

A National Snapshot of Satisfaction with Breast Cancer Procedures

Dunya M. Atisha, MD¹, Christel N. Rushing, MS³, Gregory P. Samsa, PhD³, Tracie D. Locklear, PhD⁴, Charlie E. Cox, MD², E. Shelley Hwang, MD, MPH⁵, Michael R. Zenn, MD⁶, Andrea L. Pusic, MD, MPH⁷, and Amy P. Abernethy, MD, PhD^{4,8}

¹Division of Plastic Surgery, Department of Surgery, Morsani College of Medicine, University of South Florida, Tampa, FL; ²Division of Breast Surgery, Department of Surgery, Morsani College of Medicine, University of South Florida, Tampa, FL; ³Department of Biostatistics and Bioinformatics, Duke University Medical Center, Durham, NC; ⁴Center for Learning Health Care, Duke University Medical Center, Durham, NC; ⁵Division of Surgical Oncology, Department of Surgery, Duke University Medical Center, Durham, NC; ⁶Division of Plastic Surgery, Department of Surgery, Duke University Medical Center, Durham, NC; ⁷Plastic and Reconstructive Surgery, Memorial Sloan Kettering Cancer Center, New York, NY; ⁸Health Policy and Management, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC

ABSTRACT

Purpose. Women with early-stage breast cancer face the complex decision to undergo one of three equally effective oncologic surgical strategies: breast-conservation surgery with radiation (BCS), mastectomy, or mastectomy with breast reconstruction. With comparable oncologic outcomes and survival rates, evaluations of satisfaction with these procedures are needed to facilitate the decision-making process and to optimize long-term health.

Methods. Women recruited from the Army of Women with a history of breast cancer surgery took electronically administered surgery-specific surveys, including the BREAST-Q[®] and a background survey evaluating patient-, disease-, and procedure-specific factors. Descriptive statistics and regression analysis were used to evaluate the effect of procedure type on breast satisfaction scores.

Results. Overall, 7,619 women completed the questionnaires. Linear regression revealed that women who underwent abdominal flap, or buttock or thigh flap reconstruction reported the highest breast satisfaction score, scoring an average of 5.6 points and 14.4 points higher than BCS, respectively ($p < 0.0001$ and $p = 0.027$, respectively). No difference in satisfaction was observed in

women who underwent latissimus dorsi flap reconstruction compared with those who underwent BCS. Women who underwent implant reconstruction reported scores 8.6 points lower than BCS ($p < 0.0001$). Those with mastectomies without reconstruction or complex surgical histories scored, on average, 10 points lower than BCS ($p < 0.0001$).

Conclusion. Women who underwent autologous tissue reconstruction reported the highest breast satisfaction, while women undergoing mastectomy without reconstruction reported the lowest satisfaction. These findings emphasize the value of patient-reported outcome measures as an important guide to decision making in breast surgery and underscore the importance of multidisciplinary participation early in the surgical decision-making process.

This year, more than 280,000 women will be diagnosed with breast cancer in the US. Women with early-stage disease face the complex decision to undergo one of three oncologic surgical strategies with equivalent survival outcomes: breast-conservation surgery with radiation (BCS), mastectomy (M), or mastectomy with breast reconstruction (BR). Since all three options have comparable disease-specific outcomes and survival rates, evaluations of patient satisfaction in women who have had these treatments are needed to inform the decision-making process and to optimize the long-term health of those facing a new breast cancer diagnosis.

The patient's assessment of the surgical outcome can be very different from that of the surgeon; therefore, direct

assessment of the patient experience using clinically relevant, scientifically sound patient-reported outcomes (PROs) survey instruments is critical. Current studies in the literature regarding satisfaction with breast cancer surgery are limited by small sample size, limited representativeness of institutions and surgeons, and the use of generic surveys not specifically designed for this population.^{1–6} The BREAST-Q is a new PRO instrument that specifically addresses these needs. Developed with extensive patient input and Rasch psychometric methods, it was designed to measure both satisfaction and quality-of-life outcomes for patients undergoing breast surgery.^{7,8} The BREAST-Q has modules for patients undergoing M, BCS or BR; each module examines procedure-specific issues and permits comparison across surgical groups.

The goal of the current study was to facilitate comparisons of BCS, M, and BR from a patient perspective and provide a reference point for comparisons between studies and surgical populations. We employed the newly developed BREAST-Q© questionnaires and a novel survey strategy to reach a large, broad sample of respondents.

METHODS

Study Population

Participants were recruited from the Love/AVON Army of Women (AOW) program that was launched in 2008 by the Dr. Susan Love Research Foundation to help connect scientists with study volunteers. Studies submitted to the AOW must have funding, and must receive Scientific Advisory Committee and Internal Review Board (IRB) approval.⁹ After approval from the AOW Scientific Advisory Committee and the Duke University Medical Center IRB, a call-to-action email was sent to all AOW members. Women enrolled in the AOW (age ≥ 18 years) with a history of breast cancer surgery were recruited. Women without a history of breast cancer, those who did not have definitive breast cancer surgery, or women who received their treatment outside of the US were excluded.

Measures

BREAST-Q© is a portfolio of well-validated breast surgery-specific PRO instruments developed following internationally accepted guidelines.^{7,8} The conceptual model and item list were developed from patient interviews, focus groups, expert panels and literature review.^{10–12} Iterative development of BREAST-Q© led to separate modules for each surgery type—BCS, M, and BR. Each module has a pre- and postoperative version; subscales assess (1) psychosocial well-being; (2) physical

well-being; (3) sexual well-being; (4) satisfaction with breasts; and (5) satisfaction with care. Cronbach's alpha scores for all scales range from 0.87 to 0.98, and test–retest reliability, as measured by intraclass correlation coefficients, range from 0.85 to 0.98.^{7,8,13} Validity is supported by correlations with multiple existing well-recognized measures and confirmation of hypotheses regarding group differences.

The 'satisfaction with breast' scale measures patient satisfaction with their breasts and asks questions regarding size, symmetry, and softness of the breasts. The scale also examines perceptions of appearance and how normal the person feels both in and out of clothing. The items are transformed on a scale of 0–100, with higher values representing a more favorable outcome. A clinically relevant difference is defined as a difference that exceeds half a standard deviation (SD) of the baseline value.¹⁴ The BREAST-Q© is responsive to change over time and is able to discriminate between interventions.^{13,15–17}

Participants also self-reported their demographic background, age, height, weight, comorbidities (including other cancers), diet, and exercise habits. Patients provided information about their breast cancer history, including disease stage, adjuvant and neoadjuvant therapies, recurrence or development of new breast cancers, breast cancer surgeries received, and complications with procedures.

Procedure

AOW volunteers meeting the eligibility criteria were sent an email linking them to a series of questionnaires. Participants were directed to take the relevant postoperative BREAST-Q© module based on their most recent procedure, followed by the self-reported personal and clinical data questionnaires. Other PRO measures were conducted, as detailed in our methodology report.⁹ Surveys were administered electronically using Qualtrics software (Provo, UT, USA; www.qualtrics.com).

Data Analysis

Descriptive statistics and linear regressions were used to describe the cohorts and evaluate the effect of procedure type on breast satisfaction. Patients were categorized according to their procedure type, including BC, M, BR, or complex (C). The BR cohort was further broken down into the different reconstructive subtypes (implants, latissimus dorsi (LD) flaps, abdominal flaps, or gluteal/thigh flaps) since each has differing patient experiences.^{18–23} The 'C' group represented women who underwent multiple procedures, and was created to preserve the purity of the other procedure cohorts. For example, women who had multiple BCS procedures who went on to have either M or BR were

classified as ‘C’. Women who had complications with their implants requiring removal and no further reconstruction were also classified as ‘C’.

Independent variables included (1) body mass index (BMI); (2) patient age; (3) time since surgery; (4) type of surgery; (5) history of radiation, (6) chemotherapy, and (7) anti-hormonal therapy; (8) disease stage; (9) history of recurrence or (10) second primary breast cancer; (11) report of currently being treated; (12) presence of minor or major complications; and (13) socioeconomic factors. Complications were classified as either major or minor. Major complications were defined as those resulting in major interventions or hospitalization, and minor complications were defined as those wound or flap issues that could be managed conservatively. ‘Time since surgery’ was defined as the time elapsed from the date of surgery to the date the survey was completed. Time was defined by categories, and 1–5 years post-surgery was the most commonly reported time lapse.

Regression analysis was performed to evaluate the effect of procedure type on satisfaction while holding potential confounding variables constant. Estimates represent the difference in average breast satisfaction score for the stated characteristic compared with the reference group.

RESULTS

At the time of study initiation, the AOW consisted of 365,594 members; approximately 106,000 members identified themselves as having a history of breast cancer. After the ‘call-to-action’ e-mail was sent to all AOW members, 9,289 women with a history of breast cancer surgery expressed an interest in participating in the study; 7,619 (82 %) women consented and completed the surveys, and, of this total, 3,801 women (50 %) also provided narrative responses about their treatment and surgical experiences. Respondents hailed from the South, West, Northeast, and Midwest United States (29, 26, 24, and 21 %, respectively). Respondents received their breast cancer care at community hospitals (50 %), university hospitals (21 %), unaffiliated standalone cancer centers (14 %), or managed care centers (5 %).

Mean age was 57.9 years (SD 9.4) and the women were mostly White, married, employed or retired, college educated, and earned more than \$50,000 per year (Table 1). Most respondents had early-stage breast cancer, with the most common type being ductal carcinoma in situ (29.6 %) or invasive ductal carcinoma (33.3 %); 5.7 % reported a recurrence and 6.9 % reported a second diagnosis of a new primary cancer. Surgical procedures are presented in Table 2; mean time since surgery was 6.7 years (SD 5.9).

TABLE 1 Description of patients in the entire cohort ($N = 7,619$)

Parameter	Percentage of cohort, N or mean (SD)	
<i>Mean age, years</i>	57.9 (9.4)	
<i>Mean BMI at the time of the survey</i>	26.7 (5.6)	
<i>Radiation</i>		
No	35.45	2,701
Yes	64.55	4,918
<i>Chemotherapy</i>		
No	41.30	3,147
Yes	58.70	4,472
<i>Stage</i>		
0	27.08	2,063
1	28.47	2,169
2	28.02	2,135
3	10.21	778
4 or metastatic disease	1.39	106
I do not know	4.44	338
<i>Non-recurrent second cancer</i>		
No	93.08	7,092
Yes	6.92	527
<i>Recurrence</i>		
No	93.66	7,136
Yes	5.71	435
<i>Race</i>		
American Indian or Alaskan Native	0.12	9
Asian or Pacific Islander	0.98	75
Black or African American	1.77	135
Other	0.70	53
White	94.16	7,174
Two or more races	2.01	153
<i>Ethnicity</i>		
Hispanic or Latino	1.93	147
Non-Hispanic or non-Latino	96.38	7,343
<i>Marital status</i>		
Divorced	11.00	838
Living with significant other	5.16	393
Married	71.06	5,414
Separated	1.13	86
Single, never married	6.76	515
Widowed	4.66	355
<i>Income</i>		
Less than \$15,000	2.19	167
\$15,000–\$24,999	3.98	303
\$25,000–\$34,999	5.24	399
\$35,000–\$49,999	8.95	682
\$50,000–\$74,999	19.28	1,469
\$75,000–\$99,999	17.34	1,321
\$100,000 and over	38.19	2,910

TABLE 1 continued

Parameter	Percentage of cohort, or mean (SD)	<i>N</i>
<i>Education</i>		
College, trade, or university diploma	36.46	2,778
High-school diploma	4.86	370
Masters/Doctoral degree	32.45	2,472
Some Masters/Doctoral degree	7.76	591
Some college, trade, or university	18.09	1,378
Some high school	0.11	8
<i>Work status</i>		
Employed full-time	38.17	2,908
Employed part-time	14.73	1,122
Homemaker	8.02	611
Other	5.66	431
Retired	23.36	1,780
Student	0.49	37
Unable to work/disabled	2.89	220
Unemployed/seeking employment	2.21	168
Voluntary work	4.25	324

BMI body mass index, *SD* standard deviation

Satisfaction with Breast Cancer Surgery

When accounting for potential confounding variables, linear regression (Table 3) revealed that those with abdominal flap reconstruction reported an average of 5.6 points higher breast satisfaction scores than BCS ($p < 0.0001$), and those with gluteal or thigh flaps scored an average of 14.1 points higher than BCS ($p < 0.0271$). Women with LD flaps did not demonstrate any significant differences in their scores compared with patients having BCS. On the other hand, women who underwent implant reconstruction demonstrated scores that were an average of 8.6 points lower than women who underwent BCS ($p < 0.0001$). Women with a complex surgical history scored an average of 10.0 points lower than BCS ($p < 0.0001$). Women who had mastectomies without reconstruction reported the lowest satisfaction scores, averaging 10.1 points lower than BCS ($p < 0.0001$).

Predictors of Satisfaction

Women with higher-stage disease, namely stages 2 and 3, reported significantly lower breast satisfaction than those with stage 1 disease (Table 4). Women who experienced a recurrence and those who were currently being treated scored significantly lower in their breast satisfaction scores. BMI appeared to negatively impact satisfaction with breasts, whereas factors such as age did not. Socioeconomic factors such as higher income (more than \$100,000 per year), graduate-level education, and the ability to work or volunteer all resulted in significantly higher breast satisfaction scores.

TABLE 2 Description of procedures by type

	Percentage of cohort, or mean (SD)	<i>N</i>
<i>Procedure type</i>		
Breast-conservation surgery	46.0	3,507
Mastectomy alone	16.7	1,269
Reconstruction	30.6	2,328
Complex surgical history	6.8	515
<i>Reconstruction type</i>		
Implants	18.4	1,400
Latissimus (with or without implants)	2.3	177
Abdominal flaps	8.6	657
DIEP or free TRAM		273
Regular TRAM		384
Gluteal or thigh flaps (SGAP, IGAP, TUG)	0.1	9
Unknown reconstruction type	1.1	83
<i>Prophylactic mastectomy</i>		
No	34.2	2,609
Yes	19.2	1,465
<i>Time since surgery, years (categorical)</i>		
<1	10.0	759
1–5	40.4	3,081
5–10	26.2	1,998
10–15	13.6	1,034
15–20	5.8	443
>20	3.9	297
<i>Mean time since surgery (years)</i>	6.7 (5.9)	
<i>Major complication</i>		
No	91.5	6,971
Yes	8.5	648
<i>Minor complication</i>		
No	72.7	5,538
Yes	27.3	2,081

SD standard deviation

Time had a significant effect on satisfaction scores for the whole cohort, such that women who were 15 years or more since the date of surgery reported significantly lower breast satisfaction scores compared with those who were between 1 and 5 years since surgery. Figure 1 demonstrates the trends in satisfaction for the procedures according to time elapsed since surgery. Women who underwent implant reconstruction, C, and BCS all reported lower breast satisfaction scores with greater time since surgery. Women who underwent abdominal and LD flap reconstruction maintained similar scores in the short- and long-term. Those with mastectomy and no reconstruction reported increasingly higher scores the further they were from the date of surgery.

TABLE 3 Linear regression model evaluating procedure type and satisfaction with breast

	Estimate	<i>p</i> value	95 % confidence limits
Gluteal or thigh flaps versus BCS	14.1	0.0309	1.3–27.0
Abdominal flaps versus BCS	5.6	<0.0001	3.7–7.5
Latissimus dorsi flaps versus BCS	–1.0	0.5447	–4.2 to 2.2
Implants versus BCS	–8.7	<0.0001	–10.3 to –7.0
Complex versus BCS	–10.1	<0.0001	–12.6 to –7.7
Mastectomy alone versus BCS	–10.2	<0.0001	–11.7 to –8.6

The reference group was defined as patients who underwent BCS; received no chemotherapy, radiation, or hormone therapy; had stage 1 disease; experienced no major or minor complications; had surgery from 1 to 5 years ago; were White, non-Latino, married, employed full-time with an income in the \$50,000–\$74,999 range; highest education was high-school diploma; are not currently being treated; did not have a second cancer diagnosis; and did not have a recurrence. Any departure from this list of characteristics is measured in the model

BCS breast-conservation surgery

DISCUSSION

These past several decades have seen a paradigm shift in the surgical management of breast cancer from radical mastectomy to BCS and now to another increase in the rate of mastectomy, particularly contralateral prophylactic mastectomy (CPM).^{26–31} Efforts to manage the increasing trend of mastectomies is evident, including standards published by the National Accreditation Program for Breast Centers (NAPBC), which require that BCS is performed on at least 50 % of all patients diagnosed with early-stage breast cancer (stages 0, 1, 2).³² While some women do not have a choice of procedure due to presentation of disease, there is a general belief that most patients should be given the opportunity to make their decision based on their values, preferences, and psychological state, as long as it is oncologically appropriate. To do this, women need reliable procedure-specific data on the personal experience of other women like themselves who are undergoing these differing procedures.

This study documents experiential differences in breast satisfaction with the different breast cancer procedures. In general, results favor autologous tissue reconstructive approaches (Fig. 1; Table 3). While it is well known in the plastic surgery literature that autologous tissue is superior to implant reconstruction in terms of aesthetic satisfaction and long-term durability,^{18–23} this is the first study to demonstrate higher levels of patient-reported breast

TABLE 4 Factors other than procedure type that significantly influence satisfaction with breast

	Estimate	<i>p</i> value	95 % confidence limits
Chemotherapy	–1.5	0.0147	–2.6 to –0.3
Radiation	–4.5	<0.0001	–5.8 to –3.1
Stage 2 versus stage 1	–2.5	0.0001	–3.8 to –1.2
Stage 3 versus stage 1	–3.6	0.0001	–5.5 to –1.7
Recurrence	–3.1	0.0045	–5.2 to –1.0
Major complication	–2.6	0.0136	–4.6 to –0.5
Minor complication	–6.6	<0.0001	–7.7 to –5.6
5–10 years versus 1–5 years from the date of surgery	–1.8	0.0034	–3.0 to –0.6
15–20 years versus 1–5 years from the date of surgery	–3.4	0.0013	–5.5 to –1.3
>20 years versus 1–5 years from the date of surgery	–3.7	0.0042	–6.3 to –1.2
Body mass index	–0.5	<0.0001	–0.6 to –0.4
Disabled versus employed full-time	–5.0	0.0007	–7.8 to –2.1
Income: ≥\$100,000 versus \$50,000–\$74,999	2.0	0.0030	0.7–3.3
Unreported income versus \$50,000–\$74,999	4.2	0.0006	1.8–6.6
Voluntary work versus employed full-time	2.9	0.0174	0.5–5.3
Masters/Doctoral degree versus high school diploma	4.0	0.0006	1.7–6.3
Some Masters/Doctoral degree versus high school diploma	2.9	0.0358	0.2–5.5
Currently being treated	1.3	0.0270	0.2–2.5

The reference group was defined as patients who underwent BCS; received no chemotherapy, radiation, or hormone therapy; had stage 1 disease; experienced no major or minor complications; had surgery from 1 to 5 years ago; were White, non-Latino, married, employed full-time with an income in the \$50,000–\$74,999 range; highest education was high-school diploma; are not currently being treated; did not have a second cancer diagnosis; and did not have a recurrence. Any departure from this list of characteristics is measured in the model

BCS breast-conservation surgery

satisfaction, including size, symmetry, and softness of the breasts, compared with BCS.

Women who choose mastectomy with autologous tissue reconstruction are more likely to be involved in the decision-making process and may have invested more of themselves (research, time, and effort) into their care. More involvement in the process of care may lead to increased satisfaction with outcomes. Studies about satisfaction with certain breast cancer procedures (namely CPM) have shown that women who report active roles in their decision-making process were twice as likely to be satisfied with their decision compared with those who reported more

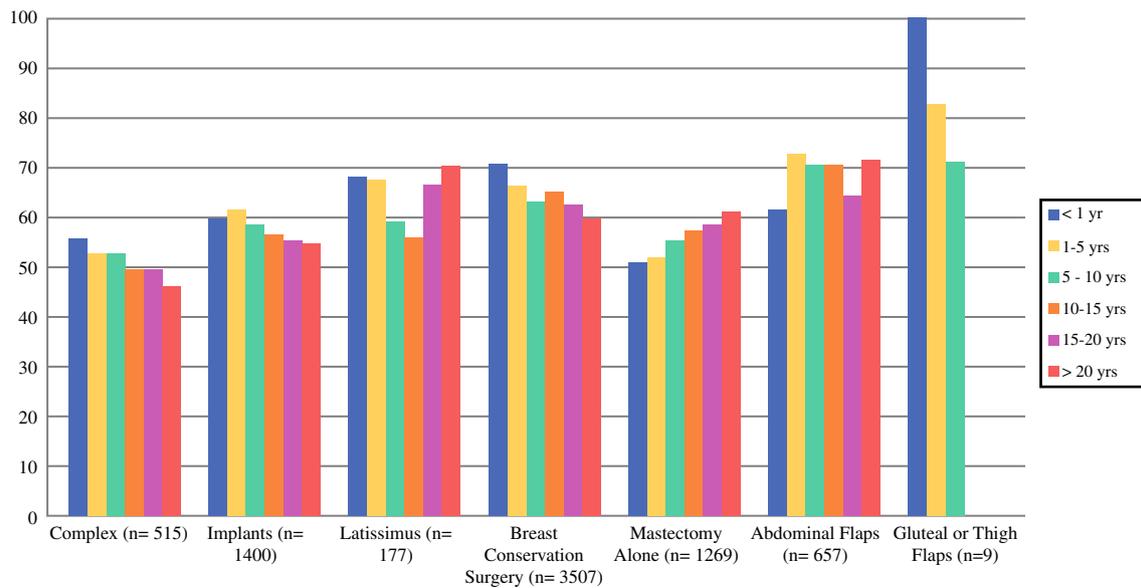


FIG. 1 Breast satisfaction scores by procedure type and time since surgery

passive roles.³⁴ That being said, autologous tissue reconstruction can help to improve overall body contour and body image as excess tissue is removed from undesired areas to provide a natural reconstruction. In a recent study by Gopie et al., patients opting for autologous tissue reconstruction were more focused on regaining natural breast appearance and, in addition, sought to benefit from the advantages of autologous tissue reconstruction.³⁴ In unilateral autologous tissue reconstruction, there is the added benefit of improved symmetry to the contralateral breast compared with unilateral implant reconstruction.³⁵ In women undergoing bilateral mastectomy with autologous tissue reconstruction, the ability to achieve symmetry between the two reconstructed breasts is improved and there may be the added benefit of decreasing psychological distress by a reduction in the risk of contralateral breast cancer. In a recent analysis of young women undergoing prophylactic mastectomies, 95 % reported the ‘desire for peace of mind’ as an extremely or very important reason for choosing to undergo CPM.³⁶

Women undergoing implant-based reconstruction were not as satisfied as the women who had elected to preserve their breasts. Women who underwent implant reconstruction scored an average of 8.6 points lower than those with BCS. With unilateral implant reconstruction, achieving symmetry to the contralateral breast may be challenging, particularly since natural changes in the contralateral breast occur with time. Additionally the softness of the implant drastically differs from the contralateral natural breast, perhaps contributing to lower breast satisfaction scores. Even with bilateral implant reconstruction, one cannot achieve the same level of

softness and natural feel as an autologous tissue reconstruction. There is also the issue that implant reconstruction requires maintenance throughout time due to the lifespan of implants and increased rate of rupture. While breast satisfaction scores were lowest for women with implants in the reconstruction cohort, they still scored an average of 10.1 points higher than patients with mastectomy alone.

Women who underwent LD flap reconstructions reported similar satisfaction profiles as those who underwent BCS. LD flaps are a good autologous tissue option for women with a history of radiation, those who are too obese or too thin for other reconstructive options, those with a history of prior abdominal surgery, or those who are deterred by the commitment and recovery time associated with abdominal flap reconstruction. Similar to our findings, previous studies have shown that LD flaps produce a high level of patient satisfaction for a wide range of breast operations, ranging from quadrantectomy to skin-sparing or nipple-sparing mastectomies.^{37–39}

Women with a complex surgical history scored an average of 10.0 points lower than BCS ($p < 0.0001$). This cohort of women experienced multiple operations, either due to complications or due to a recurrence of cancer or a new primary cancer that ultimately changed their final outcome. Dissatisfaction with their breasts compared with the BCS population may be due to failure to meet expectations or disappointment that the original plan for their breast and for their cancer treatment failed. They may also be experiencing decisional regret by not choosing or not having the option to choose the procedure they ultimately received earlier on in the surgical decision-making process.

Individual patient characteristics drive perceived satisfaction independent of procedure type (Table 4). For example, women with a higher BMI are less likely to be satisfied than those with a normal BMI. Features reflective of worse disease (higher stage and recurrence) tend to erode satisfaction, while positive factors such as higher education or income improve satisfaction. Practical data such as this can help surgeons and patients tease out the optimal surgical approach and help to set reasonable expectations in anticipation of the specific surgical procedure selected.

While these findings represent only one snapshot in time in each woman's life, time from surgery was an important determinant of satisfaction in these women in that breast satisfaction of the entire cohort decreased as time elapsed since surgery increased (Table 3). Interestingly, the reduction in satisfaction was affected by procedure type (Fig. 1). BCS, implant reconstruction, those with a complex surgical history, and gluteal and thigh flaps reported decreased satisfaction with time. On the other hand, women with latissimus flaps or abdominal flaps had higher satisfaction than women who were further out from the date of surgery. One explanation for this is that, with time, women tend to experience changes in the shape and outcomes of their breast. For example, women undergoing BCS with radiation have noted changes in the fibrosis and cosmetic outcome of their breast, even 20 years after treatment.²⁴ It is also possible that older techniques may have been less considerate of volume removed in women undergoing BCS. It is well-known in the plastic surgery literature that satisfaction with BR changes with time. Long-term data show that women who underwent implant reconstruction reported significantly decreased aesthetic satisfaction compared with autologous tissue reconstruction over a women's life span.^{15,18,25} This is due to the risk of rupture with older implants and the need for revision surgeries, particularly as a woman's body and shape changes long-term. On the other hand, autologous tissue reconstruction withstands time, and flaps will change as the patient gains or loses weight. There is also avoidance of the upkeep associated with implants.

The most interesting finding is that of higher satisfaction scores in women who were further out from the date of mastectomy without reconstruction. There is probably a treatment bias in that these women are those who likely declined reconstruction initially and are content with their current body image and chest wall appearance. For these women, mastectomy alone may still afford high levels of long-term satisfaction.

Ultimately, the choice of surgery and the subsequent outcomes are a personal experience, and perhaps women who underwent more substantial procedures also had more sense of personal investment in the procedure, accounting for a greater sense of satisfaction. These data can be used to help guide personal choice, with a candid discussion of all

treatment options. Moreover, it is important to monitor and support these women over time regardless of the surgery treatment choice that is made.

Our study had several major strengths. The access provided by the AOW program resulted in the largest study to date evaluating patient-reported concerns following breast cancer surgery. With an 82 % response rate, these women provided important data about breast cancer treatment that could be used as a foundation for real-time, shared, medical decision making. We used validated measures specific to the question at hand. Additionally, patient perception was represented along the continuum of time—from <1 to >20 years from the time of surgery. In an era where younger women are presenting for these procedures, long-term data are instrumental in providing information about changes in satisfaction that can occur with time. Finally, in evaluating the effects of procedure type on breast satisfaction, our analyses controlled for several other potential confounding variables, including neoadjuvant or adjuvant therapies, socioeconomic factors, and breast cancer characteristics. While a randomized controlled trial (RCT) design would be more effective in controlling for both known and unknown confounders, a breast surgery RCT would likely prove to be ethically and logistically challenging.

Our analysis should be interpreted in the context of some limitations. This study was retrospective in nature and represented only a snapshot in time. A prospective evaluation of PROs along several designated time points would provide a more accurate comparison of procedures. This particular study reflects upon breast satisfaction only, which is specific to size, symmetry, and softness of the breasts. This analysis did not assess satisfaction with care or quality of life measures such as physical, psychological or sexual function. We plan to evaluate these measures in a future analysis. The AOW cohort represents a unique population of women with breast cancer, who are likely to be more affluent, engaged, and personally motivated; the sample is thus not representative of the breast cancer population as a whole. Additionally, the large sample size may have led to over-interpretation of findings.

CONCLUSIONS

Our data suggest that mastectomy with autologous tissue reconstruction can result in improved breast satisfaction compared with other surgical options employed for the treatment of breast cancer. These results underscore the importance of educating patients about the option of BR in the informed consent process before women make a final decision between BCS and mastectomy. These data also demonstrate the importance of considering the impact of

radiation therapy on future outcomes. For this reason, we routinely schedule appointments with the medical, radiation, and surgical oncologists, as well as the plastic surgeon, to ensure that all options are considered in a truly multidisciplinary fashion. Such discussions, while complex, will ultimately result in a patient's satisfaction with her surgical decision, and incorporating personal outcomes as reported by patients is essential to this process.

ACKNOWLEDGMENT We would like to acknowledge the AOW participants for volunteering to take this series of surveys in order to help improve and further our knowledge of outcomes associated with breast cancer care. The authors also acknowledge Andrea Pusic, MD, MPH, and the team of researchers at Memorial Sloan Kettering Cancer Center for providing us with the Breast Q[®], and to Donald T. Kirkendall, ELS, for his assistance in the preparation of the manuscript. This study was supported by Grant #235066 from the Plastic Surgery Foundation.

REFERENCES

- Atisha D, Alderman AK, Lowery JC, Kuhn LE, Davis J, Wilkins EG. Prospective analysis of long-term psychosocial outcomes in breast reconstruction: two-year postoperative results from the Michigan Breast Reconstruction Outcomes Study. *Ann Surg.* 2008;247:1019–28.
- Janz NK, Mujahid M, Lantz PM, et al. Population-based study of the relationship of treatment and sociodemographics on quality of life for early stage breast cancer. *Qual Life Res.* 2005;14:1467–79.
- Nicholson RM, Leinster S, Sassoon EM. A comparison of the cosmetic and psychological outcome of breast reconstruction, breast conserving surgery and mastectomy without reconstruction. *Breast.* 2007;16:396–410.
- Sackey H, Sandelin K, Frisell J, Wickman M, Brandberg Y. Ductal carcinoma in situ of the breast. Long-term follow-up of health-related quality of life, emotional reactions and body image. *Eur J Surg Oncol.* 2010;36:756–62.
- Ueda S, Tamaki Y, Yano K, et al. Cosmetic outcome and patient satisfaction after skin-sparing mastectomy for breast cancer with immediate reconstruction of the breast. *Surgery.* 2008;143:414–25.
- Wilkins EG, Cederna PS, Lowery JC, et al. Prospective analysis of psychosocial outcomes in breast reconstruction: one-year postoperative results from the Michigan Breast Reconstruction Outcome Study. *Plast Reconstr Surg.* 2000;106:1014–25; discussion 1026–1017.
- Aaronson N, Alonso J, Burnam A, et al. Assessing health status and quality-of-life instruments: attributes and review criteria. *Qual Life Res.* 2002;11:193–205.
- US Food and Drug Administration. Guidance for industry. Patient-reported outcome measures: use in medical product development to support labeling claims. Silver Spring (MD). 2009. <http://www.fda.gov/downloads/Drugs/Guidances/UCM193282.pdf>. Accessed 15 Apr 2014.
- Atisha DM, Locklear TD, Rogers UA, Rushing CN, Samsa GP, Abernethy AP. Partnering with engaged patients accelerates research. *J Surg Oncol.* 2014;109:504–5.
- Cano SJ, Klassen AF, Scott AM, Cordeiro PG, Pusic AL. The BREAST-Q: further validation in independent clinical samples. *Plast Reconstr Surg.* 2012;129:293–302.
- Cano SJ, Klassen AF, Scott AM, Pusic AL. A closer look at the BREAST-Q[®]. *Clin Plast Surg.* 2013;40:287–96.
- Cano SJ, Klassen AF, Pusic AL. From BREAST-Q[®] to Q-Score[®]: using Rasch measurement to better capture breast surgery outcomes. Presented at the Joint International IMEDO TCI + TC7 + TC13 Symposium, 31 Aug–2 Sept 2011, Jena.
- Pusic AL, Klassen AF, Scott AM, Klok JA, Cordeiro PG, Cano SJ. Development of a new patient-reported outcome measure for breast surgery: the BREAST-Q. *Plast Reconstr Surg.* 2009;124:345–53.
- Norman GR, Sloan JA, Wyrwich KW. The truly remarkable universality of half a standard deviation: confirmation through another look. *Expert Rev Pharmacoecon Outcomes Res.* 2004;4:581–5.
- Hu ES, Pusic AL, Waljee JF, et al. Patient-reported aesthetic satisfaction with breast reconstruction during the long-term survivorship period. *Plast Reconstr Surg.* 2009;124:1–8.
- McCarthy CM, Klassen AF, Cano SJ, et al. Patient satisfaction with postmastectomy breast reconstruction: a comparison of saline and silicone implants. *Cancer.* 2010;116:5584–91.
- Zhong T, McCarthy C, Min S, et al. Patient satisfaction and health-related quality of life after autologous tissue breast reconstruction: a prospective analysis of early postoperative outcomes. *Cancer.* 2012;118:1701–9.
- Alderman AK, Wilkins EG, Lowery JC, Kim M, Davis JA. Determinants of patient satisfaction in postmastectomy breast reconstruction. *Plast Reconstr Surg.* 2000;106:769–76.
- Eberlein TJ, Crespo LD, Smith BL, Hergrueter CA, Douville L, Eriksson E. Prospective evaluation of immediate reconstruction after mastectomy. *Ann Surg.* 1993;218:29–36.
- Hidalgo DA. Aesthetic refinement in breast reconstruction: complete skin-sparing mastectomy with autogenous tissue transfer. *Plast Reconstr Surg.* 1998;102:63–70; discussion 71–72.
- Kroll SS, Baldwin B. A comparison of outcomes using three different methods of breast reconstruction. *Plast Reconstr Surg.* 1992;90:455–62.
- Kroll SS, Coffey JA Jr, Winn RJ, Schusterman MA. A comparison of factors affecting aesthetic outcomes of TRAM flap breast reconstructions. *Plast Reconstr Surg.* 1995;96:860–4.
- Slavin SA, Schnitt SJ, Duda RB, et al. Skin-sparing mastectomy and immediate reconstruction: oncologic risks and aesthetic results in patients with early-stage breast cancer. *Plast Reconstr Surg.* 1998;102:49–62.
- Hernanz F, Sanchez S, Cerdeira MP, Figuero CR. Long-term results of breast conservation and immediate volume replacement with myocutaneous latissimus dorsi flap. *World J Surg Oncol.* 2011;9:159.
- Lantz PM, Janz NK, Fagerlin A, et al. Satisfaction with surgery outcomes and the decision process in a population-based sample of women with breast cancer. *Health Serv Res.* 2005;40:745–67.
- Tracy MS, Rosenberg SM, Dominici L, Partridge AH. Contralateral prophylactic mastectomy in women with breast cancer: trends, predictors, and areas for future research. *Breast Cancer Res Treat.* 2013;140(3):447–52.
- Tuttle TM, Habermann EB, Grund EH, Morris TJ, Virnig BA. Increasing use of contralateral prophylactic mastectomy for breast cancer patients: a trend toward more aggressive surgical treatment. *J Clin Oncol.* 2007;25(33):5203–9.
- Tuttle TM, Jarosek S, Habermann EB, Arrington A, Abraham A, Morris TJ, et al. Increasing rates of contralateral prophylactic mastectomy among patients with ductal carcinoma in situ. *J Clin Oncol.* 2009;27(9):1362–7.
- Yao K, Stewart AK, Winchester DJ, Winchester DP. Trends in contralateral prophylactic mastectomy for unilateral cancer: a report from the National Cancer Data Base, 1998–2007. *Ann Surg Oncol.* 2010;17(10):2554–62.
- Peralta EA, Ellenhorn JD, Wagman LD, Dagens A, Andersen JS, Chu DZ. Contralateral prophylactic mastectomy improves the

- outcome of selected patients undergoing mastectomy for breast cancer. *Am J Surg.* 2000;180(6):439–45.
31. McLaughlin CC, Lillquist PP, Edge SB. Surveillance of prophylactic mastectomy: trends in use from 1995 to 2005. *Cancer.* 2009;115(23):5404–12.
 32. American College of Surgeons. National Accreditation Program for Breast Centers. <http://napbc-breast.org/standards/standards.html>.
 33. Nekhlyudov L, Bower M, Herrinton LJ, Altschuler A, Greene SM, Rolnick S, et al. Women's decision-making roles regarding contralateral prophylactic mastectomy. *J Natl Cancer Inst Monogr.* 2005;35:55–60.
 34. Gopie JP, Hillhorst MT, Kleijne A, Timman R, Menke-Pluymers MB, Hofer SO, et al. Women's motives to opt for either implant or DIEP flap breast reconstruction. *J Plast Reconstr Surg.* 2011;124(6): 1781–9.
 35. Lin C, Zhunag Y, Momeni A, Luan J, Chung M, Wright E, et al. Quality of life and patient satisfaction after microsurgical abdominal flap versus staged expander/implant breast reconstruction: a critical study of unilateral immediate breast reconstruction using patient reported outcomes instrument Breast-Q. *Breast Cancer Res Treat.* 2014;146(1):117–26.
 36. Rosenberg SM, Tracy M, Meyer ME, Sepucha K, Gelber S, Hirschfield Bartek J, et al. (2013) Perceptions, knowledge and satisfaction with contralateral prophylactic mastectomy among young women with breast cancer: a cross-sectional survey. *Ann Intern Med.*;159(6):373–81.
 37. Hernanz F, Regano S, Redondo-Figuero C, Orallo V, Erasun F, Gomez Fleitas M. Oncoplastic breast-conserving surgery: analysis of quadrantectomy and immediate reconstruction with latissimus dorsi flap. *World J Surg.* 2007;31:1934–40.
 38. Denewer A, Setit A, Hussein O, Farouk O. Skin-sparing mastectomy with immediate breast reconstruction by a new modification of extended latissimus dorsi myocutaneous flap. *World J Surg.* 2008;32:2586–92.
 39. Gerber B, Krause A, Dieterich M, Kundt G, Reimer T. The oncological safety of skin sparing mastectomy with conservation of the nipple-areola complex and autologous reconstruction: an extended follow-up study. *Ann Surg.* 2009;249(3):461–8.