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Time to final breast reconstruction: Effect on quality of life and associated factors

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Summary *Background:* Breast cancer patients often undergo prolonged periods of care due to chemotherapy, radiation, and multiple breast reconstruction procedures. The time to final reconstruction (TTFR) after mastectomy can span years, during which time patients may experience reduced quality of life (QoL). However, the relationship between prolonging this interval and long-term QoL is unclear.
Methods: We analyzed a prospectively collected registry of patients who received breast reconstruction at our institution. We obtained data for patients meeting the following criteria: received breast reconstruction between 2010 and 2015; had at least 12 months of Breast-Q follow-up; and for whom TTFR was available. Patients who received final breast reconstruction on the same day as mastectomy were excluded.
Results: We identified 198 female patients. The median time to final reconstruction was 199 days. Women with a BMI of $\geq$35 kg/m^2 experienced the longest interval (936 days; p=0.001). African-American women also experienced greater delays (mean: 527 days; p=0.05). Women undergoing autologous reconstruction experienced a significantly greater delay compared to implant-based or fat grafting (325 days; p=0.02). However, this did not hold in the adjusted model. Compared to staged, women undergoing delayed reconstruction waited the longest (mean: 1269 days; $p < 0.001$). Regarding QoL, a linear regression revealed reductions across all domains per each day of delay in final reconstruction.

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Conclusion: A longer interval between mastectomy and final reconstruction may be associated with decreases in QoL outcomes. Factors including mastectomy type, reconstruction type, and patient demographics may impact this interval. These factors are worth considering when discussing reconstruction options.

Breast cancer remains one of the most common malignancies affecting female patients.[1] With more than 252,000 new diagnoses of breast cancer per year in the USA, it is easy to understand why breast reconstruction rates have been constantly rising in the last few years.[2] Many options for reconstruction are available and very few contraindications exist. The decision on performing breast reconstruction, and which type is appropriate, lies in the hands of the patient. However, surgeons play a pivotal role in guiding, educating and informing their patients. One important aspect of this discussion is the timing of breast reconstruction.

Patients undergoing prophylactic mastectomies may be offered the option of immediate breast reconstruction, which entails the performance of the final breast reconstruction on the same day as the mastectomy. Therapeutic mastectomy may also be followed with immediate reconstruction; however, if radiation therapy is required due to present disease, patients must often choose a staged breast reconstruction. This includes placement of a tissue expander (TE) on the day of the mastectomy and, on a later day, exchange of the TE for a permanent implant or flap. The other option would be delayed breast reconstruction, when breast reconstruction is performed later without the initial placement of a TE.[3]

Despite the vast knowledge on factors affecting the satisfaction of our patients following breast reconstruction, little is known about the impact of the time interval between mastectomy and final breast reconstruction on patient satisfaction and quality of life. In addition, while many factors can affect the duration of this time interval (including patient preference, recovering from initial surgery, chemotherapy and radiation treatment), a paucity of data exists on how demographic and other clinical variables may alter this time interval.[4–11]

We conducted the present study in order to evaluate the effect of time interval between mastectomy and final breast reconstruction on the reported quality of life (QoL) of our patients and to assess potential demographic and clinical factors that may affect the duration of that interval.

Patients and methods

We analyzed our IRB-approved, prospectively collected registry of female patients who received breast reconstruction at our institution between 2010 and 2015. Using standardized chart review, clinical information was gathered for patients meeting the following criteria: 1) received staged or delayed breast reconstruction between 2010 and 2015; 2) had a Breast-Q score (quality-of-life instrument specific to breast reconstruction) preoperatively and at least 12 months of follow-up after the first reconstructive surgery; and 3) for whom time to final reconstruction (TTFR) was available. Patients who received final breast reconstruction on the same day as mastectomy—i.e., immediate reconstruction—were excluded.

Staged breast reconstruction refers to a multi-step surgical approach where the reconstruction process is divided into separate phases. This method is used to improve aesthetic and clinical outcomes, as well as to minimize complications, especially in patients with challenging anatomical features or those undergoing complex procedures. Staged reconstruction involves initial placement of a tissue expander, followed by definitive reconstruction with a free flap or implant after a suitable interval. This study investigates the time interval between the initial procedure and final breast reconstruction.

Data of interest included demographic characteristics, comorbidities, smoking status, laterality, type of mastectomy, type of breast reconstruction, and time interval to final reconstruction. Additionally, health-related quality of life (QoL) was captured using the Breast-Q patient-reported outcome instrument pre-operatively, after tissue expander placement, and at 6 and 12 months after final reconstruction. Effect estimates are reported as adjusted mean differences with 95% confidence intervals.

We used descriptive statistics to characterize our study population. Differences in our sample were analyzed using several parametric and nonparametric statistical methods, such as the Wilcoxon signed-rank test, t-test, Pearson's chi-squared, and ANOVA. Outliers were maintained in the statistical models to explore the maximum extent of final reconstruction delays. However, for certain key analyses, extreme outliers were removed to assess their impact on the statistical model. The criteria for extreme outliers were observations with z-scores greater than 3 or less than −3. Where outliers were removed, this is noted explicitly in the text.

To assess the association between TTFR and demographic and clinical factors, we conducted simple and multiple linear regression analyses, adjusting for potential confounders. Demographic confounders included age, race, and body mass index (BMI). Clinical confounders included mastectomy type, reconstruction type (staged vs. delayed), smoking history, and prior breast surgery. Oncologic confounders included whether patients had adjuvant therapy, such as chemo or radiotherapy. The confounders were selected based on prior literature and clinical relevance to the study. Additionally, we explored the relationship between time to final reconstruction and long-term quality of

life as measured by Breast-Q scores at 12 months postoperatively. We set the alpha probability at 0.05. Statistical analysis was performed using StataNow® 19 (StataCorp, College Station, Texas).

Results

Patient characteristics

Our initial data set included 300 female patients who underwent breast reconstruction at our institution between 2010 and 2015. Of these, we identified 198 (66%) patients for whom data on the interval to final reconstruction (staged or delayed) were available. For inclusion, a TTFR of ≥1 day was required. Consequently, the 102 women (34%) who underwent immediate reconstruction were excluded from this study.

The mean age of this sample was 50 years (SD: 9.5 years). The majority of women were white (155 [78%]), nonsmokers (127 [64%]) and did not have a prior history of breast surgery (180 [91%]). In regard to treatment, 82 (41%) women received chemotherapy: 34 (17%) neoadjuvant and 48 (24%) adjuvant. Only 50 (25%) women underwent radiation therapy. Demographic and clinical characteristics are summarized in Table 1.

Table 1 Demographic and clinical characteristics of our patient population (n=198).

	n (%)
Age	Mean: 50; SD: 9.5
BMI	Median: 25 kg/m^2
	IQR: 7 (22-29)
Race	
White	155 (78%)
African-American	25 (13%)
Asian	5 (2.5%)
Pacific Islander	3 (1.5%)
Other	10 (5%)
Smoking status	
Nonsmoker	127 (64%)
Past smoker	61 (31%)
Current smoker	10 (5%)
Comorbidities	
None	162 (54%)
1	102 (34%)
2	30 (10%)
3	6 (2%)
History of breast surgery	
No	180 (91%)
Yes	18 (9%)
Chemotherapy	
Not administered	116 (59%)
Neoadjuvant	34 (17%)
Adjuvant	48 (24%)
Radiation	
No radiation therapy	148 (75%)
Radiation (after mastectomy)	50 (25%)

Table 2 Characteristics of mastectomy (n=198 unless otherwise specified).

	n (%)
Type	
Prophylactic[a]	22 (11%)
Total/simple	87 (44%)
Modified radical	34 (17%)
Skin sparing	19 (10%)
Nipple sparing	35 (17.5%)
Unknown	1 (0.5%)
Laterality	
Unilateral	80 (40%)
Bilateral	118 (60%)
Prophylactic (n=76)	
CPM[b]	67 (88%)
BPM	9 (12%)
Axillary dissection	
No	117 (59%)
Yes	81 (41%)

CPM: contralateral prophylactic mastectomy. BPM: bilateral prophylactic mastectomy.

[a] Denotes the mastectomies reported as "prophylactic" by the surgeon. The complete number of prophylactic mastectomies from chart review is below (n=76).

[b] Denotes women who underwent a therapeutic mastectomy on the contralateral breast.

Mastectomy

Most women (176 [88%]) underwent therapeutic mastectomy, of which total or simple mastectomy was the most common type (87 [44%]). Other types of mastectomy are listed in Table 2. Most mastectomies were bilateral (118 [60%]). Of note, 76 (38%) women underwent prophylactic mastectomy; while the majority of these were contralateral (67 [88%]), 9 (12%) women underwent bilateral prophylactic mastectomies.

Breast reconstruction

The median time to final reconstruction was 199 days (IQR: 200 [127–327]), with a minimum interval of 15 days and a maximum of 6140 (1022 days after removing outliers). With respect to type, most reconstructions were implant-based (107 [54%]), followed by autologous (78 [39%]); mixed or fat grafting procedures comprised only 7% of total reconstructions. In regard to timing, the majority of reconstructions were done in a staged fashion, that is to say, they involved placement of a tissue expander before final reconstruction was attempted (187 [94%]). Delayed breast reconstruction accounted for only 6% of all reconstructions. Regarding complications, 96 patients (46%) experienced at least one complication; 45 (47%) of these patients underwent a staged process and 51 (53%), delayed reconstruction. Characteristics of breast reconstruction are presented in Table 3.

Impact of clinical and demographic factors on TTFR

Several clinical and demographic characteristics had an impact on time to final reconstruction (Table 4). Increases in

Table 3 Characteristics of breast reconstruction (n=198).

	n (%)
Time to final reconstruction	Median: 199 days IQR: 200 (127-327)
Type	
Implant-based	107 (54%)
Mixed	7 (4%)
Autologous	78 (39%)
Fat grafting only	6 (3%)
Timing	
Staged	187 (94%)
Delayed	11 (6%)

age progressively increased the average time interval to final reconstruction, with women 59 years or older experiencing the greatest delays (368 days compared to 236 for women under 42 years). However, these results were far from significant (p=0.52). BMI values outside the normal weight range (18.5-24.9 kg/m^2) significantly increased the average interval to final reconstruction; women with a BMI of 35 kg/m^2 or greater experienced the longest delay (936 days; p=0.001). In regard to race, African-Americans experienced greater intervals than any other race (mean: 527 days) while Asians had the shortest interval to final reconstruction (mean: 123 days) (Figure 1). These results, however, were marginally statistically significant (p=0.05). Being a smoker or having a history of breast surgery did not increase the interval to final breast reconstruction.

Impact of type and timing of breast reconstruction on TTFR

Factors related to breast reconstruction, such as type and timing, affected the interval to final reconstruction. Concerning timing, compared to staged, women undergoing delayed breast reconstruction waited the longest to receive final reconstruction (mean: 1269 days; p < 0.001) (Figure 2). We identified two outliers (observations with z-scores greater than 3 or less than −3). After removing these two outliers, the longer wait times for women undergoing delayed breast reconstruction were maintained (mean: 363.3 days; p=0.04). The relationship between type and timing of reconstruction and TTFR can be seen in Table 5.

A multiple linear regression adjusted for potential confounders revealed statistically significant increases in the time to final reconstruction for women with increasing BMI (19 days; p=0.008), those who underwent skin-sparing mastectomy (497 days; p=0.002), and women who underwent delayed breast reconstruction (1234 days; p=0.04).

Non-significant factors that decreased the interval to final reconstruction were a history of breast surgery (−104.7 days), Asian race (−139.4 days), and nipple-sparing mastectomy (−29.6 days). When adjusted for covariates, autologous breast reconstruction significantly decreased said interval (−145.1 days, p=0.08) (Table 6).

After removing outliers, we uncovered additional differences. Increased intervals were observed for modified radical mastectomy (130.2 days; p=0.006), mixed breast reconstruction (175.5 days; p=0.007), and patients with three comorbidities (100 days; p=0.39) (Supplementary Table 1).

Table 4 Relationship between demographic and clinical factors and TTFR (n=198).

	Mean time in days	SD	95% CI	p
Smoking status				0.55
Nonsmoker	306	563	223.6-387.4	
Smoker	259	138	166.7-352.2	
History of breast Sx				0.52
No	307	569	222.8-390.2	
Yes	267	156	189-344.3	
Age group				0.53
< 41.8	236	171	183.1-288.2	
≥41.8 - < 46.9	284	196	220-347	
≥46.9 - < 52.1	259	186	199.4-318.3	
≥52.1 - < 58.5	379	715	144.3-614.4	
≥58.5	368	970	50-687.6	
BMI class				**0.001**
< 18.5	244	232	−124.6-613	
≥18.5 - < 25	219	142	190.4-247.6	
≥25 - < 30	237	136	199-275.4	
≥30 - < 35	292	217	205.9-377.2	
≥35	936	1593	168.2-1703.6	
Race				0.05
White	276	495	196.9-354.1	
African-American	527	873	166.2-886.8	
Asian	123	36	79.1-167.7	
Pacific Islander	190	63	33-346.3	
Other	292	296	79.9-503.4	
Comorbidities				0.34
None	279	448	193-364.9	
1	350	710	184.3-515.6	
2	223	128	154.5-290.8	
3	507	416	−3235.5-4248.5	

TTFR: time to final reconstruction. SD: standard deviation. CI: confidence interval. Sx: surgery.
Statistically significant values (p < 0.05) and certain clinically significant values are in bold.

Quality of life and TTFR

With respect to quality of life, a comparison between preoperative and postoperative Breast-Q scores revealed increases in most domains at 12 months. However, the only statistically significant difference was the increase in the 'Satisfaction with Breasts' score in women who underwent staged reconstruction (from 59.5 to 66.1; p=0.05). These differences are summarized in Supplementary Table 2.

Regarding the association between quality of life and TTFR, a linear regression of Breast-Q scores at 12 months revealed reductions across all domains per each day of delay in final reconstruction (Table 7). The greatest and only significant reduction was observed in the 'Satisfaction with Outcomes' domain, with a decrease of −0.007 points per

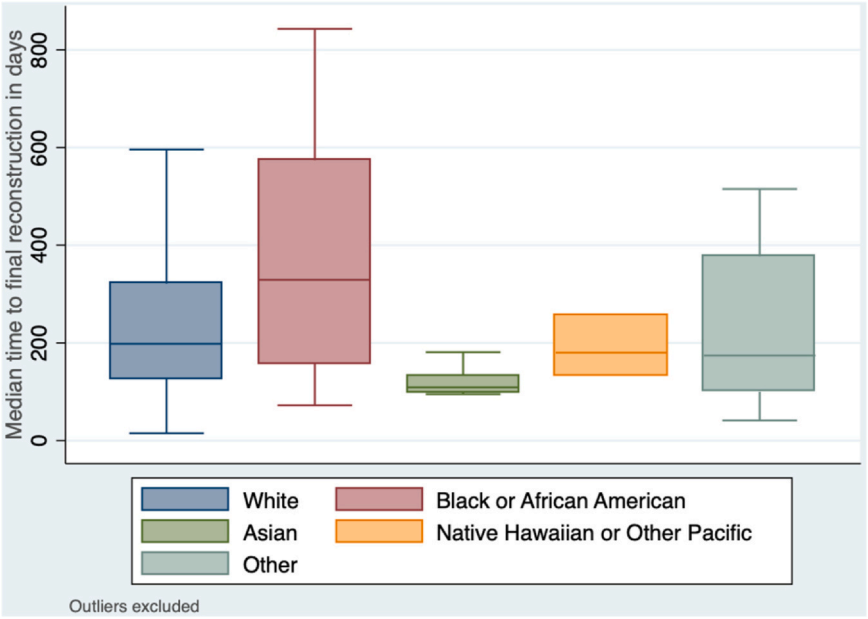

Figure 1 Median time to final reconstruction by race. African-Americans experienced longer delays compared to other races (median: 329 days).

day of delay in breast reconstruction (p=0.008) (Figure 3). However, after removing outliers, significant reductions were observed in *all* domains except for 'Physical Well-being: Chest' and 'Physical Well-being: Abdomen' (Supplementary Table 3).

Although the association between longer TTFR and lower satisfaction with outcome scores was statistically significant, the observed effect size should be interpreted in the context of clinical relevance. The estimated change in Breast-Q scores associated with TTFR did not exceed the established Minimal Important Difference (MID) threshold of 4 points (1.4 drop in QoL over 199-day average TTFR), suggesting that while prolonged TTFR may be associated with lower QoL, the absolute difference may not be substantial enough to impact clinical decision-making. One cohort experienced changes in Breast-Q scores that exceeded the MID: women who underwent delayed breast reconstruction (1234 days, MID = 8.84).

Discussion

Our study identified 198 patients with a median time to final reconstruction of 199 days. The majority of reconstructions were implant-based, followed by autologous, and fat-grafting. Of these, 94% were completed in a staged fashion with the placement of a tissue expander. This cohort is consistent with 2018 procedural statistics from the American Society of Plastic Surgeons, which report that nearly 70% of all reconstructions are implant-based and nearly 80% of prosthetic breast reconstructions utilize a tissue expander. These statistics reveal a steady annual growth in the volume of breast reconstructions over the years, with a concurrent rise in bilateral mastectomies. Currently, bilateral mastectomies generally account for 11% of the mastectomy approach in the US.[12] Axillary dissection was performed in 41% of women (36% in the original sample of 300 women). As of 2021, approximately 18% of mastectomy patients underwent axillary lymph node dissection in the US.[13]

Mastectomy type was also revealed to have an effect on the time a patient waits for reconstruction. In our findings, women who underwent skin-sparing mastectomies (SSM) were associated with significantly longer TTFR (497 days; p=0.002), a finding that initially appears counterintuitive. Skin-sparing mastectomy is commonly performed in conjunction with immediate reconstruction and is associated with superior aesthetic results over traditional mastectomy.[14,15] Our study excluded patients who received final breast reconstruction on the same day as mastectomy, suggesting these patients who underwent skin-sparing mastectomies were not candidates for immediate construction. Mastectomy skin flap quality is evaluated intraoperatively for thickness, color, and vascularity. One explanation may be that these patients' skin flaps after mastectomy were too thin or at greater risk for skin necrosis, and thus the reconstruction surgery was delayed until the skin was more viable.

However, given that our study was not designed to determine causality, this association should be interpreted cautiously. Future research should explore whether institutional protocols or patient factors systematically contribute to increased TTFR in SSM patients.

In addition to the type of reconstruction, a higher BMI progressively increased the average time interval to final reconstruction. Increasing age also correlated with longer intervals; however, this difference did not reach significance, most likely due to lack of power. The association between obesity, age, and delaying reconstruction is in accordance with other studies.[16,17] This disparity may be due to a number of factors, including a lack of patient education or a clinician's bias regarding the relevance and safety of reconstruction in older or obese women.

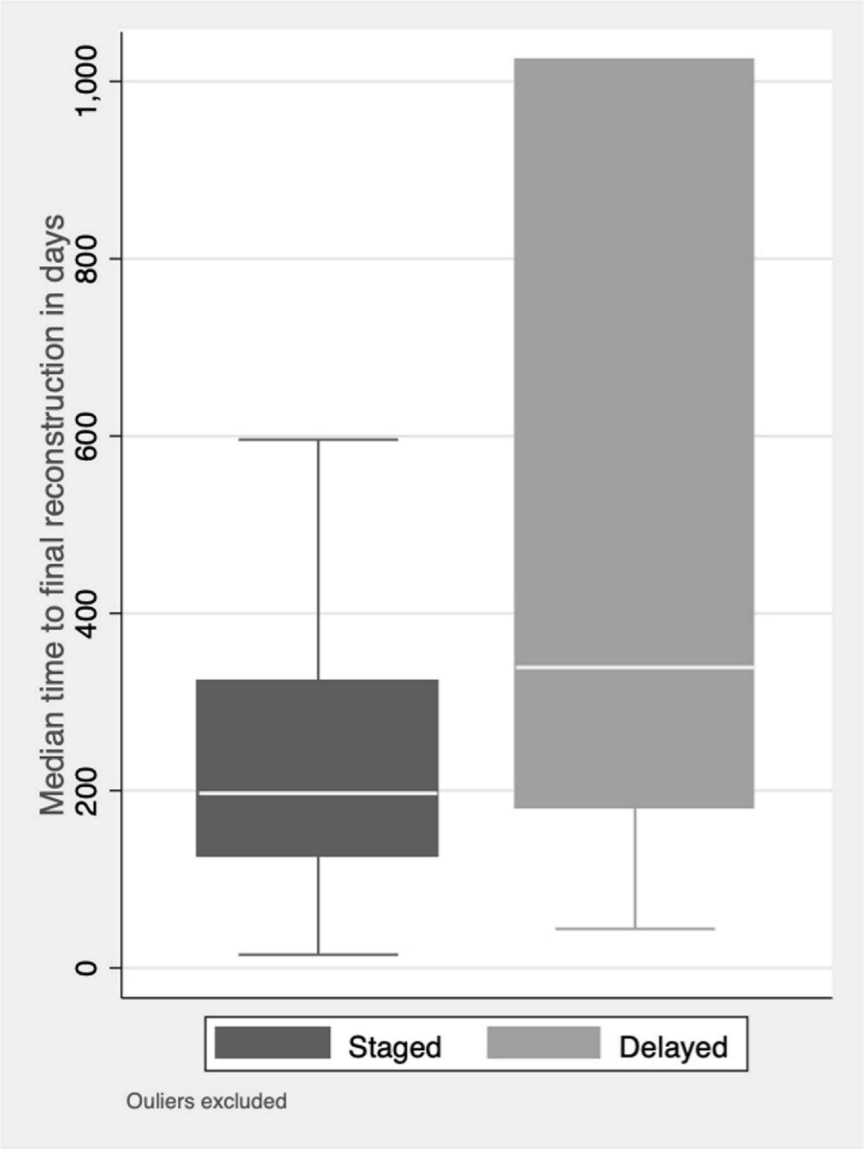

Figure 2 Median time to final reconstruction by timing. Women undergoing delayed reconstruction experienced significantly greater intervals compared to staged reconstruction (median: 339 days; $p < 0.001$).

Table 5 Differences in TTFR between type and timing of reconstruction (n=198).

	Mean time in days	SD	95% CI	p
Type				
Implant	280	574	173.7-386.7	0.05
Autologous	325	458	237.5-412.9	**0.02**
Fat grafting only	203	160	134.3-272.3	0.05
Timing				
Staged	246	164	222.2-269.3	**< 0.001**
Delayed	1269	2063	−117.1-2654.5	**< 0.001**

TTFR: time to final reconstruction.SD: standard deviation. CI: confidence interval.
Statistically significant values ($p < 0.05$) and certain clinically significant values are in bold.

Previous studies investigating factors that may influence the surgeon's decision to offer immediate reconstruction have found that increasing age was associated with a decrease in the probability of undergoing reconstruction.[18-20] Reasons included hesitation from the patient to undergo more surgery, as well as reluctance from the physician to offer reconstruction as an option.

In addition to physician bias, another contributing factor may be that older patients are more risk-averse or may have health issues that cause them to delay surgery until they are more suitable candidates. Some studies mention that older women also attach less significance to body image, femininity, and sexuality, and therefore feel that the benefits of reconstruction do not outweigh its risks.[21] However, a 2016 study by Santosa et al. showed that breast reconstruction is a viable and safe option in elderly patients,[22] while other studies have also reported comparable risks and benefits of reconstruction between older and younger patients.[22,23] Collectively, these factors likely extended the complex

Table 6 Adjusted multiple linear regression of time to final reconstruction by various independent variables.

	Coefficient (time in days)	95% CI	p
Age	1.8	−5.9-9.5	0.6
BMI	19	4.9-32.9	**0.008**
Smoking	41.4	−256.5-339.3	0.7
History of breast Sx	−104.7	−354.7-145.3	0.4
Race			
White (reference)	0	0	0
African-American	163	−55-380.8	0.1
Asian	−139.4	−573.4-294.5	0.5
Pacific Islander	73.9	−620.8-768.6	0.8
Other	−88.4	−399.5-222.7	0.5
Comorbidities			
None (reference)	0	0	0
1	−20.7	−169.9-128.6	0.7
2	−107.8	−380.5-164.9	0.4
3	−14.3	−717.1-688.4	0.9
Mastectomy type			
Prophylactic (reference)	0	0	0
Total/simple	5.3	−231.5-242	0.9
Modified radical	167	−109.7-443.8	0.2
Skin sparing	497	192.7-801.3	**0.002**
Nipple sparing	−29.6	−292.9-233.7	0.8
Type of reconstruction			
Implant-based (reference)	0	0	0
Mixed	89.2	−291.9-470.3	0.6
Autologous	−145.1	−309.3-18.9	**0.08**
Fat grafting only	−7.7	−420.3-404.9	0.9
Timing			
Immediate (reference)	0	0	0
Staged	155	−1022.9-1332.9	0.7
Delayed	1234	9.9-2457.9	**0.04**

CI: confidence interval. Sx: surgery.
Statistically significant values ($p < 0.05$) and certain clinically significant values are in bold.

process of deciding on reconstruction for patients of increasing age.

On the other hand, being overweight or obese is generally associated with higher complication rates and poorer outcomes after reconstruction.[24] A history of smoking did not significantly delay reconstruction in this study, which is interesting considering that smoking is a known risk factor for complications following reconstructive surgery.[25,26]

One possible explanation is selection bias: patients who smoked may have been steered toward delayed reconstruction early in the process, meaning their TTFR was already prolonged by design. Another possibility is that patients who smoked may have quit before undergoing reconstruction, thereby reducing their risk of complications and allowing them to proceed with surgery at a rate similar to non-smokers.

Our findings on TTFR should be interpreted in the context of existing literature comparing immediate and delayed breast reconstruction.[27] Studies have consistently shown that immediate reconstruction (IR) offers superior aesthetic and psychosocial benefits, as patients do not experience a prolonged period without breast reconstruction.

Table 7 Linear regression of quality of life as measured by Breast-Q scores at 12 months by the time to final reconstruction. The coefficient represents the change in Breast-Q scores per each day of delay in breast reconstruction.

	Coefficient (change in Breast-Q score)	95% CI	p
Satisfaction with breasts	−.004	−.009-.0008	0.1
Psychosocial well-being	−.002	−.007-.004	0.5
Sexual well-being	−.0008	−.007-.005	0.7
Physical well-being: chest	−.002	−.006-.002	0.3
Physical well-being: abdomen	−.003	−.008-.003	0.3
Satisfaction with outcomes	−.007	−.01- −.002	**0.008**

CI: confidence interval.
Statistically significant values ($p < 0.05$) and certain clinically significant values are in bold.

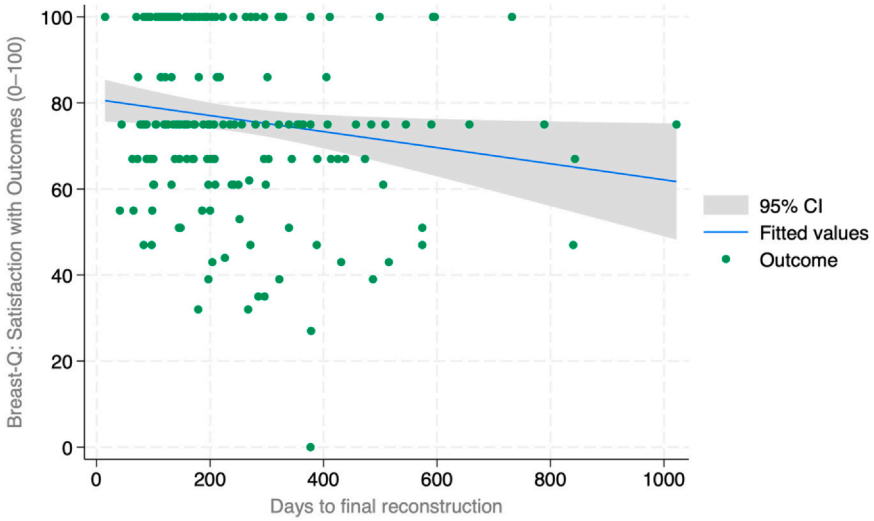

Figure 3 Linear prediction plot of the Breast-Q score for Satisfaction with Outcomes ("Outcomes") at 12 months by the time to final reconstruction. The fitted values (blue line) represent the expected reduction in this score with longer delays in final reconstruction. Outliers were removed from this prediction plot (observations with z-scores greater than 3 or less than −3).

Post-mastectomy complications are an important factor that may contribute to prolonged TTFR. Surgical site infections (SSIs), delayed wound healing, seroma formation, and flap necrosis have been shown to delay the initiation of breast reconstruction, either by necessitating additional surgical interventions or by requiring extended recovery before reconstruction can proceed.[28] Patients experiencing these complications may have longer waiting times due to increased medical oversight, additional treatment needs, or a reassessment of reconstructive feasibility.

The study also revealed a marginally significant disparity in the timing of reconstruction according to race, with African American patients experiencing the greatest delays. Historical evidence has shown similar differences in reconstruction delays.[29-31] These studies report that African American breast cancer patients are more likely to delay or not receive reconstruction for a variety of reasons. Low socioeconomic status and lack of insurance can be a barrier to breast reconstruction, and African Americans are more likely to experience both of these factors.[32,33] These patients may have to delay reconstruction until they are able to take off work or get appropriate insurance coverage. Additional time to understand the procedure due to health literacy or language barriers may also extend the interval. This underscores the importance of discussing the reconstruction options available to these patients at the time of mastectomy. Some studies also suggest physician bias as a possible contributor to minority women being referred for breast reconstruction at lower rates.[31,34] Unlike other patient variables, race has not been recognized as an independent predictor of surgical complications, and thus, women of every race should be offered reconstruction equally.[35,36] It is important to consider that the majority of study participants were white and non-smokers and that this might affect the significance of these results.

When comparing preoperative Breast-Q scores to postoperative scores at 12 months, there were increases in nearly all domains for women who received either staged or delayed reconstruction. This highlights the important role of reconstruction in improving quality-of-life outcomes. However, prolonged delays in reconstruction have a negative impact on quality of life. Our findings suggest that longer TTFR is associated with lower QoL, but it is important to acknowledge that other factors beyond surgical timing may influence these patient-reported outcomes. Variables such as preoperative expectations, post-operative complications, and mental health status could also contribute to the differences observed.

While our findings indicate a statistically significant relationship between prolonged TTFR and lower patient-reported satisfaction, the clinical significance of this result must also be considered. The Minimal Important Difference (MID) for the Breast-Q domain has been previously established as approximately 4 points[37], meaning that a change of at least 4 points is generally considered meaningful to patients. In our study, the estimated decrease in Satisfaction with Outcome per day of delay was −0.007. Given that the average TTFR in our cohort was 199 days, this suggests that delays of approximately 572 days would be required to reach a clinically meaningful decline in Breast-Q scores.

Our study exclusively examined patients undergoing staged (tissue expander-based) and delayed breast reconstruction, excluding cases of immediate reconstruction. This decision was made to specifically evaluate the impact of time to final reconstruction (TTFR) on quality of life (QoL), which requires a defined waiting period between mastectomy and final reconstruction.

The literature suggests that immediate autologous reconstruction generally results in superior long-term aesthetic and psychosocial outcomes compared to implant-based reconstruction, largely due to the preservation of breast skin and natural contouring.[27] Patients who undergo immediate flap reconstruction also report higher satisfaction and lower emotional distress, as they avoid the extended waiting period associated with staged or delayed reconstruction.[38] However, immediate autologous reconstruction is a more complex surgical procedure with higher initial complication rates, including flap necrosis, vascular compromise, and longer hospitalization.[27]

While TE-based reconstruction offers greater flexibility and lower early surgical risks, it has been associated with higher complication rates in irradiated patients and lower long-term patient satisfaction compared to autologous techniques.[28]

Limitations

This research is not without limitations. For instance, our sample size is relatively small because of the inclusion criteria used. In addition to size, the sample is skewed with the majority of women undergoing staged rather than delayed reconstruction. This may further limit the generalizability of the findings. The study is further limited by its insufficient follow-up and inability to assess long-term quality of life outcomes. The 12-month follow-up after reconstruction was considered sufficient because reconstruction failures usually occur within the first few months after surgery, and the patient usually knows the final aesthetic result by this time. However, patients can experience complications and changes in well-being beyond 1 year, so a follow-up of 2 or more years could have extended the generalizability of the findings.

Another important limitation has to do with the relationship between the interval to final reconstruction and QoL. While there seems to be an association between these two variables, it is also possible that the decreased QoL may be due to complications related to the initial surgery, chemotherapy, or radiation, which may result in longer intervals.[39-42]

Strategies to potentially reduce delays include enhanced coordination between oncology and plastic surgery teams, patient education on reconstruction options, and improved access to reconstructive services for underrepresented groups.[43,44]

Conclusion

In summary, we provide preliminary evidence that patients who wait longer to receive reconstructive surgery experience greater declines in satisfaction and well-being. Timelier reconstruction may prevent breast cancer patients from prolonging a period of social, physical, and psychological distress. The results of this study demonstrate several important clinical and demographic factors that can prolong this interval and lead to greater declines, including surgical and reconstructive technique, BMI, and race. Efforts should be made to minimize the delay and prevent non-clinical barriers to reconstruction, such as physician bias and socioeconomic status.

However, patient selection is crucial, and these findings should not be interpreted as a recommendation for routinely shortening the time interval to reconstruction. Certain clinical and demographic factors are predictors of outcomes following breast reconstruction and must be discussed with patients preoperatively. Although not every patient is a candidate for immediate reconstruction, our findings emphasize the need for healthcare providers to be aware of the regression a patient may experience while waiting to begin reconstruction and how to reduce it by preventing unnecessary factors. While this study is not the first to show the benefits of reconstruction,[45] it does provide new information that would help to set appropriate expectations as to the optimal time for reconstruction.

Ethical approval statement

This study uses data from an IRB-approved, prospectively collected registry of female patients who received breast reconstruction at Johns Hopkins Hospital between 2010 and 2015. Protocol #IRB00046361.

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Declaration of competing interest

None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.bjps.2025.05.029.

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