances across studies are also indicated

Surgical-related variables (n = 9)	Clinical variables (n = 9)	Psychosocial variables (n = 9)	Sociodemographic variables (n = 5)
Type of reconstruction (n = 20) <sup>a</sup>	Radiotherapy (n = 13) <sup>a</sup>	Prereconstruction QoL (n = 3) <sup>a</sup>	Age (n = 14) <sup>a</sup>
Timing of reconstruction (n = 11) <sup>a</sup>	Chemotherapy (n = 6) <sup>a</sup>	Depression (n = 2) <sup>a</sup>	Marital status (n = 4) <sup>a</sup>
BR-related complications (n = 11) <sup>a</sup>	BMI (n = 6) <sup>a</sup>	Personality (n = 2) <sup>a</sup>	Educational level (n = 3) <sup>a</sup>
Type of mastectomy (n = 4) <sup>a</sup>	Cancer stage (n = 4) <sup>a</sup>	Satisfaction with esthetic outcome (n = 2) <sup>a</sup>	Work status (n = 4) <sup>a</sup>
Type of implant (n = 4) <sup>a</sup>	Smoking status (n = 2) <sup>a</sup>	Decision-making processes (n = 1) <sup>a</sup>	Race (n = 2) <sup>a</sup>
Fat grafting (n = 2) <sup>a</sup>	Comorbidities (n = 1) <sup>b</sup>	Perceptions on scaring (n = 1) <sup>a</sup>	
Time after reconstruction (n = 2) <sup>a</sup>	Immunotherapy (n = 1) <sup>a</sup>	Psychosocial well-being (n = 1) <sup>a</sup>	
Previous breast surgery (n = 1) <sup>a</sup>	Anxiolytic therapy (n = 1) <sup>b</sup>	Sexual well-being (n = 1) <sup>a</sup>	
Breast symmetrization (n = 1) <sup>b</sup>	Lymphedema (n = 1) <sup>a</sup>	Interpersonal problems (n = 1) <sup>a</sup>	

<sup>a</sup>Variables that reached statistical significance ( $P < .05$ ) at least once, on the included studies.

<sup>b</sup>Variables that did not reach statistical significance ( $P < .05$ ) but had medium or large effect sizes (odds ratio  $\geq 2$ , according to Sullivan and Feinn's editorial review from 2012).

Table 2 shows all the main results of the 44 included studies for qualitative synthesis. Only medium to large OR were reported. For support information on the calculation of effect sizes, see Appendix 3.

### 3.7 | Surgical-related variables

Type of mastectomy, previous breast surgery, breast symmetrization, timing of breast reconstruction, type of breast reconstruction, time after breast reconstruction, type of implants, fat-grafting, and complications were identified as variables affecting patient-reported outcomes of quality of life.

Regarding the type of mastectomy, three studies out of four (75%) found that patients who underwent nipple-sparing mastectomy reported significantly higher psychosocial<sup>36</sup> and sexual well-being,<sup>37</sup> when compared with non-nipple-sparing surgeries. Skin sparing mastectomy has also been found to better preserve physical well-being (in the chest), compared with modified radical mastectomy.<sup>10</sup>

Six studies out of 11 (54%) reported no significant differences between immediate and delayed procedures.<sup>14,26,32,34,38,39</sup> Studies that identified between group differences also reported mixed findings. On one hand, two studies reported the benefits of a delayed procedure for emotional,<sup>40</sup> psychosocial, sexual, and physical well-being,<sup>30</sup> while, on the other hand, three studies reported the benefits of an immediate breast reconstruction for physical, sexual, and emotional well-being.<sup>41-43</sup>

Nine studies out of 20 (45%) reported results favoring autologous procedures for psychosocial and sexual well-being.<sup>5,12,15,30,37,40,43-45</sup> Some studies also differentiated between different types of autologous procedures, favoring DIEP flaps over TRAM for psychosocial and physical well-being on the abdomen.<sup>42,45</sup> No significant differences were found between patients who underwent TRAM or latissimus dorsi flap.<sup>3,13,28</sup> One study found that implant-related breast reconstruction resulted on better physical function on the chest compared with autologous tissue reconstructions, which, in spite of its

benefits regarding psychosocial and sexual function, seemed to be more associated with lower vitality,<sup>46</sup> and higher body pain<sup>5,6</sup> than implant-based reconstructions.

Results regarding the association of fat grafting procedures with quality of life are mixed, since one study reported no significant associations,<sup>47</sup> while the other study reported fat grafting to be associated with psychosocial and sexual well-being.<sup>29</sup>

Regarding the choice between saline or silicone implants, the results pointed towards higher physical, psychosocial, and sexual well-being after silicone implant.<sup>48</sup> One study also suggested that there were no significant differences regarding the shape of the implant.<sup>49</sup>

Two studies assessed the role of time after reconstruction on these patients' quality of life. Santosa et al,<sup>37</sup> found that psychosocial, physical, and sexual well-being increased with time after this surgery. However, Matthews and colleagues<sup>50</sup> did not find this variable to be a significant predictor of quality of life.

Lastly, four studies out of 11 (36%) suggested that complications had a significant impact on physical, emotional, and sexual well-being.<sup>6,15,40,41</sup> Menez et al<sup>41</sup> reported that major complications (vs minor) were associated with lower psychosocial, emotional, and sexual well-being, while Winters et al<sup>6</sup> found that early complications (vs later) were associated with lower overall quality of life.

### 3.8 | Patients clinical characteristics

This review found important results regarding the associations between quality of life dimensions and clinical variables such as radiotherapy, chemotherapy, immunotherapy, cancer stage, lymphedema, body mass index (BMI), smoking status, and taking anxiolytics.

Three studies out of 13 (23%) reported significant associations between radiotherapy and lower social function,<sup>6</sup> lower physical well-being on the chest,<sup>51</sup> and lower psychosocial, physical, and sexual well-being.<sup>37</sup> Most studies reported nonstatistically significant results with low effect sizes.

**TABLE 2** Factors affecting quality of life after breast reconstructions, major results and effect sizes

Critical Appraisal	References	QoL Tools	Factors Affecting QoL	Results
Good (N = 16)	Bennet et al, 2017	BREAST-Q	Fat grafting	•Fat grafting ↓ psychosocial and sexual well-being
	Beugels et al, 2018	BREAST-Q	Timing of reconstruction (IR vs DL)	•NS
	Dauplat et al, 2017	QLQ-C30; BR23	Age at interview; BMI; work status; cancer stage; satisfaction with outcome	•Younger patients (<60y) ↑ QoL •↓ BMI ↑ QoL •Active work ↑ QoL •Advanced stages ↓ QoL •Satisfaction ↑ QoL
	Eltahir et al, 2015	BREAST-Q	Type of reconstruction (implant vs FLAP)	•NS
	Eriksson et al, 2013	BREAST-Q	RT; neo-CT; BMI; age at interview; type of implant; presence of a plastic surgeon at MT; plastic surgeon experience	•For psychosocial well-being: no RT > prior to BR (OR = 3.31), no RT > after BR (OR = 7.19), NS •For sexual well-being: no RT > prior to RT (OR = 5.12), no RT > after BR (OR = 9.14), NS •For physical well-being: no RT > prior to RT (OR = 4.43), no RT > after BR (OR = 3.97), prior to BR < after BR (OR = 2.14), NS •↑ BMI ↓ psychosocial and sexual well-being •Younger patients (< 66y) ↓ psychosocial well-being
	Jeevan et al, 2017	BREAST-Q	Timing of reconstruction (IR vs DL); type of reconstruction (implant vs pedicle tram vs DIEP FLAP vs free TRAM FLAP)	•Pedicule TRAM ↑ psychosocial, physical and sexual well-being •DIEP FLAP ↑ psychosocial and physical well-being; DL: free TRAM ↑ sexual well-being •Silicone ↑ physical function (OR = 2.03)
	Macadam et al, 2010	QLQ-C30; BR23; BREAST-Q	Type of implant (silicone vs saline)	
	Macadam et al, 2013	BREAST-Q	Type of implant (shaped vs round)	•NS
	Macadam et al, 2016	BREAST-Q	Type of reconstruction (DIEP, pedicled TRAM, free TRAM, and muscle-sparing TRAM)	•DIEP ↑ physical well-being abdominal scale (OR = 15.20)
	Penha et al, 2016	QLQ-C30; BR23	Presence of lymphedema	•Lymphedema ↓ physical function, role function, cognitive function, and body image
	Potter et al, 2009	QLQ-C30; BR23; FACT-B	Complications	•NS
	Pusic et al, 2017	BREAST-Q; PROMIS-29	Type of reconstruction (implant vs FLAP); implant procedure; type of autologous reconstruction	•FLAP ↑ psychosocial and sexual well-being but ↑ pain interference
	Tonseth et al, 2008	SF-36	Type of reconstruction (DIEP vs implant)	•NS
	Winters et al, 2016	QLQ-C30; BR23; FACT-B	Type of reconstruction (implant vs FLAP); lymph node positivity; BMI; type of axillary surgery; tumor size; margin positivity; RT; CT; complications; age	•FLAP ↑ pain and ↑ sexual function •RT ↓ social function •CT ↓ global QoL, social functioning, functional well-being, arm symptoms •Early complications ↓ global QoL, role functioning, social functioning, physical well-being, and functional well-being •↓ Age ↓ physical well-being
	Zhong et al, 2011	BREAST-Q	Timing of reconstruction (IR vs DL)	•NS
	Zhong et al, 2016	SF-36	Timing of reconstruction (IR vs DL)	•IR ↑ psychosocial and sexual well-being, NS •DL ↑ physical well-being (chest), NS

(Continues)

TABLE 2 (Continued)

Critical Appraisal	References	QoL Tools	Factors Affecting QoL	Results
Fair (N = 16)	Bellino et al, 2011	SF-36	Depression; anxiety; work status; personality; interpersonal problems; illness severity; illness duration; number of childbirths; age at diagnosis; age at reconstruction	<ul style="list-style-type: none"> <li>•Unemployed or housewife ↓ QoL</li> <li>•Harm avoidance ↑ QoL (OR = 4.43)</li> <li>•Vindictive/self-centered problems ↑ QoL (OR = 2.14)</li> <li>•↑ Age at reconstruction ↑ QoL</li> <li>•NS</li> </ul>
	Brandberg et al, 2000	SF-36	Type of reconstruction (TRAM vs LD vs LTD); RT	•NS
	Browne et al, 2017	Constructed questionnaire	Complications; timing of reconstruction (IR vs DL); type of reconstruction (implant vs FLAP)	<ul style="list-style-type: none"> <li>•FLAP with complications ↓ emotional well-being (OR = 3.56), NS</li> <li>•Implant-related complications ↓ emotional well-being (OR = 3.08), NS</li> <li>•Implant-related complications ↓ physical well-being (OR = 2.62), NS</li> </ul>
	Cereijo-Garea et al, 2018	BREAST-Q	Age at interview; marital status; comorbidities; anxiolytics; type of MT (NSSM VS SSM VS MRM); simmetrization; lymphedema; RT; immunotherapy	<ul style="list-style-type: none"> <li>•Comorbidities ↓ psychosocial well-being (OR = 2.10), NS</li> <li>•Divorced ↑ psychosocial well-being (OR = 6.90), NS</li> <li>•Taking anxiolytic ↑ sexual well-being (OR = 3.48), NS</li> <li>•SSM ↑ physical well-being (chest) (OR = 4.27)</li> <li>•Simmetrization ↑ physical well-being (OR = 2.49), NS</li> <li>•Lymphedema ↓ physical well-being (chest) (OR = 12.9)</li> <li>Immunotherapy ↓ psychosocial (OR = 4.25) and sexual well-being (OR = 7.34)</li> </ul>
	Dean et al, 2016	BREAST-Q	Timing of reconstruction (IR vs DL); type of reconstruction (implant vs FLAP)	<ul style="list-style-type: none"> <li>•DL reconstruction ↑ physical function (chest), psychosocial and sexual well-being</li> <li>•FLAP ↑ psychosocial well-being</li> </ul>
	Dieterich et al, 2015	BREAST-Q	Type of implant (implant vs TILOOP); timing of reconstruction (IR vs DL); type of MT (SSM or NSSM vs MRM vs SMT); additional FLAP; age at reconstruction; previous breast surgery; complications; seroma; lymph node dissection; CT; RT; BMI; smoking status	<ul style="list-style-type: none"> <li>•TILOOP ↑ physical well-being (chest) (OR = 5.31), NS</li> <li>•Previous breast surgery ↑ physical and psychosocial well-being</li> <li>•↑ BMI ↓ physical well-being</li> <li>•Smoking ↓ physical well-being</li> </ul>
	Juhl et al, 2017	SWLS	Personality; prereconstruction QoL; age at interview; BMI; marital status; educational level; laterality of reconstruction; complications (minor vs major); RT; CT; type of reconstruction (implant vs FLAP); timing of reconstruction (IR vs DL)	<ul style="list-style-type: none"> <li>•↑ Neuroticism ↓ QoL</li> <li>•↑ Openness ↓ QoL</li> <li>•↑ prereconstruction QoL ↑ QoL after BR</li> <li>•↑ BMI ↓ QoL</li> </ul>
	Liu et al, 2014	BREAST-Q	Complications; type of reconstruction (implant vs FLAP)	<ul style="list-style-type: none"> <li>•Complication ↓ physical well-being</li> <li>•Flap ↑ psychosocial (OR = 3.02) and sexual well-being (OR = 3.25)</li> </ul>
	Oh et al, 2018	FACT-B	Timing of reconstruction (IR vs DL); type of reconstruction (implant vs FLAP)	•NS
	Parra Pont et al, 2017	BREAST-Q	RT	•RT ↓ physical well-being (chest)
	Peiris et al, 2017	BREAST-Q	Timing of RT (after BR; before BR)	•NS
	Pinell-White et al, 2015	WHO-QoL BREF	Age at interview; race; educational level; marital status; community setting; work status; insurance type; cancer stage; complications; obesity; RT; type of reconstruction (implant vs LD vs TRAM); additional surgery	<ul style="list-style-type: none"> <li>•↑ Educational level ↑ psychological losses</li> <li>•Married ↓ overall QoL, social and environmental domains</li> <li>•Advanced stages ↓ satisfaction with life</li> </ul>
	Pirro et al, 2017	BREAST-Q	Type of reconstruction (implant vs FLAP)	•Implant ↑ chest physical well-being (OR = 2.81), NS
	Qureshi et al, 2017	BREAST-Q	Implant procedure; fat grafting	•NS

(Continues)

TABLE 2 (Continued)

Critical Appraisal	References	QoL Tools	Factors Affecting QoL	Results
	Santosa et al, 2018	BREAST-Q	Type of reconstruction (implant vs FLAP); age; BMI; prereconstruction QoL; time after reconstruction; laterality of reconstruction; lymph node dissection; type of MT (NSSM vs MRM); diabetes; smoking status; RT; CT; race; ethnicity; educational level; level of income; marital status; work status	<ul style="list-style-type: none"> <li>•FLAP ↑ higher psychosocial and sexual well-being</li> <li>•↑ Age ↑ psychosocial and sexual well-being</li> <li>•↑ BMI ↓ physical well-being</li> <li>•↑ Prereconstruction QoL ↑ psychosocial, physical and sexual well-being after reconstruction</li> <li>•↑ Time after reconstruction ↑ psychosocial, physical and sexual well-being</li> <li>•NSSM ↑ psychosocial and sexual well-being</li> <li>•Ex-smokers ↓ psychosocial and sexual well-being</li> <li>•RT after reconstruction ↓ psychosocial, physical and sexual well-being</li> <li>•Chemotherapy ↓ psychosocial and sexual well-being</li> <li>•Black race ↑ psychosocial and sexual well-being</li> <li>•College ↓ sexual well-being</li> <li>•Married ↑ psychosocial and sexual well-being</li> <li>•Part-time ↑ physical well-being</li> <li>•NS (<math>\rho = 0.12</math>)</li> </ul>
	Sisco et al, 2015	BREAST-Q	Age at interview (<65>)	<ul style="list-style-type: none"> <li>•NS (<math>\rho = 0.12</math>)</li> </ul>
Poor (N = 9)	Ashraf et al, 2013	SF-12	Paternalistic, informed, or shared decision	<ul style="list-style-type: none"> <li>•Paternalistic ↓ physical function (OR = 4.12)</li> </ul>
	Bailey et al, 2017	BREAST-Q	Type of MT; quality of care; complications; prereconstruction QoL	<ul style="list-style-type: none"> <li>•NSPM ↑ psychosocial well-being (OR = 2.57)</li> </ul>
	De Gournay et al 2010	QLQ-C30; BR23	Type of reconstruction (implant vs FLAP); complications	<ul style="list-style-type: none"> <li>•NS</li> </ul>
	Heneghan et al, 2011	QLQ-C30; BR23; FACT-B	RT; type of reconstruction (LD alone and LD with implant); cancer stage	<ul style="list-style-type: none"> <li>•LD alone ↑ QLQC-30 global score (OR = 12.90), NS</li> </ul>
	Ludolph et al, 2015	BREAST-Q	Age at interview (<60<)	<ul style="list-style-type: none"> <li>•NS</li> </ul>
	Matthews et al, 2017	QLQ-C30	Age at interview; type of reconstruction (implant vs FLAP); time after reconstruction; perceptions on scaring; satisfaction with outcome; psychosocial and sexual well-being	<ul style="list-style-type: none"> <li>•↑ Perceptions on scar quality ↑ overall QoL</li> <li>•↑ Satisfaction ↑ overall QoL</li> <li>•↑ Psychosocial well-being ↑ overall QoL</li> <li>•↑ Sexual well-being ↑ overall QoL</li> </ul>
	Menez et al, 2017	BREAST-Q	Timing of reconstruction (IR vs DL); DL reconstruction (failure vs conversion); type of reconstruction (DIEP, LDI, LD); complications (minor vs major); age	<ul style="list-style-type: none"> <li>•IR ↑ sexual well-being (OR = 129.2)</li> <li>•Failure reconstruction ↑ sexual well-being (OR = 5.50), NS</li> <li>•LDI ↑ sexual well-being (OR = 4.12), NS</li> <li>•Major complications ↓ psychosocial and sexual well-being</li> <li>•Older patients (&gt;60) ↑ psychosocial well-being</li> </ul>
	Thorarinsson et al, 2017	SF-36; PGWB; EQ-5D; BREAST-Q	Type of reconstruction (DIEP vs LD vs LDT vs implant)	<ul style="list-style-type: none"> <li>•DIEP ↓ vitality</li> </ul>
	Yang et al, 2015	SF-36	RT; lymph node dissection	<ul style="list-style-type: none"> <li>•NS</li> </ul>
Very Poor (N = 3)	Goktas et al, 2011	QLQ-C30; SCL-R-90; SF-36	Timing of reconstruction (IR vs DL)	<ul style="list-style-type: none"> <li>•DL ↓ physical (OR = 5.12), emotional function (OR = 2.62) and ↑ body pain (OR = 2.62)</li> </ul>
	Min et al, 2010	BR-23	Cancer stage; age (<40<); postop RT; postop CT; Neo-CT	<ul style="list-style-type: none"> <li>•Lower stages ↓ body image (OR = 15.20), sexual functioning (OR = 52.15); and future perspectives (OR = 4.76), NS</li> <li>•No RT ↑ sexual functioning (OR = 3.62), and future perspectives (OR = 2.26), NS</li> <li>•Neo-CT ↓ future perspectives (OR = 5.50)</li> </ul>

(Continues)

TABLE 2 (Continued)

Critical Appraisal	References	QoL Tools	Factors Affecting QoL	Results
	Szadowska-Szlachetka et al, 2013	QLQ-C30; BR23	Depression	•Depression ↓ overall QoL (OR = 10.38), physical (OR = 5.31), role (OR = 4.67), emotional (OR = 9.14), and cognitive function (OR = 8.66)

Abbreviations: BMI, Body mass index; BREAST-Questionnaire; DIEP, deep inferior epigastric perforators flap; DL, delayed reconstruction; EORTC QLQ-C30, The European Organization for Research and Treatment of Cancer (General module); EQ-5D, The EuroQol Group questionnaire; FACT-B, The Functional Assessment of Cancer Therapy-Breast; IR, immediate reconstruction; LD, latissimus dorsi myocutaneous flap; LDI, latissimus dorsi myocutaneous flap with implant; LTD, lateral thoracodorsal flap; MRM, modified radical mastectomy; neo-CT, neoadjuvant chemotherapy; NS, not statistically significant ( $P > .05$ ); NSPM, nipple-sparing mastectomy; NSSM, nonskin sparing mastectomy; OR, odds ratio; PGWB, Psychological General Well-Being Index; postop CT, postoperative chemotherapy; postop RT, postoperative radiotherapy; QLQ-BR23, Supplementary questionnaire (breast cancer module); SF-36, The 36-Item Short Form Health Survey questionnaire; SF-12, an abridged version of the SF-36; Satisfaction with Life Scale (SWLS); SMT, subcutaneous mastectomy; SSM, skin-sparing mastectomy; TILOOP, titanium-coated polypropylene mesh implant; TRAM, transverse rectus abdominis myocutaneous flap; WHO-QOL-BREF, World Health Organization Quality of Life questionnaire.

Four studies out of six (67%) reported that chemotherapy was associated with low levels of psychosocial, sexual, and social function, and an overall lower quality of life.<sup>6,37,52,53</sup> One study found that patients who underwent immunotherapy presented higher odds of having lower psychosocial and sexual well-being.<sup>10</sup>

Two studies out of four (50%) found that less invasive stages were associated with higher levels of overall quality and satisfaction with life.<sup>3,31</sup> However, further analysis revealed that patients with advanced stages of cancer had higher odds of worse overall quality of life, especially for sexual function.<sup>53</sup>

Presence of lymphedema was identified as a significant predictor of lower physical well-being on the chest,<sup>10</sup> role function, cognitive function, and body image.<sup>2</sup>

Five studies out of six (83%) reported that a higher BMI significantly affected the overall quality of life and its physical, psychosocial and sexual dimensions.<sup>31,37,39,52</sup> Regarding smoking status, both studies that identified this variable consistently reported its negative effects on physical, psychosocial, and sexual function.<sup>37,39</sup>

Lastly, one study<sup>10</sup> also found that patients who took anxiolytics also presented higher odds of having lower sexual well-being after breast reconstruction.

### 3.9 | Psychosocial variables

Prereconstruction quality of life, psychosocial and sexual well-being, depression, personality, interpersonal relationships, satisfaction with the cosmetic outcome, perceptions on scarring, and the process of decision-making were identified across the included studies as factors affecting quality of life.

Two studies out of three (67%) found that higher levels of prereconstruction quality of life were significant predictors of higher levels of overall quality of life<sup>36</sup> and its dimensions such as psychosocial, physical, and sexual well-being.<sup>32,37</sup>

The association between depression symptoms and quality of life was identified by two studies. One study did not find depression to be a significant predictor of overall quality of life,<sup>27</sup> while the other

study found that higher depression levels were significantly associated with lower overall quality of life, physical, role, emotional, and cognitive function, with large OR.<sup>54</sup>

Two studies focused on the role of personality characteristics on self-reported quality of life. Results revealed that higher levels of harm avoidance were associated with higher levels of overall quality of life,<sup>27</sup> while high neuroticism and openness were associated with lower overall quality of life.<sup>32</sup>

Satisfaction with esthetic outcome and scar quality were also associated with higher levels of overall quality of life.<sup>31,50</sup>

Lastly, one study found that patients with a paternalistic decision-making process (vs informed) reported lower levels of physical function.<sup>55</sup>

### 3.10 | Patients sociodemographic characteristics

Age, marital status, educational level, work status, and race were the sociodemographic characteristics that presented significant results related to quality of life after breast reconstruction.

Six studies out of 14 (43%) identified age as a significant factor. Three studies found that older patients reported higher levels of psychosocial, sexual, and physical well-being,<sup>6,37,41</sup> while Dauplat et al<sup>31</sup> found that younger patients reported higher overall quality of life, but with low effect sizes. Two studies suggested that older patients reported higher levels of overall quality of life after breast reconstruction.<sup>27,39</sup> The remaining studies did not report significant differences between younger and older patients.<sup>3,10,32,50,52,53,56,57</sup>

Four studies reported findings regarding marital status. One study reported that married women reported lower levels of overall quality of life,<sup>3</sup> while another study reported somewhat opposite results, since married women reported higher levels of psychosocial and sexual well-being.<sup>37</sup> Juhl and colleagues<sup>32</sup> did not find any differences regarding marital status, but Cereijo-Garea and colleagues<sup>10</sup> found that divorced women had higher odds of having higher psychosocial well-being, when compared with single women.



Two studies out of three (67%) suggested that women with higher levels of education reported lower levels of psychological and sexual function.<sup>3,37</sup>

Work status was studied by four studies. Three of them (75%) found that active women reported higher levels of quality of life,<sup>27,31</sup> especially if working in part-time jobs.<sup>37</sup>

Lastly, two studies reported results regarding race,<sup>3,37</sup> and one of them reported significant differences favoring black women for psychosocial and sexual well-being.<sup>37</sup>

## 4 | DISCUSSION

Since the percentage of patients who underwent breast reconstruction increased from 26.9% in 2005 to 43% in 2014,<sup>58</sup> the assessment of these patient's point of view is considered a further step towards a more integrated approach of cancer treatment.

To the best of our knowledge, the present study is the first systematic review of the literature that explores the relationship between surgical, clinical, psychosocial, and sociodemographic variables and self-reported quality of life after postmastectomy breast reconstruction in breast cancer patients.

Which factors affect quality of life after breast reconstruction?

This review identified 32 empirically based variables associated with self-reported domains of quality of life in women with breast cancer after reconstruction.

Some variables were more prominent than others as they presented a higher number of appearances across studies, such as type of reconstruction, time of reconstruction, surgical-related complications, and postreconstruction radiotherapy. This finding sustains the argument that research focused on quality of life after breast reconstruction is still focused on surgical variables and their impact on the patients' quality of life outcomes. However, interesting results were found for psychosocial, clinical, and sociodemographic variables and, thus, also worthy of discussion.

This review found that decision-making process may affect patients' self-reported quality of life after breast reconstruction. Patients within the paternalistic model, which represents a physician dominated communication, reported lower physical function compared with the patients who took a more active role in their treatment choices. This result sustains the need to increase the patients' information about this procedure in order to prevent decisional-regret, a common phenomenon after breast reconstruction.<sup>59</sup>

Personality traits also had significant effects on the patient's overall quality of life after breast reconstruction, specially neuroticism.<sup>32</sup> This personality trait has previously been reported as a risk factor for overall quality of life in the general population.<sup>60</sup> This finding suggests that these characteristics should be carefully evaluated before surgery so that precise referrals can be made to psycho-oncology units to help these patients develop better coping mechanisms. The same principle should be applied when depressive symptoms are present before reconstruction, since this review also suggested that this

variable is negatively associated with physical, role, emotional, and cognitive function after this procedure.<sup>54</sup>

This review also suggested that prereconstruction levels of psychosocial and sexual functioning may also help predict postreconstruction quality of life.<sup>32,36,37</sup> Hereafter, prospective studies are also needed to explore which psychosocial, clinical, demographic, and surgical variables may influence these patients' postreconstruction quality of life.

In addition, current results have congruently proposed higher BMI as a possible risk factor for lower quality of life.<sup>31,32,39</sup> A recent meta-analysis also supported the suggested impact of obesity on morbidity and surgical complications after reconstruction.<sup>61</sup>

When considering sociodemographic variables, age is an important variable to discuss. A recent systematic review has reported that the uptake of breast reconstruction after mastectomy is lower in older patients, raising the question that some older women are currently not proposed for reconstruction because of generalized assumptions about esthetic needs or age-related safety concerns.<sup>62</sup> Interestingly, this review suggested that patients with 60 years old or more reported higher levels of psychosocial well-being after this surgery,<sup>22,34</sup> or similar overall quality of life results when compared with younger patients.<sup>55,58</sup> Similar results have been previously reported.<sup>63</sup> Therefore, this review seems to suggest that age alone is not a contraindication for quality of life after breast reconstruction. Instead, it supports the idea that older women can benefit from reconstruction, and this procedure should be offered and openly discussed with them.

Previous research also suggests that married women are more likely to undergo breast reconstruction than single women.<sup>64</sup> Future research should focus on women's relationship motivations for breast reconstruction and on the expected impact of this surgery on the couple's attachment and marital adjustment.

## 5 | CONCLUSION

The results' section of this review identified a broad collection of 32 empirically-based factors affecting quality of life grouped into four different categories: surgical, clinical, psychosocial, and sociodemographic variables. Therefore, it sustains the need to adopt a more holistic approach and advises the consideration of preoperative psychosocial, clinical, and sociodemographic variables to better understand these patient's overall quality of life and to implement future preventive measures. Its new contribution is that it goes beyond surgical factors of morbidity and uses patient reported outcomes to scope wider issues that influence quality of life, particularly preoperative psychosocial, clinical, and sociodemographic factors.

### 5.1 | Study limitations

The consideration of PROMs for the assessment of quality of life resulted on the exclusion of qualitative studies, and, as a result, relevant content may have been excluded. Also, some of the included studies presented associations with global quality of life measures.

Since quality of life is a broad concept, an effort was made to discriminate between its different dimensions throughout this review, although this was not always possible. Most of the included studies used cross-sectional retrospective designs, but this methodology is susceptible to a high error rate and bias. Most papers did not control for confounding factors on their regression models. Studies with poor and very poor quality were included in this review, but the evaluation of quality was not considered when reporting the results, which may increase the risk of bias. Therefore, results should be carefully interpreted, and further prospective, higher quality, larger studies, with instruments discriminating the different quality of life domains, such as the BREAST-Q breast reconstruction module, should be utilized.

## 5.2 | Clinical implications

Findings regarding modifiable factors such as psychosocial and clinical variables suggested that patients who are proposed to breast reconstruction may benefit from a preoperative assessment in order to identify possible vulnerability factors for worse quality of life. Preoperative psychosocial assessment is already implemented as a routine practice in other clinical settings such as bariatric surgery,<sup>65</sup> organ transplantation,<sup>66</sup> and other cosmetic surgeries.<sup>67</sup> These assessments can help identify patients at risk for lower quality of life, which patients are more likely to benefit from this procedure, and help the identification of areas for psychosocial intervention, both before and after reconstruction. This may also include the need to discuss breast reconstruction outcomes, including the negative ones, in order to give these women more realistic expectations, as suggested in a previous review.<sup>22</sup>

Other clinical modifiable factors, such as weight and smoking status, should also be carefully addressed preoperatively, reinforcing the possible benefits of adopting preventive measures. Additional research is needed to determine if weight and tobacco reductions prior to reconstruction improve postoperative quality of life and if endocrine therapy poses and additional risk to quality of life after this procedure.

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## DISCLOSURE STATEMENT

No potential conflict of interest to declare.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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