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Effect of Patient Age on Outcomes in Breast Reconstruction: Results from a Multicenter Prospective Study

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Abstract

Background—Although over 40% of new breast cancer diagnoses in the U.S. are in older women, few studies have assessed the outcomes of post-mastectomy reconstruction in this population. Our objective was to evaluate age effects on postoperative complications and patient-report outcomes (PROs) in women undergoing breast reconstruction, and to investigate whether age effects differ between reconstructive procedure types.

Study Design—Eligible patients in the Mastectomy Reconstruction Outcomes Consortium study from 11 institutions (57 providers) in North America were analyzed. Two-year complications and PROs via BREAST-Q domains were compared across younger (<45 years), middle-aged (45–60 years), and older (>60 years) women. Mixed-effects regression models were used, controlling for a range of demographic and clinical covariates.

Results—A total of 1,531 patients were studied: 494 younger, 803 middle-aged, and 234 older. Age was not a significant predictor of complications. For sexual well-being two years post-reconstruction, older women reported 4.25 ($p=0.04$) higher mean scores with implant procedures, and 10.39 ($p<.01$) higher mean scores with autologous procedures compared to younger women. No age effect was seen with implant procedures with regards to physical and psychosocial well-being; however, older women who underwent autologous procedures reported 6.07 ($p<.01$) higher physical and 8.21 ($p<.01$) higher psychosocial well-being scores than younger women.

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Conclusions—Age did not significantly affect complication rates. Older women demonstrated higher sexual well-being for both procedures, and better satisfaction, physical and psychosocial well-being than younger women with autologous procedures. Post-mastectomy reconstruction is a viable option for older patients, with risks and benefits comparable to those in younger women.

Precis

Findings collected from a multicenter, prospective trial confirm that post-mastectomy breast reconstruction is a viable option for older women (>60 years) with complication rates and patient-reported outcome benefits comparable to those reported in younger women.

Introduction

According to the Surveillance, Epidemiology and End Results (SEER) database, approximately 250,000 women will be diagnosed with breast cancer in 2016. Nearly 40 percent of these new diagnoses will be in older women, as the median age of breast cancer diagnosis is now 62 years old (1). As survival rates for breast cancer continue to improve, more patients will be living longer after being diagnosed and treated for breast cancer. Moreover, use of mastectomy for breast cancer treatment has also risen over the past decade (2, 3). Along with this increase, more women have been opting for prophylactic mastectomy and breast reconstruction than ever before (2, 4–6). However, despite these trends, older women are still less likely to receive reconstruction following mastectomy, compared with younger patients (7–11).

There are several reasons that may explain why older women are less likely to undergo breast reconstruction. One possible explanation is that surgeons may not be offering reconstructive options to older women due to unfounded beliefs that elderly women would not tolerate the procedure well (12). For example, younger age (under 50 years) has been found to be the strongest predictor of being offered reconstruction (9). Another contributing factor may be older women's perceptions of increase risk of complications after reconstruction with advancing age, and the feeling that the benefits of reconstruction do not outweigh the risks (13, 14). Regardless of the reason, it is apparent that more robust evidence evaluating the outcomes of breast reconstruction in older women is needed to improve this shared-decision making process (14).

While other studies have sought to determine the effects of advancing age on breast reconstruction outcomes, they have been largely retrospective in design (14–17) or focused on one type of reconstruction, either implant-based or autologous techniques (15, 18). For our current study, we sought to evaluate the effects of age on postoperative complications and patient-reported outcomes (PROs) in a large multicenter, prospective study of women who underwent breast reconstruction in the United States and Canada.

Methods

Study Population

Patients included for analysis in this study were recruited as part of the Mastectomy Reconstruction Outcomes Consortium (MROC) Study. This National Cancer Institute-

funded project involves 57 plastic surgeons at 11 academic and private practice sites across the U.S. and Canada, including Michigan, New York, Illinois, Ohio, Massachusetts, Washington, D.C., Georgia, Texas, British Columbia, and Manitoba. The primary aim of the MROC Study is to compare patient outcomes among the common surgical options for breast reconstruction. All women 18 years or older presenting for first time breast reconstruction following mastectomy at MROC centers were eligible for enrollment into the MROC study. Participants included patients undergoing immediate or delayed, unilateral or bilateral reconstruction after mastectomies for breast cancer treatment or prophylaxis.

For this study, we analyzed data from patients enrolled in MROC from February 2012 to December 2015. We included any woman who completed implant-based or autologous reconstruction and had at least two-year follow-up from their reconstruction date. Due to limited numbers of patients in these cohorts, we excluded those who received latissimus dorsi with and without tissue expander/implant reconstructions; women who received a combination of implant and autologous-based techniques; crossover patients (i.e. those who changed their reconstructive technique during enrollment in the study); and mixed timing patients (i.e. those who received immediate reconstruction following mastectomy on one side and delayed reconstruction on the other side). Our analysis also excluded patients who did not complete the study's preoperative surveys. For the analysis of PROs, we further excluded patients who experienced reconstructive failure, as no outcome data were collected from this group.

To evaluate the effects of age on outcomes following breast reconstruction, we divided patients into three cohorts: (1) younger women, defined as those < 45 years old, (2) middle-aged women, defined as those 45–60 years old, and (3) older women, defined as those >60 years old.

Two-year complication rates were compared among the three cohorts with the dependent variables of interest being any complication, major complication (i.e. complication requiring hospital readmission or surgical exploration), and reconstructive failure (i.e. removal of expander/implant or flap with or without subsequent replacement). With Institutional Review Board (IRB) or Research Ethics Board (REB) approval at all centers, electronic medical records (EMRs) for each patient were reviewed by study coordinators preoperatively and at one and two years postoperatively to obtain demographic and clinical data. Complication data were collected from the EMRs at one and two years following reconstruction. All data were uploaded onto Velos (Velos Inc., Fremont, CA), a web-based clinical trial management system.

In addition to complication rates, we also evaluated PROs using the BREAST-Q Reconstructive Module. The BREAST-Q Reconstructive Module is a validated, condition-specific PRO instrument that has been widely used to measure health-related satisfaction and quality of life in breast reconstruction patients (19, 20). The scales used in this study included satisfaction with breast, as well as psychosocial, physical, and sexual well-being. For each scale, responses were summed on a 0–100 scale, with higher numbers reflecting better outcomes (i.e. higher satisfaction with breast, and greater psychosocial, physical, or sexual well-being). Study patients completed the web-based questionnaire pre-operatively,

and at one and two years postoperatively. Of note, only two-year PRO data are presented here.

Clinical variables such as age, body mass index (Body Mass Index - BMI=kg/m²), and smoking status were collected. Medical comorbidities were recorded and the total number of comorbidity conditions were obtained (21). In addition to reconstructive variables such as procedure type (i.e. implant-based vs. autologous), laterality, and timing (i.e. immediate vs. delayed) of reconstruction, we also collected oncologic variables such as indication for mastectomy, radiation and chemotherapy status, and lymph node management at the time of reconstruction. Indication for mastectomy was subdivided into cancer treatment or prophylaxis. Radiation status was divided into three groups: (1) history of radiation before reconstruction, (2) receipt of radiation during or after reconstruction, and (3) no radiation. Similarly, patients were subdivided into two groups with respect to their chemotherapy status: (1) receipt of chemotherapy during or after reconstruction and (2) no chemotherapy during or after reconstruction. Information regarding neoadjuvant chemotherapy was not available. Finally, lymph node management at the time of reconstruction was categorized as: (1) sentinel lymph node biopsy (SLNB), (2) axillary lymph node dissection (ALND), or (3) no lymph node removal.

Statistical Analysis

Patient characteristics by age group were analyzed using one-way ANOVA or chi-square tests. Two-year postoperative complication rates and PROs were also summarized by age and procedure type. Mixed effects regression models were employed to further compare the outcomes of patients across age groups. For each model, we included two of the three age group cohorts as the primary predictor variables, with younger (i.e. <45 years old) women as the reference group. Additionally, interaction terms between age groups and procedure types were used to explore differential effects of age on the outcomes between patients who underwent implant-based versus autologous techniques. Independent variables with statistically significant effects in the univariate analysis (p-value of <0.05) and those variables known to be predictors of postoperative complications in breast reconstruction based on previous literature (i.e. BMI, laterality, and smoking status) were included in the regression models (22). For each model, we controlled for baseline covariates and included random intercepts for centers (hospitals) to account for between-center variability. Baseline and two-year PROs as well as certain covariates were missing for some patients. To account for such missing data, multiple imputation with chained equations were employed to create 10 complete imputed data sets, each of which was used to run the regression models specified above. The results were then combined using Rubin's rules (23). Statistical analysis was performed using SAS 9.4 (SAS Institute, Cary, NC), and statistical significance was set at 0.05.

Results

Summary of Demographic Data

We identified a total of 1,531 women who underwent immediate or delayed, implant-based or autologous reconstruction between 2012 and 2014, and had at least two-year follow-up

from their initial reconstruction date. Of these, 494 (32.3%) were younger (<45 years old), 803 (52.5%) were middle-aged (45–60 years old), and 234 (15.3%) were older (>60 years old), all of whom were included for complication analysis. Among these 1,531 patients, 84 experienced reconstructive failure at some point during the two-year postoperative period. A total of 1,447 patients were thus, included for PRO analysis.

Results of the bivariate analyses of demographic and clinical variables are summarized in Table 1. There were statistically significant differences in BMI and number of comorbidities across age groups. Additionally, indications for mastectomy, management of regional lymph nodes, as well as use of radiation treatment and chemotherapy differed significantly among the three age groups. Reconstructive variables such as procedure type (i.e. implant-based versus autologous), timing of reconstruction, and laterality also differed significantly across age cohorts. For example, while the majority of women in all age groups underwent immediate reconstruction, a higher proportion of older women received delayed reconstruction, as compared to the younger patients (11.1% versus 4.1%, respectively). Moreover, the majority of younger women (73.3%) underwent bilateral reconstruction, while the majority of older women (70.1%) received unilateral reconstruction. As potential confounders, these clinical, reconstructive, and oncologic variables were all included in the regression models.

Complications

Results of bivariate analyses for all complications, major complications, and reconstructive failures are described in Table 2. Within both implant and autologous tissue procedure types, there were no statistically significant differences across the age cohorts for these outcomes. However, overall complication rates were generally higher in women undergoing autologous reconstruction as compared to patients receiving implant-based techniques across all age groups, while two-year reconstruction failure rates were lower in autologous than implant procedures.

Similar findings were observed in our mixed-effects logistic regression models presented in Table 3. Controlling for covariates and between-center variability, we found that age was not a significant predictor of overall complications or major complications. Interaction between age group and procedure type (not shown here) was found to be insignificant, indicating that age effects on overall complications and major complications did not differ significantly for implant versus autologous tissue reconstructions. Due to the small numbers of reconstructive failures, we did not have sufficient power to evaluate the effects of age on this outcome. Finally, significant effects on overall and/or major complications were noted for many of the covariates in our analysis, including procedure type, BMI over 35, laterality, timing of reconstruction, current smoking status, and receipt of radiation (during or following reconstruction).

Patient-Reported Outcomes

Mean scores for the four domains of BREAST-Q before reconstruction and at two-years post-reconstruction are presented in Table 4. Across all age groups, and irrespective of procedure type, patients reported improved satisfaction and psychosocial well-being two

years after reconstruction. Sexual well-being also improved across all age groups undergoing autologous reconstructions. Older women who underwent implant-based procedures reported lower physical well-being after reconstruction while older women who underwent autologous reconstruction reported an improvement in physical well-being scores.

Results from the mixed-effects regression models for the four domains of the BREAST-Q Reconstructive module are summarized in Table 5. Two years after reconstruction, older women with implant procedure reported 4.25 ($p=0.04$) higher sexual well-being scores than younger women, while older autologous patients reported 10.39 ($p<0.01$) higher outcomes compared to younger patients. For both physical and psychosocial well-being, no age effect was observed within implant patients. However, older women who underwent autologous procedures reported 6.07 ($p<.01$) higher physical well-being scores, and 8.21 ($p<.01$) higher psychosocial well-being scores, compared to younger women. Older patients receiving implant-based procedures reported 5.05 ($p=0.025$) lower satisfaction scores than younger patients. On the other hand, both older and younger autologous patients reported comparable satisfaction two years after reconstruction. We present adjusted means (i.e., estimated population marginal means) to illustrate the differential age effects between two procedure types described above in Figure 1. Other clinical variables that had significant effects on patient satisfaction with breast, and psychosocial, physical, and sexual well-being are summarized in Table 5.

Discussion

Although over 40 percent of new female breast cancer diagnoses are made in older women (1), they are less likely to undergo breast reconstruction than their younger counterparts (7–9, 11, 16). Reasons behind this disparity are multifaceted and largely unknown. What we do know is that while breast reconstruction decision-making is a complex process for patients of all ages, this may be particularly true for older women, who may be more risk-averse or may have health issues that impact their choices. Older women considering post-mastectomy breast reconstruction and their providers must weigh the risk of post-reconstruction complications against the potential quality of life benefits. Unfortunately, while other studies have attempted to provide comprehensive information on outcomes, evidence is still currently lacking. This knowledge gap may be responsible, in part, to the relatively lower utilization rates of breast reconstruction in women over 60 years old.

Analyses of age effects on breast reconstruction complication rates have yielded mixed results. For example, in two studies from Fischer and coworkers (24, 25) utilizing the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) to evaluate complication rates following immediate breast reconstruction, advancing age was not a predictor of post-reconstruction complications. However, in other studies employing similar study designs, older age (variously defined as 45 years or above, over 50 years, or greater than 55 years), conferred an increased risk of complication rates, compared with younger age groups (18, 26, 27). While these studies were adequately powered, they were limited only to complications following immediate reconstruction, and were not designed to specifically evaluate the impact of advancing age on post-reconstruction complication rates.

In a larger analysis, Butz and coworkers (16) recently reported findings from the ACS-NSQIP database examining the role of advancing age on complications following immediate implant-based and autologous techniques. Among the 40,769 patients in their cohort, complication rates between younger (less than 65 years old) and older (65 years or above) women who underwent immediate implant-based reconstruction did not differ significantly. However, older women undergoing autologous reconstruction were more likely to develop venous thromboembolism. This study, like the others mentioned, only evaluated outcomes following immediate reconstruction and had limited follow-up of 30 days post-reconstruction. Furthermore, none of these studies included PRO assessments, since they were designed as retrospective analyses of large administrative databases.

Results from studies evaluating PROs in older women undergoing breast reconstruction are more consistent in their findings, demonstrating that older women achieve similar or even higher levels of satisfaction than younger women post-reconstruction (14, 15, 28, 29). For example, Sisco and coworkers (29) conducted a prospective cohort study of 315 patients undergoing immediate reconstruction and found that patients over 65 years of age achieved similar quality of life scores to younger patients. Similarly, Johnson and colleagues (28) found that women 65 years or older reported similar physical and upper body well-being scores, compared with younger women. Moreover, in a study of 1,751 patients who underwent autologous reconstruction, patients over 65 years and younger women achieved similar high levels of satisfaction (15). However, these studies did not include any complication data. In a more comprehensive design, the current analysis used prospectively collected data from 11 centers across North America to evaluate the impact of age on postoperative complication rates as well as PROs across different procedure types.

Our results confirm previous findings that advancing age is not a predictor of complications following breast reconstruction (15, 17, 30). However, we did observe significant age-related differences in some of the PRO measures; while older women reported greater sexual well-being than younger women, patients over 60 years were less satisfied with their reconstruction than their younger counterparts. These age-related differences in satisfaction may vary by procedure type: Older women who opted for autologous reconstruction reported significantly higher satisfaction than women of the same age undergoing implant-based techniques. This finding may be attributable to the ability of autologous techniques to obtain superior symmetry with a ptotic contralateral breast, compared with implant-based reconstructions (12, 15, 31). While reconstructive surgeons may avoid autologous reconstruction in older women due to concerns over longer anesthetic times, our results indicate that autologous procedures may be viable options in older patients, given that advancing age is not associated with greater risks and that autologous reconstruction in this population still achieves high levels of satisfaction and physical well-being.

The strengths of the current study include its multicenter design, use of prospectively collected data, inclusion of implant and autologous procedures, and focus on both complications as well as PROs. However, limitations remain. Firstly, because this was not a randomized controlled trial, there are certainly other potential cofounders that we could not control for in our analysis. However, it is not possible to randomize across age. Secondly, these findings may not be generalizable to all patients across all centers; the vast majority of

MROC sites are academic centers, so our conclusions may not apply to all patients treated at all facilities. Additionally, while we had two-year follow-up for our patients, longer follow-up is still necessary to evaluate late complications, such as capsular contracture, as they may adversely affect long-term patient satisfaction and quality of life.

Conclusions

Despite previous concerns among some surgeons over the potential risks of post-mastectomy reconstruction in older women, it appears that age does not significantly affect complication rates. Furthermore, older patients appear to enjoy many of the same quality of life benefits of reconstruction as do younger women. For older patients considering breast reconstruction and for surgeons performing these procedures, the study findings confirm that reconstruction is a viable option, with risks and benefits comparable to those reported in younger women.

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Abbreviations

SEER	Surveillance, Epidemiology and End Results
PRO	patient reported outcomes
MROC	Mastectomy Reconstruction Outcomes Consortium
SLNB	sentinel lymph node biopsy
ALND	axillary lymph node dissection
BMI	body mass index

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Figure 1.

Adjusted mean scores of 2-year postoperative BREAST-Q domains by age group and procedure type. A) Satisfaction with breast, B) psychosocial well-being, C) physical well-being, D) sexual well-being.

Table 1

Clinical and Demographic Characteristics of Patients by Age Group (N=1,531)

Characteristic	Age Groups, y			p Value
	<45 (N=494)	45 to 60 (N=803)	>60 (N=234)	
BMI, mean (SD)	25.8 (5.7)	27.2 (5.9)	27.6 (5.4)	<0.001
Procedure type, n (%)				
Implant-based	373 (75.5)	522 (65.0)	164 (70.1)	<0.001
Autologous	121 (24.5)	281 (35.0)	70 (29.9)	
Laterality, n (%)				
Unilateral	132 (26.7)	360 (44.8)	164 (70.1)	<0.001
Bilateral	362 (73.3)	443 (55.2)	70 (29.9)	
Indication for mastectomy, n (%)				
Therapeutic	396 (80.2)	740 (92.2)	224 (95.7)	<0.001
Prophylactic	98 (19.8)	63 (7.9)	10 (4.3)	
Timing of reconstruction, n (%)				
Immediate	474 (96.0)	747 (93.0)	208 (88.9)	0.002
Delayed	20 (4.1)	56 (7.0)	26 (11.1)	
Management of lymph nodes, n (%)				
None	149 (30.2)	196 (24.4)	55 (23.5)	0.008
SLNB only	199 (40.3)	398 (49.6)	122 (52.1)	
ALND	146 (29.6)	209 (26.0)	57 (24.4)	
Smoking, n (%)				
Non-smoker	351 (71.6)	494 (62.0)	131 (56.5)	<0.001
Previous smoker	129 (26.3)	278 (34.9)	95 (41.0)	
Current smoker	10 (2.0)	25 (3.1)	6 (2.6)	
Charlson index, n (%)				
0	72 (14.6)	47 (5.9)	8 (3.4)	<0.001
1	380 (76.9)	672 (83.7)	183 (78.2)	
2	42 (8.5)	84 (10.5)	43 (18.4)	
Radiation, n (%)				
Before reconstruction	43 (8.7)	88 (11.0)	42 (18.0)	0.008
During/after reconstruction	93 (18.8)	143 (17.8)	37 (15.8)	
None	358 (72.5)	572 (71.2)	155 (66.2)	
Chemotherapy, n (%)				
During/after reconstruction	152 (30.8)	255 (31.8)	53 (22.7)	0.026
Not during/after reconstruction	342 (69.2)	548 (68.2)	181 (77.4)	

BMI, body mass index; SLNB, sentinel lymph node biopsy; ALND, axillary lymph node dissection;

Table 2

Two-Year Postoperative Complication Rate by Procedure Type and Age Group

Variable	Procedure	Age groups, y						p Value [*]
		<45 (N=494)		45 to 60 (N=803)		>60 (N=234)		
		n	%	n	%	n	%	
Any complication	Implant	80	21.5	142	27.2	48	29.3	0.182
	Autologous	56	46.3	130	46.3	34	48.6	0.928
Major complication	Implant	56	15.0	105	20.1	38	23.2	0.132
	Autologous	40	33.1	82	29.2	22	31.4	0.852
Reconstructive failure	Implant	22	5.9	42	8.1	11	6.7	0.497
	Autologous	3	2.5	6	2.1	0	0.0	0.438

^{*} For a global test of age group, based on mixed-effects logistic regression models adjusting for center (hospital).

Table 3

Mixed-Effects Logistic Regression Model* for One-Year Postoperative Complication

Covariates	Overall complication			Major complication		
	Odds ratio	95% CI	P Value	Odds ratio	95% CI	p Value
Age, y						
<45		-Reference-			-Reference-	
45 to 60	1.23	(0.93, 1.62)	0.140	1.16	(0.85, 1.57)	0.349
>60	1.46	(0.99, 2.15)	0.059	1.43	(0.93, 2.18)	0.101
Procedure						
Implant		-Reference-			-Reference-	
Autologous	2.05	(1.47, 2.87)	<.001	1.95	(1.35, 2.80)	<.001
Obesity class						
Normal (18.5 BMI<25)		-Reference-			-Reference-	
Underweight (BMI<18.5)	1.34	(0.58, 3.10)	0.495	1.50	(0.60, 3.73)	0.386
Overweight (25 BMI<30)	0.95	(0.71, 1.28)	0.746	0.97	(0.70, 1.35)	0.851
Obese I (30 BMI<35)	1.18	(0.84, 1.67)	0.339	1.34	(0.92, 1.95)	0.123
Obese II (BMI 35)	2.44	(1.61, 3.70)	<.001	2.38	(1.55, 3.66)	<.001
Laterality						
Unilateral		-Reference-			-Reference-	
Bilateral	1.48	(1.14, 1.92)	0.003	1.42	(1.07, 1.89)	0.016
Indication for mastectomy						
Therapeutic		-Reference-			-Reference-	
Prophylactic	0.94	(0.47, 1.90)	0.869	1.00	(0.45, 2.19)	0.991
Timing of reconstruction						
Immediate		-Reference-			-Reference-	
Delayed	0.42	(0.24, 0.74)	0.003	0.61	(0.33, 1.13)	0.118
Management of lymph nodes						

Covariates	Overall complication			Major complication		
	Odds ratio	95% CI	p Value	Odds ratio	95% CI	p Value
None		-Reference-			-Reference-	
ALND	0.68	(0.43, 1.07)	0.095	0.77	(0.46, 1.28)	0.310
SLNB	0.69	(0.47, 1.02)	0.064	0.95	(0.62, 1.46)	0.818
Smoking						
Non-smoker		-Reference-			-Reference-	
Previous smoker	1.23	(0.96, 1.59)	0.102	1.12	(0.84, 1.47)	0.442
Current smoker	2.53	(1.28, 4.99)	0.008	2.25	(1.13, 4.47)	0.021
Charlson Index						
0		-Reference-			-Reference-	
1	1.43	(0.67, 3.07)	0.352	1.22	(0.52, 2.87)	0.646
2	1.93	(0.84, 4.42)	0.121	1.84	(0.73, 4.63)	0.197
Radiation						
No radiation		-Reference-			-Reference-	
Before reconstruction	1.75	(1.18, 2.59)	0.006	1.40	(0.90, 2.15)	0.132
During/after reconstruction	1.99	(1.38, 2.86)	0.000	2.34	(1.58, 3.48)	<.001
Chemotherapy						
Not during/after reconstruction		-Reference-			-Reference-	
During/after reconstruction	1.24	(0.93, 1.67)	0.148	1.32	(0.96, 1.83)	0.092

* Each model also included random intercepts for centers (hospitals). Results were combined based on n=10 imputation.

SLNB, sentinel lymph node biopsy; ALND, axillary lymph node dissection;

Table 4

Summary of BREAST-Q Score by Procedure Type, Age Group, and Time

Patient-reported outcomes	Implant			Autologous		
	Age <45 y	Age 45 to 60 y	Age >60 y	Age <45 y	Age 45 to 60 y	Age >60 y
Satisfaction with breast						
Baseline	65.9 (22.5)	61.1 (22.1)	60.9 (21.1)	55.2 (20.2)	54.1 (21.6)	51.5 (20.4)
2 years postop	67.3 (16.4)	63.5 (17.7)	59.2 (19.9)	67.2 (16.7)	68.9 (18.7)	71.9 (21.1)
Psychosocial well-being						
Baseline	71.8 (17.4)	70.0 (17.9)	73.3 (18.8)	62.7 (18.0)	65.4 (18.5)	68.5 (19.1)
2 years postop	73.7 (18.9)	74.3 (18.6)	75.9 (20.4)	71.6 (19.1)	76.1 (19.3)	83.8 (16.8)
Physical well-being						
Baseline	81.4 (14.0)	79.4 (14.6)	81.3 (13.7)	76.2 (14.7)	74.4 (15.0)	79.9 (15.6)
2 years postop	79.9 (13.3)	76.3 (13.4)	76.2 (16.1)	72.8 (16.1)	75.7 (15.7)	82.4 (13.5)
Sexual well-being						
Baseline	60.9 (18.3)	57.3 (18.6)	54.1 (24.0)	51.0 (22.1)	49.1 (21.4)	48.8 (23.3)
2 years postop	54.1 (20.2)	53.3 (20.2)	55.0 (23.5)	53.6 (19.4)	57.1 (22.0)	65.4 (23.4)

All data presented as mean (SD).

Table 5

Partial Results from Mixed-effects Regression Model^{*} for Two-year Postoperative Patient-Reported Outcomes

Covariates	Satisfaction with breast			Psychosocial well-being			Physical well-being			Sexual well-being		
	Beta	95% CI	p Value	Beta	95% CI	p Value	Beta	95% CI	p Value	Beta	95% CI	p Value
Age group, y												
<45		-Reference-			-Reference-			Reference-			-Reference-	
45 to 60	-1.41	(-4.34, 1.52)	0.342	2.16	(-0.85, 5.17)	0.157	-1.18	(-3.46, 1.11)	0.307	1.43	(-1.83, 4.70)	0.386
>60	-5.05	(-9.44, -0.67)	0.025	2.13	(-1.81, 6.06)	0.287	-0.71	(-3.93, 2.52)	0.663	4.25	(0.26, 8.23)	0.037
Procedure												
Implant		-Reference-			-Reference-			Reference-			-Reference-	
Autologous	3.96	(-0.91, 8.83)	0.110	-0.78	(-5.77, 4.22)	0.758	-2.06	(-5.36, 1.23)	0.219	3.71	(-1.31, 8.74)	0.147
Age × Procedure												
45 to 60 years × Autologous	2.24	(-2.75, 7.24)	0.377	2.10	(-3.38, 7.58)	0.448	4.36	(0.96, 7.77)	0.012	3.04	(-2.65, 8.73)	0.293
>60 years × Autologous	8.82	(1.20, 16.45)	0.024	6.08	(-0.46, 12.62)	0.068	6.78	(2.07, 11.49)	0.005	6.14	(-0.93, 13.22)	0.089

^{*} Each model also adjusted for the following covariates: baseline outcome, BMI, laterality, indication for mastectomy, timing of reconstruction, Management of lymph nodes, smoking, charlson index, radiation and chemotherapy. Each model also included random intercepts for centers (hospitals). Results were combined based on n=10 imputation.