



# Immediate versus delayed breast reconstruction: Long-term follow-up on health-related quality of life and satisfaction with breasts

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## KEYWORDS

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Patient-reported outcomes;  
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**Summary** *Introduction:* Health-related quality of life (HRQL) can be improved by breast reconstruction following mastectomy. The optimal timing of the reconstruction remains unclear. *Methods:* A cross-sectional study on 338 women who had undergone immediate or delayed breast reconstruction between 08/2017 and 07/2019 was performed. The postoperative HRQL was assessed using the BREAST-Q Reconstruction Module and the 36-Item Short Form Survey (SF-36). Regression analysis was performed for group-wise comparison.

*Results:* A total of 146 (43%) patients participated. Seventy-seven patients (53%) had undergone immediate, and 69 patients (47%) had delayed reconstruction. The median age was 55 years (interquartile ratio [IQR] 50-62) for the Immediate group, and 60 years (IQR 54-65) for the delayed reconstruction group. The median follow-up time was 2.3 years (IQR 1.8-2.9). No difference between the groups was detected in satisfaction with breasts (median 61, IQR 53-71 vs. 62, IQR 46-71,  $p = 0.62$ ), physical well-being of the chest (median 100, IQR 80-100 vs. 100, IQR 80-100,  $p = 0.95$ ) or psychosocial well-being (median 69, IQR 54-83 vs. 62, IQR 54-74,  $p = 0.19$ ). No difference was detected in the SF-36 domains either.

*Conclusions:* The timing of the breast reconstruction does not affect the postoperative HRQL. Patients with both immediate and delayed breast reconstruction reported high satisfaction with the breast and psychosocial well-being.

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Reconstruction of the breast after mastectomy has been shown to increase patient satisfaction and health-related quality of life (HRQL).<sup>1-4</sup> The breast reconstruction can be performed immediately at the time of the mastectomy or later. Immediate reconstruction has been associated with better psychosocial, sexual, and emotional well-being compared to delayed reconstruction.<sup>5-7</sup> Immediate reconstruction is cost-effective compared with delayed reconstruction due to reduced overall operating room time and shorter hospital stays.<sup>6</sup> However, delayed reconstruction has been linked with significantly lower complication and failure rates.<sup>8,9</sup>

Delayed reconstruction offers an advantage, especially in patients with comorbidities or in other ways not suitable for extensive, time-consuming operations. Furthermore, some studies have suggested that women with delayed breast reconstruction score higher in emotional, functional, and physical well-being.<sup>5,10</sup> Despite these early differences, the HRQL at one year postoperatively does not seem to differ between the groups.<sup>8,11</sup> There is still an ongoing debate regarding the effect of the reconstruction timing on the postoperative HRQL.

Generic and specific patient-reported outcome measures (PROMs) can be used to gain a comprehensive view of the HRQL of women undergoing breast surgery.<sup>12</sup> A widely used generic PROM is the 36-Item Short Form Survey (SF-36), which evaluates the general mental and physical health of the patients.<sup>13</sup> The BREAST-Q Reconstruction Module, in turn, is a breast-specific PROM used for assessing HRQL and patient satisfaction after breast reconstructive surgery.<sup>14,15</sup>

The aim of this study was to assess the HRQL in patients with immediate and delayed breast reconstruction on long-term follow-up. No restrictions regarding the reconstruction method were applied, reflecting the true reconstructive service at our institution at the time. Both a generic PROM, the SF-36, and a breast-specific PROM, the BREAST-Q Reconstruction Module, were used.

## Patients and methods

### Methods

A cross-sectional study was performed on patients with breast reconstruction after mastectomy between 08/2017 and 7/2019 in Helsinki University Hospital, Department of Plastic Surgery, as previously described.<sup>16</sup> The patients were identified using operating theater logs and sent a questionnaire package including a background information form, information on the study, the BREAST-Q questionnaire, the SF-36 form, the Holmes-Rahe stress scale, a consent form, and a prepaid return envelope. The questionnaire forms were resent if no answer was received the first time.

The patients' medical records were viewed for information on health status, underlying diseases, diagnosis, given oncological treatments, and the surgical approach. The patients were divided into two groups depending on the time of reconstruction. The study protocol was approved by the Helsinki University Hospital ethics committee (HUS/2737/2017). Written consent was obtained from all patients.

### Study questionnaires

The BREAST-Q Reconstruction Module (version 2.0) was used to assess the patients' postoperative HRQL. It has recently been validated for Finnish use.<sup>17</sup> Ten postoperative scales were analyzed for the study: psychosocial well-being, sexual well-being, satisfaction with breasts, physical well-being: chest, satisfaction with nipple reconstruction, adverse effects of radiation, satisfaction with information, satisfaction with surgeon, satisfaction with medical team, and satisfaction with office staff.<sup>18</sup>

The generic HRQL was assessed with the 36-Item Short Form Health Survey (SF-36), a self-reported outcome measure consisting of eight domains: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health.<sup>13</sup>

The Holmes-Rahe stress scale was used to evaluate the patients' stress levels. The Holmes-Rahe stress scale consists of 43 stressful life events, which can contribute to decreased HRQL. Each event is weighted differently depending on its severity. Total scores < 150 indicate low, 150-299 moderate, and > 300 high risk of illness.<sup>19</sup>

### Statistical analysis

The BREAST-Q scores were assessed and rescaled according to the instructions of the original authors of the BREAST-Q (2.0).<sup>20,21</sup> The SF-36 scores were rescaled per the authors' instructions.<sup>22</sup> The total score for the Holmes-Rahe stress scale was calculated.<sup>23</sup> The Spearman's rank correlation analysis was performed to determine the possible association between stress levels and HRQL.

Unless stated otherwise, the results are presented as the median and interquartile range (IQR, 25th and 75th percentiles). Group wise comparison was conducted using the Mann-Whitney U test for linear variables and the Chi-square test for binominal variables. Regression analysis was performed, correcting for age and indication for surgery. Correlations between the Holmes-Rahe stress scale and HRQL were analyzed using the Spearman's rank correlation. Fisher-Freeman-Halton test with post hoc Fisher Exact was used for groupwise comparison of patient and disease characteristics. Linear regression models adjusting for age, complications, reoperations, radiation, and whether the reconstruction process was complete or not were used to determine a possible correlation between these factors and the BREAST-Q and SF-36 scores. All

statistical tests were two-tailed. P-values < 0.05 were considered statistically significant.

Statistical analysis was conducted by using IBM SPSS version 27 and STATA version 17 statistical software.<sup>24,25</sup>

## Results

In total, 338 patients were identified, of whom 146 (43%) participated in the study. The participants' median age was 57 years (range 30-78, IQR 52-63). The median age for patients with immediate reconstruction was 55 years (IQR 50-62) and 60 years (IQR 54-65) for patients with delayed reconstruction,  $p = 0.003$ . There was no significant difference between the groups regarding smoking habits, body mass index (BMI), or American Society of Anesthesiologists (ASA)-classification (Table 1). The median time from the breast reconstruction to answering the survey was 28 months (IQR 21-35), and the median time from the last breast reconstruction procedure to the survey was 16 months (IQR 10-21). The indication for mastectomy was cancer ( $n = 115$ , 79%) or the presence of a cancer-associated gene ( $n = 20$ , 14%). Of all patients, 12 (8.2%) had both cancer and a cancer-associated gene (Table 1). The median age of the nonresponders was 54 years (IQR 47-62),  $p = 0.019$ . Although the nonresponders were significantly younger than the study participants, we found no associations in regression analyses between age and BREAST-Q scores in any of the used scales.

Seventy-seven patients (53%) underwent immediate and 69 patients (47%) delayed reconstruction. The reconstructive modalities chosen for each patient are listed in Table 2. Most of the patients ( $n = 119$ , 82%) had undergone more than one reconstructive surgery, including nipple reconstructions ( $n = 67$ , 46%) and reoperations due to complications ( $n = 22$ , 15%). A total of 56 patients (38%) were still waiting for minor reconstructive procedures, including

nipple reconstructions and serial fat grafting. In 21 patients (14%), it was unclear whether further reconstructive surgeries were required.

Of all patients, 68 (47%) had no postoperative complications. The most common complications were seromas ( $n = 29$ , 20%) and prolonged wound healing ( $n = 13$ , 9%). Primary revision surgery, either reanastomosis, hemostasis, or hematoma evacuation, was performed in 20 cases (4%). Two cases (1.4%) resulted in flap loss. Forty-seven patients (61%) with immediate reconstruction suffered a complication compared with only 18 (26%) of the patients with delayed reconstruction,  $p < 0.001$ . Minor complications were significantly more common in the group with immediate reconstruction compared with delayed reconstruction ( $n = 29$  vs  $n = 11$ ,  $p = 0.03$ ) (Table 2). When performing regression analyses, surgical complications did not affect BREAST-Q scores or the SF-36. In patients requiring a reoperation, we found a negative effect on the Satisfaction with Breast scale, although not statistically significant,  $p = 0.054$ . The median for patients with and without reoperations did not differ (median 61, IQR 35-71 vs median 61, IQR 51-71,  $p = 0.39$ ).

## Psychosocial and sexual well-being

Psychosocial well-being was similar in patients with immediate and delayed reconstruction ( $n = 77$ , median 69, IQR 54-83 vs.  $n = 68$ , median 62, IQR 54-74,  $p = 0.19$ ). The scores for sexual well-being did not differ either ( $n = 76$ , median 50, IQR 37-66 vs.  $n = 66$ , median 49, IQR 39-66,  $p = 0.83$ ) (Table 3a, Figure 1a).

## Satisfaction with breast and physical well-being: Chest

The overall median score for satisfaction with breasts was 61 (IQR 49-71). No significant difference was detected between

**Table 1** General characteristics of the study participants.

Group	All	Immediate	Delayed	
N (%)	146 (100)	77 (53)	69 (47)	
<b>Variable</b>	<b>Median (IQR) range</b>			<b>P-value</b>
Age (years)	57 (52-63), 30-78	55 (50-62), 30-75	60 (54-65), 36-78	< 0.005
Time from first reconstruction (months) <sup>a</sup>	28 (21-35), 10-174	26 (20-34), 10-172	29 (21-35), 13-140	0.28
Time from last reconstruction (months) <sup>a</sup>	16 (10-21), 0.2-38	14 (8-18), 0-36	17 (10-24), 0-37	0.04
BMI (kg/m <sup>2</sup> )	25 (23-28), 18-34	26 (23-30), 19-34	25 (23-27), 18-33	0.09
<b>Variable</b>	<b>All, N (%)</b>	<b>Immediate, N (%)</b>	<b>Delayed, N (%)</b>	<b>P-value</b>
Active smoker				0.72
Yes	5 (3.4)	2 (3.4)	2 (2.9)	
No	139 (93)	72 (94)	67 (97)	
Missing	2 (1.4)			
ASA-classification				0.73
ASA I	74 (51)	38 (49)	36 (52)	
ASA II-III	72 (49)	39 (51)	33 (48)	
Reason for surgery				< 0.005
Cancer	126 (86)	61 (87)	66 (96)	
Cancer-associated gene	20 (14)	17 (22)	3 (4.3)	

ASA, American Society of Anesthesiologists; BMI, body mass index; IQR, interquartile range.

<sup>a</sup> Time from reconstruction to answering the BREAST-Q.

**Table 2** Surgical characteristics of the study participants.

Variable	All, N (%)	Immediate, N (%)	Delayed, N (%)	P-value
<b>Primary reconstruction method</b>				
LD <sup>a</sup> (+/- implant)	45 (31)	33 (43)	12 (17)	< 0.005
Microvascular flap	77 (53)	38 (49)	39 (57)	0.41
Fat graft <sup>b</sup>	18 (12)	1 (1.3)	17 (25)	< 0.005
Implant only	6 (4.1)	5 (6.5)	1 (1.4)	0.21
<b>Total no of reconstruction</b>				
1	27 (18)	13 (17)	14 (20)	
2-3	85 (58)	44 (57)	41 (59)	
4-5	24 (16)	15 (19)	9 (13)	
> 5	10 (6.8)	5 (6.5)	5 (7.2)	0.76
<b>Contralateral surgery for symmetrization</b>				
Reduction mammoplasty	20 (14)	4 (5.2)	16 (23)	< 0.005
Mastopexy	9 (6.2)	0	9 (13)	< 0.005
Mastectomy	1 (0.7)	0	1 (1.4)	0.47
None	116 (80)	73 (95)	43 (62)	< 0.005
<b>Nipple reconstruction</b>				
Yes	67 (56)	29 (38)	38(55)	
No	79 (54)	48 (62)	31 (45)	0.04
<b>Radiation to the chest</b>				
Yes	77 (53)	28 (36)	49 (71)	
No	69 (47)	49 (64)	20 (29)	< 0.005
<b>Complications: Clavien-Dindo classification</b>				
0	81 (56)	30 (39)	51 (74)	< 0.005
I	40 (27)	29 (38)	11 (16)	0.005
II	3 (2.1) <sup>c</sup>	3 (3.9)	0	0.25
III a	2 (1.4) <sup>d</sup>	1 (1.3)	1 (1.4)	1.0
III b	20 (14) <sup>e</sup>	14 (18)	6 (8.7)	0.15

<sup>a</sup> Latissimus Dorsi-flaps.

<sup>b</sup> Fat grafting alone in serial sessions.

<sup>c</sup> Infection (n = 2), cardiovascular complications (n = 1).

<sup>d</sup> Infection (n = 2).

<sup>e</sup> Bleeding (n = 13), pedicle occlusion (n = 3), infection (n = 3), partial flap necrosis (n = 1).

patients who had undergone immediate (n = 61, median 61, IQR 53-71) or delayed reconstruction (n = 54, median 62, IQR 46-71), p = 0.62. After finishing the reconstruction process, patients had a positive association with satisfaction with breasts (mean difference 6.5, CI 95% 1.8-11.2, p = 0.007). The physical well-being of the chest was high in patients with immediate and delayed reconstruction, and no significant difference was detected between the groups (n = 77, median 100, IQR 80-100 vs. n = 69, median 100, IQR 80-100), p = 0.95 (Table 3b, Figure 1b). Prior radiation to the chest was found to have a negative association with the physical

well-being of the chest (mean difference -3.7, confidence interval [CI] 95% -7.1, -0.3, p = 0.033).

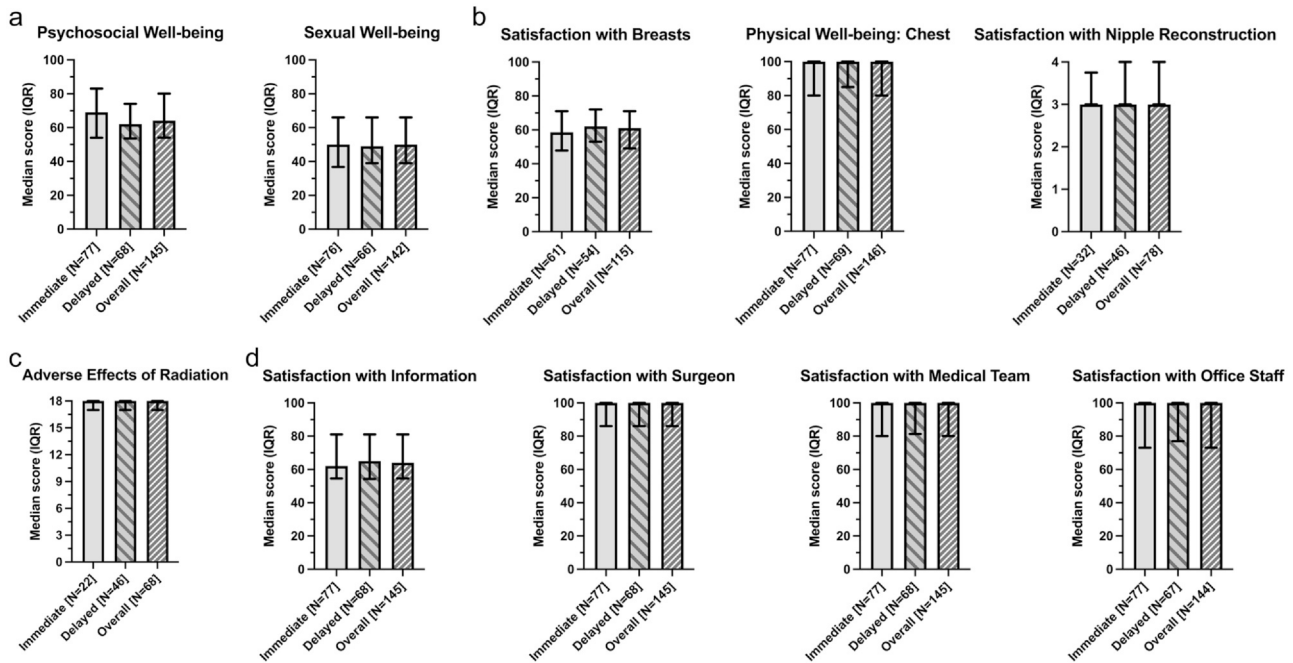
### Satisfaction with nipple reconstruction

A total of 78 (53%) patients had undergone nipple reconstruction. On the 1-4-point scale, the overall median score for satisfaction with the nipple reconstruction was 3 (IQR 3-4). Both patients with immediate (n = 32, median 3, IQR 3-4) and delayed reconstruction (n = 46, median 3, IQR

**Table 3a** BREAST-Q scores for psychosocial and sexual well-being of the study participants 2.3 (0.8-14.3) years after breast reconstruction.

Scale	All		Immediate		Delayed		P-value
	N (%)	Median (IQR)	N (%)	Median (IQR)	N (%)	Median (IQR)	
Psychosocial well-being	145 (99)	64 (54-80)	77 (100)	69 (54-83)	68 (99)	62 (54-74)	0.22
Sexual well-being	142 (97)	50 (39-66)	76 (99)	50 (37-66)	66 (96)	49 (39-66)	0.61

IQR, interquartile range.



**Figure 1** a. BREAST-Q scores for psychosocial and sexual well-being of the study participants 2.3 (0.8-14.3) years after breast reconstruction. b. BREAST-Q scores for satisfaction with breasts, physical well-being: chest, and satisfaction with nipple reconstruction of the study participants 2.3 (0.8-14.3) years after breast reconstruction. c. BREAST-Q scores for adverse effects of radiation of the study participants 2.3 (0.8-14.3) years after breast reconstruction. d. BREAST-Q scores for satisfaction with care of the study participants 2.3 (0.8-14.3) years after breast reconstruction.

3-4) were satisfied with the nipple reconstruction,  $p=0.72$  (Table 3b, Figure 1b).

**Adverse effects of radiation**

Of all patients, 68 (47%) had received radiotherapy to the chest area. In this directly scored scale ranging from 3 to 18, high scores indicate few adverse effects of radiation. There was no difference in adverse effects of radiation between patients with immediate ( $n=22$ , median 18, IQR 17-18) and delayed ( $n=46$ , median 18, IQR 17-18) reconstruction,  $p=0.26$  (Table 3c, Figure 1c).

**Satisfaction with care**

All patients scored high on the scales regarding satisfaction with the care. No significant difference was detected between the immediate and delayed reconstruction groups in satisfaction with information ( $n=77$ , median 69, IQR 55-83 vs.  $n=68$ , median 59, IQR 53-74,  $p=0.28$ ), satisfaction with surgeon ( $n=77$ , median 100, IQR 84-100 vs.  $n=68$ ,

median 100, IQR 86-100,  $p=0.68$ ), satisfaction with medical team ( $n=77$ , median 100, IQR 80-100 vs.  $n=68$ , median 100, IQR 81-100,  $p=0.86$ ) or satisfaction with office staff ( $n=77$ , median 100, IQR 75-100 vs.  $n=67$ , median 100, IQR 68-100,  $p=0.25$ ) (Table 3d, Figure 1d).

**36. -Item Short Form Health Survey (SF-36)**

The scores for the SF-36 survey did not significantly differ between patients with immediate and delayed reconstruction,  $p=0.2-0.8$  (Table 4).

**Holmes-Rahe stress scale**

Both patients with immediate and delayed reconstruction scored similar on the Holmes-Rahe stress scale ( $n=77$ , median 102, IQR 61-187 vs.  $n=69$ , median 104, IQR 58-149,  $p=0.48$ , respectively).

High-stress levels in the Holmes-Rahe scale correlated with the lower physical well-being of the chest (Spearman

**Table 3b** BREAST-Q scores for satisfaction with breasts, physical well-being: Chest, and satisfaction with nipple reconstruction of the study participants 2.3 (0.8-14.3) years after breast reconstruction.

Scale	All		Immediate		Delayed		P-value
	N (%)	Median (IQR)	N (%)	Median (IQR)	N (%)	Median (IQR)	
Satisfaction with breasts	115 (79)	61 (49-71)	61 (79)	61 (53-71)	54 (78)	62 (46-71)	0.53
Physical well-being: Chest	146 (100)	100 (80-100)	77 (100)	100 (80-100)	69 (100)	100 (80-100)	0.9
Satisfaction with nipple reconstruction	78 (53)	3 (3-4)	32 (42)	3 (3-4)	46 (67)	3 (3-4)	0.53

IQR, interquartile range.



**Table 3c** BREAST-Q scores for adverse effects of radiation of the study participants 2.3 (0.8-14.3) years after breast reconstruction.

Scale	All		Immediate		Delayed		P-value
	N (%)	Median (IQR)	N (%)	Median (IQR)	N (%)	Median (IQR)	
Adverse effects of radiation	68 (47)	18 (17-18)	22 (29)	18 (17-18)	46 (67)	18 (17-18)	0.24

IQR, interquartile range.

**Table 3d** BREAST-Q scores for satisfaction with information, satisfaction with surgeon, satisfaction with medical team, and satisfaction with office staff of the study participants 2.3 (0.8-14.3) years after breast reconstruction.

Scale	All		Immediate		Delayed		P-value
	N (%)	Median (IQR)	N (%)	Median (IQR)	N (%)	Median (IQR)	
Satisfaction with information	145 (99)	64 (54-81)	77 (100)	69 (55-83)	68 (99)	59 (53-74)	0.09
Satisfaction with surgeon	145 (99)	100 (86-100)	77 (100)	100 (84-100)	68 (99)	100 (86-100)	0.92
Satisfaction with medical team	145 (99)	100 (80-100)	77 (100)	100 (80-100)	68 (99)	100 (81-100)	0.67
Satisfaction with office staff	144 (99)	100 (73-100)	77 (100)	100 (75-100)	67 (97)	100 (68-100)	0.18

IQR, interquartile range.

$\rho = -0.17$ ,  $p = 0.04$ ) and lower satisfaction with the surgeon (Spearman  $\rho = -0.21$ ,  $p = 0.01$ ) (Table 5).

No difference was detected in any of the scales above after correcting for age and indication for mastectomy (cancer or the presence of a cancer-associated gene) (Supplemental Tables 1 and 2).

## Discussion

Immediate reconstruction has been considered the golden standard of breast reconstruction by many.<sup>8,26,27</sup> Patients with immediate breast reconstruction have been suggested to experience less emotional distress and fewer depressive symptoms.<sup>5</sup> Some studies have indicated that patients undergoing immediate reconstruction experience better psychosocial well-being and less emotional distress due to some of the psychosocial aspects of mastectomy being left out.<sup>5,6</sup> The esthetic results have been reported to be superior after immediate reconstruction compared to delayed reconstruction.<sup>6</sup> In this study, we detected no difference between the groups regarding the satisfaction with the breast, the psychosocial, or sexual aspects.

Our study cohort reported high satisfaction with the breast, with median scores of 61 for immediate reconstruction and 62 for delayed reconstruction. The median scores observed for the groups were in line with the results of prior studies.<sup>1,28</sup> Interestingly, the scores for both groups are higher than the normative mean score, 58, derived from healthy control groups without a prior history of breast cancer.<sup>18</sup> For the group with delayed reconstruction, the difference in the median exceeded the minimally important difference (MID), 4, for the satisfaction with the breast.<sup>29</sup> Having finished the breast reconstruction process was associated with higher satisfaction with the breast. Similarly, the physical well-being of the chest was excellent in patients with both immediate and delayed reconstruction (median 100 for both groups), being higher than the normative mean score, 93, for this scale.<sup>18</sup> With a MID of 3, these findings suggest that the physical well-being of the chest of women with breast cancer exceeds that of the control population.<sup>29</sup> However, prior radiation therapy was associated with lower physical well-being of the chest. This scale measures pain, tenderness, restriction of movement, and tightness in the chest area.

All patients reported few adverse effects of radiation, and no difference was detected between immediate and

**Table 4** 36-Item Short Form Survey (SF-36) results of the study participants 2.3 (0.8-14.3) years after breast reconstruction.

Domain	Immediate		Delayed		P-value	Normative mean score <sup>a</sup>
	N (%)	Median (IQR)	N (%)	Median (IQR)		
Physical functioning	76 (99)	86 (78-91)	68 (99)	82 (73-91)	0.46	74
Limitations of physical health	76 (99)	100 (75-100)	68 (99)	100 (56-100)	0.44	76
Limitations of emotional health	76 (99)	100 (100-100)	68 (99)	100 (67-100)	0.31	83
Energy/fatigue	76 (99)	75 (55-85)	68 (99)	70 (51-80)	0.5	59
Emotional well-being	76 (99)	80 (72-91)	68 (99)	80 (64-88)	0.2	74
Social functioning	76 (99)	100 (75-100)	68 (99)	90 (68-100)	0.43	85
Pain	76 (99)	90 (68-100)	68 (99)	90 (68-100)	0.8	75
General health	77 (100)	73 (56-85)	69 (100)	70 (50-80)	0.3	68

IQR, interquartile range.

<sup>a</sup> Normative mean scores for women aged 55-64 years.

**Table 5** Correlation between the Holmes-Rahe stress scale and BREAST-Q scores of the study participants.

Scale	BREAST-Q scores, median (IQR)	Spearman $\rho$	P-value	CI (95%)
Psychosocial well-being	64 (54-80)	-0.16	0.05	-0.32-0.007
Sexual well-being	50 (39-66)	-0.15	0.08	-0.31-0.02
Physical well-being: Chest	100 (80-100)	-0.17	0.04	-0.33(-)0.007
Adverse effects of radiation	18 (17-18)	0.05	0.68	-0.2-0.29
Satisfaction with information	64 (54-81)	-0.12	0.16	-0.28-0.05
Satisfaction with surgeon	100 (86-100)	-0.21	0.013	-0.36(-)0.04
Satisfaction with medical team	100 (80-100)	-0.06	0.47	-0.23-0.11
Satisfaction with office staff	100 (73-100)	-0.13	0.12	-0.29-0.04

IQR, interquartile range.

delayed reconstruction. Delayed reconstruction is often preferred if radiotherapy is needed after mastectomy due to a better esthetic result and lower risk of complications. The preference is especially prevalent if autologous reconstruction is planned to avoid radiation damage to the flap.<sup>8,30,31</sup> Our patient group reflects this, with a total of 43 patients (62%) given radiotherapy in the delayed group, compared with 20 patients (26%) in the immediate group. However, there are benefits and risks to both immediate and delayed reconstruction, as well as to implant-based and autologous reconstruction when radiation is included.<sup>31</sup> In our study population, most reconstructions performed were autologous, with only six patients (4.1%) having implant-based reconstruction. Despite this, 77 patients (53%) underwent immediate reconstruction. There was no significant difference in the scale for adverse effects of radiation between the groups. This scale measures physical changes such as dryness and scarring, as well as increased sensitivity, thickness, and soreness of the skin. Although radiation negatively affected the chest's physical well-being, all patients scored high on the adverse effects of radiation scale, indicating few total adverse effects.

Both the immediate and delayed breast reconstruction groups scored similarly in the SF-36 domains. Our study cohort, both women with immediate and delayed breast reconstruction, scored higher than the proposed normative mean scores for the SF-36 domains.<sup>32</sup>

The follow-up of our study, up to 4 years, exceeded that of many similar studies.<sup>1,8,10,33</sup> This might partially explain the lack of difference in HRQL between our groups, as it has been reported that the differences in HRQL between immediate and delayed reconstruction become smaller over time.<sup>34</sup> The difference between the groups in the overall HRQL assessed with the BREAST-Q, SF-36, and other HRQL measures has been observed to diminish after a follow-up exceeding a year.<sup>8,11,35</sup> One aspect may be that the post-operative decrease of HRQL due to the emotional and physical stress of the cancer diagnosis and major surgery declines over time.<sup>36</sup>

No significant difference was detected between the SF-36 or Holmes-Rahe stress scale groups, paralleling the lack of difference in psychosocial and sexual well-being. Interestingly, our results for both psychosocial and sexual well-being fell short of the normative mean scores calculated for these scales.<sup>18</sup> A partial explanation for this may be that normative mean scores are based on scores from healthy women without any history of cancer or breast surgery. Although our study was cross-sectional in design and did not

directly assess this, the negative impact of breast cancer on the HRQL can last several years after the initial diagnosis.<sup>37</sup>

Some studies have indicated that immediate breast reconstruction is associated with superior psychosocial well-being.<sup>6,38</sup> However, our study did not demonstrate a similar effect. No significant difference was observed between stress levels in patients with immediate and delayed reconstruction. High scores on the Holmes-Rahe stress scale correlated with lower physical well-being of the chest and satisfaction with the surgeon. It has previously been suggested that noncancer-related stress can have a major negative impact on the HRQL of cancer patients.<sup>39</sup>

Perioperative complications were rare in our study population, irrespective of the reconstruction method. More complications were reported in patients with immediate reconstruction compared with delayed reconstruction. The patient group with immediate reconstruction showed significantly more minor complications (Clavien-Dindo classification 1) than the delayed group, whereas the more severe complications (Clavien-Dindo classification 2-3b) did not differ significantly between the two groups. These findings align with previous studies, showing complications are more frequent in immediate reconstruction.<sup>6,8,9</sup> It has previously been suggested that complications related to breast reconstruction can have a long-lasting negative effect on the HRQL.<sup>40</sup> However, in this study, the presence of post-operative complications did not significantly affect the BREAST-Q or SF-36 scores in any of the scales used. This might be explained by the low incidence of major complications in our study population.

Although our study cohort consisted of a fairly small patient group, the division between immediate and delayed reconstruction was quite even. Several previous studies have shown the percentage of immediate reconstruction to be much larger.<sup>8,10,33</sup> The proportion of immediate and delayed reconstructions included in our study reflects our practice during the study period, with many patients undergoing delayed reconstruction. Most of the reconstructions performed in the women participating in the study were autologous, consisting of several different reconstruction methods. In addition, the study comprised a large group of patients solely reconstructed by free fat transfer, a method not often incorporated in similar studies.<sup>8,10,11</sup> Our study cohort also included patients (N = 20, 14%) who had undergone prophylactic mastectomy due to the presence of a cancer-associated gene.

Our study limitations include the cross-sectional design of this study. Despite including all patients undergoing breast

reconstructions at our hospital during the three-year period, selection bias is possible due to the high number of non-responders in this study. However, our cohort of women of varying ages, disease profiles, and reconstruction methods reflected our patient material well. In addition, the response rate of this study is similar to the average of mail surveys.<sup>41</sup> The nonresponders were younger than the study participants (median age 57 vs 54,  $p = 0.019$ ), and it has previously been suggested that younger breast cancer patients experience a longer-lasting and steeper decrease in HRQL after the cancer diagnosis.<sup>37</sup> However, our study found no correlation between age and HRQL.

In conclusion, the timing of the breast reconstruction does not influence the HRQL in long-term follow-up in patients with mastectomy and breast reconstruction. Thus, both the method and timing of the reconstruction should be determined in cooperation with the surgeon and patient, depending on patient characteristics, preferences, and the profile of the disease.

## Ethical approval

The study protocol was approved by the Helsinki University Hospital ethics committee.

## Declaration of Competing Interest

The authors have no conflicts of interest to declare.

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.bjps.2023.11.028](https://doi.org/10.1016/j.bjps.2023.11.028).

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