Ann Surg Oncol (2019) 26:4372–4380
https://doi.org/10.1245/s10434-019-07912-9

Annals of
SURGICAL ONCOLOGY
OFFICIAL JOURNAL OF THE SOCIETY OF SURGICAL ONCOLOGY

ORIGINAL ARTICLE – BREAST ONCOLOGY

An In-Visit Decision Aid for Surgeons to Address Decision Making for Bilateral Mastectomy for Newly Diagnosed Breast Cancer Patients

Katharine Yao, MD[1,6], Jeff Belkora, PhD[2], Clara Lee, MD[3], Kristine Kuchta, MS[4], Catherine Pesce, MD[1,6], Katherine Kopkash, MD[1,6], Sarah Rabbitt, RN[1], Ermilo Barrera, MD[1,6], Sandra Simovic, BS[1], and Karen Sepucha, PhD[5]

[1]Division of Surgical Oncology, Department of Surgery, NorthShore University HealthSystem, Evanston, IL; [2]University of California San Francisco School of Medicine, San Francisco, CA; [3]Division of Plastic Surgery, Department of Surgery, Ohio State University Medical Center, Columbus, OH; [4]Biostatistical Core, NorthShore University HealthSystem Research Institute, Evanston, IL; [5]Health Decision Sciences Center, Massachusetts General Hospital, Boston, MA; [6]Pritzker School of Medicine, University of Chicago, Evanston, IL

ABSTRACT

Background. Few decision aids for newly diagnosed breast cancer patients are used by surgeons during their consultations with patients.

Methods. From 2017 to 2019, an online interactive breast cancer in-visit decision aid (BIDA) was used on 63 patients and 57 patients underwent usual care (UC). We compared knowledge, decision involvement, anxiety and distress (HADS scale), quality of life (PROMIS), fear of recurrence, body image, and patient values between BIDA and UC before surgery. A knowledge score of $\geq$ 57% was considered "high knowledge."

Results. A total of 188 patients were enrolled of which 120 (63.8%) completed all study procedures. Patient demographic characteristics and anxiety and quality of life (QOL) at baseline were similar between patients in BIDA and UC cohorts. After seeing the surgeon, patients in the BIDA group had higher composite knowledge scores compared with UC patients [n = 55 (87.3%) vs. n = 39 (68.4%) respectively, p = 0.012]. Patients in the BIDA cohort reported being asked more often their surgical preference (p = 0.013) and discussing bilateral mastectomy (BM) as an option (p = 0.048). There was a trend of less patients in the BIDA cohort undergoing BM then in the UC cohort [10 (15.9%) vs. 14 (24.6%), p = 0.49]. Anxiety and distress, QOL, fear of recurrence, and body image were not significantly different between BIDA and UC cohorts.

Conclusions. A decision aid used by surgeons during their consultation was associated with higher knowledge levels, patients reporting more discussion about BM, and a trend of lower BMs. A larger study with more patients is needed to confirm this finding.

The increase in bilateral mastectomy (BM) for newly diagnosed breast cancer patients is well documented.[1–4] This increase in BM is primarily patient driven. Most guidelines do not recommend BM in the majority of patients [those at average risk of contralateral breast cancer (CBC)].[5–8] Many surgeons report they do not initiate discussions about BM with patients or feel uncomfortable performing BM.[9,10] These reasons all underscore the need for decision aids to help surgeons and patients with surgical decisions. Decision aids facilitate shared decision making by increasing patient knowledge and involvement in decisions, decreasing decisional conflict and improving patient decisional satisfaction.[11]

Electronic supplementary material The online version of this article (https://doi.org/10.1245/s10434-019-07912-9) contains supplementary material, which is available to authorized users.

First Received: 25 July 2019;
Published Online: 17 October 2019

K. Yao, MD
e-mail: kyao@northshore.org

Most decision interventions for breast cancer surgery occur outside the physician consultation, but surgeon recommendations can have a tremendous influence on surgical decisions.[12–14] A recent decision intervention for patients with early-stage breast cancer showed good concordance between computer suggested and stated treatment preference but was conducted outside the physician visit.[15] An in-visit decision intervention used in a randomized trial in Canada improved patient decisional satisfaction and resulted in more BCS choices.[16] However, this study was published before the increased trend in BM occurred and did not address decisions for BM.

We have developed and pilot tested a breast in-visit decision aid called BIDA designed for delivery at the point of care with the surgeon and patient that directly addresses BM decision making (http://www.mayobreastcancerda.takethewind.com).[17] BIDA follows the SCOPED framework.[18,19] SCOPED—Situation, Choice, Outcomes, People, Evaluate, Decide—is a decision support framework that takes patients stepwise through the decision-making process. BIDA was developed by a multidisciplinary team and conforms to decision aid quality criteria set forth by the International Patient Decision Aids Standards (IPDAS) Collaboration.[20] BM is presented as a surgical choice along with BCS and UM. Our pilot data showed that BIDA significantly increased patient knowledge of CBC risk and the impact of BM on overall outcomes.[17] However, other patient reported outcomes, such as patient decision making, anxiety, and quality of life, were not included in this study.

Since this pilot study, we have modified BIDA's content to include data on the impact of BM on not only cancer outcomes but physical outcomes as well, such as sensation, second surgeries, and breast appearance, to support value-based decision making. More information was added on CBC and local recurrence risk. The objective of this study was to measure the impact of this newly modified decision intervention (BIDA) on not only patient knowledge but how BIDA influenced patient preferences and involvement in surgical decision making. We also examined patient reported outcomes of quality of life, fear of recurrence, body image, and anxiety between BIDA and usual care (UC) and how patient values differed between different surgical procedures.

METHODS

Study Design

This was a longitudinal, prospective study of newly diagnosed unilateral breast cancer patients with AJCC Stage 0-III disease approved by our Institutional Review Board. Patients were recruited in a sequential fashion from five breast surgeon clinics at one institution and consented to participate in the study before seeing the surgeon. Two surgeons with previous decision aid experience were assigned to BIDA and three surgeons to UC. The rationale for this selection was to see if there were differences between highly motivated surgeons compared with UC. Surveys were administered before seeing the surgeon but after consenting to the study, immediately after seeing the surgeon, and before surgery but after the patient had made their surgical decision.

Breast In-Visit Decision Aid

Breast In-Visit Decision Aid (BIDA) is an online interactive decision (Appendix: Supplementary Material) described previously.[17–19] Surgeons were required to listen to an instructional video about BIDA before using it with patients. BIDA was first developed and piloted on 211 patients as previously described.[17] Since this study, we added the following components to BIDA based on patient feedback: information on the impact of different surgical procedures on quality of life, second surgeries, sensation to the chest wall, breast appearance, and updated local recurrence and more specific CBC risk information. We also included questions that asked patients how important certain factors were to their surgical decision, how important was it to: "keep your breast"; "reduce the risk of cancer in the other breast"; "avoid future mammograms and biopsies"; "remove the breast for peace of mind"; and "have both breasts look the same." [21] This updated version of BIDA was then used on approximately 25 patients for feasibility of the online tool prior to enrolling into the current study.

Patient-Reported Outcomes

A survey measuring patient preference for surgery, overall anxiety (LASA scale), and quality of life (QOL) (PROMIS) was administered to patients before they saw the surgeon.[22,23] Before surgery, the following patient-reported outcomes were collected: decision-making involvement, patient values (ad hoc questionnaire), QOL (PROMIS), overall anxiety (LASA scale), hospital distress and anxiety scale (HADS scale), body image (BREAST-Q), and fear of recurrence (Fear of Recurrence scale).[22–28] All surveys were administered on paper and entered into a REDCap database by a research coordinator.

Patient Knowledge

A survey measuring patient knowledge was administered to patients directly after seeing the surgeon. This survey included nine items pertaining to survival outcomes,

TABLE 1 Demographic factors of the decision aid and usual care cohorts

	Total *N* (%)	BIDA *N* (%)	Usual care *N* (%)	*p* value
Total patients	120	63 (52.5)	57 (47.5)	–
Age, years [mean ± SD]	56.4 ± 9.2	56.5 ± 9.3	56.3 ± 9.1	0.912
BMI [mean ± SD]	28.1 ± 6.0	27.9 ± 5.6	28.3 ± 6.5	0.751
Marital status				0.641
Single/divorced/widowed	29 (24.2)	15 (23.8)	14 (24.6)	
Married	89 (74.2)	46 (73.0)	43 (75.4)	
Unknown	2 (1.7)	2 (3.2)	0 (0.0)	
Race				0.690
Caucasian	110 (91.7)	57 (90.5)	53 (93.0)	
Black	3 (2.5)	2 (3.2)	1 (1.8)	
API	5 (4.2)	2 (3.2)	3 (5.3)	
Other	2 (1.7)	2 (3.2)	0 (0.0)	
Hispanic/latino				0.369
No	114 (95.0)	58 (92.1)	56 (98.3)	
Yes	2 (1.7)	2 (3.2)	0 (0.0)	
Unknown	4 (3.3)	3 (4.8)	1 (1.8)	
Education				0.730
HS diploma/some college	25 (20.8)	12 (19.1)	13 (22.8)	
Bachelor's degree	54 (45.0)	30 (47.6)	24 (42.1)	
Graduate school	37 (30.8)	18 (28.6)	19 (33.3)	
Unknown	4 (3.3)	3 (4.8)	1 (1.8)	
Income				0.881
< 50 K	16 (13.3)	10 (15.9)	6 (10.5)	
50–99 K	30 (25.0)	15 (23.8)	15 (26.3)	
100–199 K	33 (27.5)	18 (28.6)	15 (26.3)	
≥ 200 K	32 (26.7)	15 (23.8)	17 (29.8)	
Unknown	9 (7.5)	5 (7.9)	4 (7.0)	
Family history				0.370
No	55 (45.8)	28 (44.4)	27 (47.4)	
Yes	62 (41.7)	32 (50.8)	30 (52.6)	
Unknown	3 (2.5)	3 (4.8)	0 (0.0)	
Clinical stage				0.381
0	18 (15.0)	11 (17.5)	7 (12.3)	
1	75 (62.5)	42 (66.7)	33 (57.9)	
2	12 (10.0)	5 (7.9)	7 (12.3)	
3	1 (0.8)	0 (0.0)	1 (1.8)	
Unknown	14 (11.7)	5 (7.9)	9 (15.8)	

impact of BM on outcomes, contralateral breast cancer risk, surgical complications, sensation, and need to additional operative procedures (Appendix: Supplementary Material) based on previous work.[17]

Statistical Analysis

We compared patient demographics, surgery type, and patient reported outcomes between the BIDA and UC cohorts. Continuous data were compared using the independent *t* test or the Wilcoxon rank-sum test. Categorical data were assessed using Chi square or Fisher's exact tests.

Patient knowledge was compared between the two cohorts whereupon a score of five or greater correct answers (56%) was considered "high knowledge" and a score of four or less correct answers (44%) was considered "low knowledge." We chose a threshold of 50% as "high" knowledge as other decision aid studies have done.[29] Patient values/concerns were compared between BIDA and UC cohorts and also stratified by procedure type: BCS,

UM, and BM, using Chi square, Fisher's exact, Wilcoxon rank-sum, and Kruskal–Wallis tests. Post-hoc multiple comparisons for the Kruskal–Wallis test were computed using the Dwass, Steel, Critchlow–Flinger method. Anxiety and quality of life were compared over time using the paired *t* test. All tests were two-tailed with a significance level of 0.05. All statistical analysis was performed using SAS 9.3 (SAS Institute, Cary, NC).

RESULTS

Study Procedures

From January 2017 to May 2018, 233 eligible patients were approached, of which 188 (80.7%) enrolled into the study. Thirty-one patients did not return all the surveys and were excluded from the study. Twenty-six patients were included in a feasibility-only study, and their data were not included in this analysis. Surveys and operations are still pending on 11 patients. This left 120 patients of which 63 (52.5%) were enrolled into BIDA and 57 (47.5%) into UC.

Baseline Demographic and Surgical Characteristics

There were no significant differences in any of the demographic factors between the two cohorts with the exception of the use of MRI (Table 1). Overall, 46 (73.0%) patients in the BIDA cohort underwent BCS compared with 37 (64.9%) patients in the UC cohort; 7 (11.1%) and 6 (10.5%) underwent UM, and 10 (15.9%) and 14 (24.6%) underwent BM ($p = 0.491$).

Baseline Patient Surgery Preference, Anxiety, Quality of Life

Baseline patient overall anxiety (6.4 ± 2.5 vs. 6.4 ± 2.6, $p = 0.903$) and quality of life (7.3 ± 2.2 vs. 7.4 ± 2.3, $p = 0.659$) were no different between BIDA and UC cohorts. All patients were asked their surgery preference; overall 48 (40.0%) stated they wanted BCS, 3 (2.5%) UM, 8 (6.7%) BM, and 61 (50.8%) were "not sure, awaiting surgeon recommendation." There was no significant difference in patient preference between BIDA and UC cohorts ($p = 0.967$).

Patient Knowledge Immediately After Seeing the Surgeon

Patient responses to nine knowledge questions are listed in Table 2. Fifty-five (87.3%) and 39 (68.4%) patients in the BIDA cohort and UC cohorts respectively had "high knowledge" ($p = 0.012$). Eight of the 55 (14.6%) BIDA patients with high knowledge had BM compared with 12 of the 39 (30.8%; $p = 0.058$) UC patients with high knowledge.

Patient Decision-Making Involvement and Surgeon Recommendation before Surgery

Before surgery, patients were asked about their involvement in the decision-making process for their surgery (Table 3). Patients in the BIDA cohort reported more often being asked by the surgeon which surgery they preferred, discussing BM as an option, discussing CBC risk

TABLE 2 Patient knowledge about impact of surgery on cancer and physical outcomes

	BIDA *N* (%)	Usual care *N* (%)	*p* value
1. On average, which women with early stage breast cancer live longer?	56 (88.9)	41 (71.9)	**0.018**
2. With treatment, about how many women diagnosed with early breast cancer will eventually die of breast cancer?	50 (79.4)	38 (66.7)	0.116
3. Who has the highest chance of breast cancer coming back somewhere in the body (not including either breast)?	50 (79.4)	38 (66.7)	0.116
4. For women with cancer in one breast, how does having a double mastectomy change the chance of breast cancer coming back elsewhere in the body (not including either breast)?	55 (87.3)	36 (53.2)	**0.002**
5. If 100 women have cancer in one breast, about how many will develop cancer in the healthy breast in the 5 years after treatment?	40 (63.5)	16 (28.1)	< **0.001**
6. Mastecomy surgery can result in complications such as infection and unplanned additional surgeries. On average, which women have a higher chance of complications from surgery?	24 (38.1)	13 (22.8)	0.070
7. Some women lose sensation in the breast after breast surgery, which procedure is associated with the greatest loss of sensation?	49 (77.8)	30 (52.6)	**0.004**
8. Most women who undergo single or double mastectomy with reconstruction will need at least one more procedure in addition to the original procedure to complete their reconstruction	56 (88.9)	31 (54.4)	< **0.001**
9. Women who undergo a lumpectomy never have to go back to the operating room for a subsequent procedure	50 (79.4)	45 (79.0)	0.955

Bold values indicate statistically significant

TABLE 3 Patient reports of decision making involvement

	BIDA	Usual care	*p* value
How confident are you that your decision about surgery is the right one for you?			0.629
Very confident	56 (88.9)	49 (86.0)	
Somewhat confident	7 (11.1)	8 (14.0)	
Did any of your doctors ask you which type of surgery you preferred?			**0.013**
No	2 (3.2)	10 (17.5)	
Yes	60 (95.2)	47 (82.5)	
Unknown	1 (1.6)	0 (0.0)	
How much did you and your doctors talk about how you felt about keeping or losing your breasts?			0.335
A lot/some	53 (84.1)	44 (77.2)	
Not at all	10 (15.9)	13 (22.8)	
Did any of your doctors discuss double mastectomy as an option for you?			**0.048**
No	24 (38.1)	32 (56.1)	
Yes	39 (61.9)	25 (43.9)	
How much did you and your doctors discuss your concerns about the chance of having cancer in the other, contralateral breast?			**0.009**
A lot/some	55 (87.3)	43 (75.4)	
Not at all	5 (7.9)	14 (24.6)	
Unknown	3 (4.8)	0 (0.0)	
How much did you and your doctors discuss any concerns or feelings that you had about having the cancer come back in other parts of your body?			**0.044**
A lot/some	53 (84.1)	43 (75.4)	
Not at all	7 (11.1)	14 (24.6)	
Unknown	3 (4.8)	0 (0.0)	
In making your decision about surgery, was it made			**0.038**
Mainly your own	18 (28.6)	8 (14.0)	
Shared between you and your doctor	41 (65.1)	46 (80.7)	
Mainly your doctor	1 (1.6)	3 (5.3)	
Unknown	3 (4.8)	0 (0.0)	
How informed do you feel about the various types of surgery for breast cancer?			0.153
Very informed	53 (84.1)	46 (80.7)	
Somewhat informed	7 (11.1)	9 (15.8)	
Minimally informed	0 (0.0)	2 (3.5)	
Unknown	3 (4.8)	0 (0.0)	

Bold values indicate statistically significant

and distant recurrence risk, and making their decision about surgery on their own. There was no significant difference in patient confidence about their decision or how well-informed patients felt about different procedures between the BIDA and UC cohorts. In 46 (74.2%) of BIDA patients and 53 (93.0%) of UC patients, surgeons made a recommendation for surgery. In the entire group, BCS was recommended in 87 of these 99 patients (87.9%), UM was recommended in 11 (11.1%) and BM was recommended in 1 patient (1.0%). There was no significant difference in surgeon recommendations between BIDA and UC.

Patient Values/Concerns and Surgical Choices before Surgery

Patients were asked about how important certain values and concerns were in making their surgical decision. There were no significant differences in how patients rated these factors between BIDA and UC cohorts (all $p > 0.10$). When these values and concerns were stratified by surgical procedure, patients undergoing BM rated "removing the breast for peace of mind," "decreasing contralateral breast cancer risk," "cosmesis," "avoiding

TABLE 4 Patient values/concerns stratified by surgery type

	BCS Mean ± SD	UM Mean ± SD	BM Mean ± SD	*p* value
How important were each of the following to you as you were thinking about what type of surgery to have: (0 = Not important at all to 10 = Extremely important)				
Reduce chance of having cancer in the other breast	6.2 ± 3.3	6.4 ± 3.7	9.7 ± 0.9	< **0.001**[a,b]
Avoid multiple surgeries	7.2 ± 2.8	7.5 ± 2.5	8.6 ± 1.9	0.069
Doctor recommendation	8.8 ± 1.7	9.1 ± 1.0	8.2 ± 1.8	0.262
Remove your breast to gain peace of mind	2.7 ± 2.7	7.2 ± 3.5	9.7 ± 0.7	< **0.001**[a,c]
Desire to have both breasts look the same after surgery	5.1 ± 3.8	6.5 ± 2.7	8.4 ± 2.3	**0.004**[a,b]
Avoid future mammograms	1.4 ± 2.8	1.4 ± 1.9	5.9 ± 4.1	< **0.001**[a,b]
Avoid possible future biopsies	2.5 ± 3.3	3.3 ± 3.5	7.4 ± 3.7	< **0.001**[a,b]
Improve or extend my overall survival	8.9 ± 2.5	8.9 ± 2.8	9.9 ± 0.5	0.116
My family history	6.0 ± 4.0	6.6 ± 3.9	7.1 ± 3.2	0.536
Friend's or family's advice	3.9 ± 3.5	6.5 ± 2.0	6.1 ± 3.4	**0.003**[a,c]
Keep my breast	7.5 ± 2.9	4.7 ± 3.0	2.7 ± 2.3	< **0.001**[a,c]
Have the fastest recovery	7.3 ± 3.2	6.7 ± 4.0	5.5 ± 2.9	**0.036**[a]

[a]BCS versus BM $p < 0.05$

[b]UM versus BM $p < 0.05$

[c]BCS versus UM $p < 0.05$

future mammograms," "avoiding future biopsies," "family or friend's advice" higher then patients undergoing BCS (Table 4). BCS patients rated "keeping the breast" and "having the fastest recovery" higher than patients undergoing BM.

Patient Reported Outcomes Before Surgery

There were no significant differences in patient reported outcomes of QOL and anxiety at baseline between the BIDA and UC cohorts (Table 5) before surgery. Overall, QOL improved from before to after the surgeon consultation for questions about physical (7.3 ± 1.9 vs. 7.7 ± 1.7, $p = 0.005$) and emotional (6.7 ± 2.3 vs. 7.1 ± 2.2, $p = 0.042$) well-being. Anxiety also improved from before to after seeing the surgeon (6.4 ± 2.6 vs. 5.2 ± 2.4, $p < 0.001$). The amount of improvement was no different between the BIDA and UC cohorts ($p = 0.787$, $p = 0.295$, and $p = 0.453$ respectively).

DISCUSSION

Our prospective study of newly diagnosed breast cancer patients has shown surgeons can use a decision aid during their consultations with patients to increase patient knowledge and involvement in surgical decision making. More patients reported being asked about their surgical preferences and discussing BM as an option in the BIDA cohort than UC. There was a trend of a lower proportion of patients actually undergoing BM (24.6% vs. 15.9%) in the BIDA group, but it was not statistically significant. Likewise, patients with high knowledge were less likely to undergo BM if exposed to BIDA but again not significant. More patients are needed to confirm these findings. Other patient reported outcomes of QOL, anxiety, body image, and fear of recurrence were not significantly different between the BIDA and UC cohorts. However, these patient reported outcomes were only assessed before surgery, and we are in the process of measuring these same outcomes at 1 year from surgery.

Due to the small number of surgeons, it is not clear whether our findings are due to highly motivated surgeons willing to use a decision aid or the decision aid itself. A larger study with more surgeons is needed to decrease the confounding effect of surgeons. Nonetheless, surgeon recommendations can have tremendous influence on patient choices and behavior. A recent study showed that the rate of BM was significantly higher if the surgeon made no recommendation for or against BM compared with a surgeon making a recommendation against BM.[12] However, surgeons do not always make a recommendation for surgery, and some surgeons report discomfort performing BM.[9,13] Although most of the guidelines agree that BM should not be recommended for those with average CBC risk breast cancer, it is not clear whether there are other scenarios where BM should be recommended.[5–8] All of these findings underscore the important role that surgeons play in patient decision making. Future decision

TABLE 5 Patient reported outcomes of quality of life, body image/psychosocial well being, anxiety and fear of recurrence between BIDA and usual care

	BIDA Mean ± SD	Usual care Mean ± SD	*p* value
How would you describe: (0 = as bad as it can be to 10 = as good as it can be)			
Your overall quality of life?	7.7 ± 2.1	7.7 ± 1.8	0.883
Your overall mental (intellectual) well being?	7.6 ± 2.0	7.7 ± 1.9	0.567
Your overall physical well-being?	7.9 ± 1.7	7.6 ± 1.6	0.258
Your overall emotional well-being?	6.9 ± 2.1	7.3 ± 2.2	0.276
Your overall spiritual well-being?	7.7 ± 2.0	8.0 ± 2.1	0.307
How would you describe your level of anxiety? (0 = no anxiety to 10 = as bad as it can be)	5.5 ± 2.3	4.9 ± 2.4	0.188
The next set of questions ask about your anxiety and worry: (0 = not at all to 3 = Very Often)			
I feel tense or 'wound up'	1.3 ± 0.7	1.3 ± 0.8	0.903
I get a sort of frightened feeling as if something awful is about to happen	1.1 ± 0.9	1.3 ± 1.0	0.504
Worrying thoughts go through my mind	1.2 ± 0.9	1.2 ± 1.0	0.919
I get a sort of frightened feeling like 'butterflies' in the stomach	0.8 ± 0.8	0.9 ± 0.9	0.635
I feel restless as if I have to be on the move	1.0 ± 0.8	1.0 ± 0.9	0.905
I get sudden feelings of panic	0.7 ± 0.8	0.7 ± 0.9	0.798
I can sit at ease and feel relaxed	1.0 ± 0.7	1.0 ± 0.8	0.503
HADS-A Total (0–21)	7.1 ± 4.7	7.3 ± 5.1	0.956
With your breast area in mind, in the past 2 weeks, how often have you felt: (1 = none of the time to 5 = all of the time)			
Confident in a social setting	4.3 ± 0.8	4.2 ± 0.9	0.650
Emotionally able to do the things that you want to do	4.1 ± 1.0	4.3 ± 0.8	0.412
Emotionally healthy	4.0 ± 1.0	4.1 ± 0.9	0.715
Of equal worth to other women	4.5 ± 0.8	4.6 ± 0.7	0.278
Self-confident	4.2 ± 0.9	4.3 ± 0.8	0.923
Feminine in your clothes	4.3 ± 1.0	4.2 ± 0.8	0.321
Accepting of your body	4.1 ± 1.1	3.8 ± 1.1	0.152
Normal	4.0 ± 1.1	4.1 ± 1.0	0.964
Like other women	4.1 ± 1.1	4.2 ± 0.8	0.852
Attractive	4.0 ± 1.1	3.8 ± 0.9	0.120
Listed below are a number of statements concerning cancer patients' beliefs about having had cancer: (1 = strongly Disagree to 5 = strongly agree)			
Because cancer is unpredictable, I feel I cannot plan for the future	2.1 ± 1.0	2.0 ± 0.9	0.606
I will probably have a cancer recurrence in the next 5 years	2.2 ± 0.8	2.1 ± 0.9	0.794
My fear of my cancer coming back gets in the way of my enjoying life	1.9 ± 0.9	1.8 ± 1.0	0.459
I am afraid of my cancer coming back	3.0 ± 1.1	3.1 ± 1.3	0.763
Total score (4–20)	9.1 ± 2.6	9.0 ± 3.3	0.617

interventions that directly involve and impact the surgeon, such as an in-visit intervention may have greater impact on patient's decisions then interventions that do not involve the surgeon. Many decision aids are not administered by surgeons but occur outside the physician visit. At the same time, it may be difficult to get surgeons to adopt an in-visit decision intervention because of time constraints. Perhaps BIDA could be used in the future as a training tool to improve decision-making quality for surgeons. BIDA could be used for a limited time period, and then its impact on patient outcomes could be examined after the training period.

Knowledge levels in this study were significantly higher in both groups than in our previous study. This finding may be due to increased information presented to patients in the current version of BIDA or possibly physicians providing more information on their own. BIDA does contain information addressed in the knowledge questions. However, the knowledge questions were adopted from previous

studies that addressed common patient knowledge deficits on numerous breast cancer patients.[21,24,30] BIDA is designed to fill these knowledge gaps so patients can make truly informed decisions. Interestingly, although BIDA was associated with 18% higher overall composite knowledge score then the UC, patients reported they were equally informed in both BIDA and UC. There may be a discrepancy in what patients consider "well informed" versus what the knowledge questions assess. Patients reported more discussion about CBC risk and the impact of BM on distant recurrence risk in the BIDA group compared with the UC cohort, and likewise they answered questions about these topics more accurately in BIDA than UC. CBC risk is an important outcome to patients and worthwhile to discuss with patients on a regular basis. Patients often overestimate their CBC risks underscoring the need for physicians to clarify their CBC risk.[31]

Other patient reported outcomes of QOL, patient anxiety, worry, and fear of recurrence were not different between BIDA and UC. Because these outcomes were collected before surgery and within a relatively short timeframe, it is not surprising that BIDA would not impact them. We also assessed patient values to better understand their role in a patient's decision to undergo or not undergo BM. Patients undergoing BM were more concerned about CBC risk, cosmesis, avoiding future biopsies, and family and friend's advice than BCS patients. Interestingly, desire to improve survival was equal across all three surgical groups demonstrating concern for survival outcome will not discriminate surgical procedure choices. Therefore, any decision intervention must inform patient of other outcomes besides just survival outcomes to fully inform patients about their choices.

Our study has limitations. With a small number of surgeons participating from one institution and even smaller numbers using BIDA, our findings may be due to confounding and clustering by surgeon. A larger study with more surgeons to avoid clustering and surgeon bias is needed to validate our findings. There are many patient values or concerns that we did not include in our tool, such as preserving sexuality and the importance of keeping the nipple. Our findings may not be generalizable, because our patient population was predominantly white, affluent, and highly educated.

Our study has shown the important role that surgeons can play in patient knowledge and involvement in decision making, which are important aspects of a high-quality decision. Future decision interventions for breast cancer surgery should directly involve the surgeons in the decision-making process instead of putting the intervention outside the surgeon visit. We have also shown the importance of value-based decision making for surgical decisions and would advocate that patient-reported outcomes should be included in all decision interventions for breast cancer surgery.

ACKNOWLEDGEMENT None to report.

DISCLOSURES The authors declare no conflicts of interest and no disclosures.

REFERENCES

1. Kummerow KL, Du L, Penson DF, Shyr Y, Hooks MA. Nationwide trends in mastectomy for early-stage breast cancer. *JAMA Surg.* 2015;150(1):9–16.
2. 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.
3. Tuttle TM, Jarosek S, Habermann EB, et al. Increasing rates of contralateral prophylactic mastectomy among patients with ductal carcinoma in situ. *J Clin Oncol.* 2009;27(9):1362–7.
4. 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.
5. NCCN guidelines. 2019; Availabel at: https://www.nccn.org. Accessed July 2019.
6. Boughey JC, Attai DJ, Chen SL, et al. Contralateral Prophylactic Mastectomy (CPM) consensus statement from the American Society of Breast Surgeons: data on CPM outcomes and risks. *Ann Surg Oncol.* 2016;23(10):3100–5.
7. Boughey JC, Attai DJ, Chen SL, et al. Contralateral Prophylactic Mastectomy Consensus Statement from the American Society of Breast Surgeons: additional considerations and a framework for shared decision making. *Ann Surg Oncol.* 2016;23(10):3106–11.
8. Choosing Wisely: Promoting Conversations between Patients and Clinicians. 2019; www.choosingwisely.org. Accessed July 2019.
9. Bellavance E, Peppercorn J, Kronsberg S, et al. Surgeons' perspectives of contralateral prophylactic mastectomy. *Ann Surg Oncol.* 2016. 23(9):2779–87.
10. Musiello T, Bornhammar E, Saunders C. Breast surgeons' perceptions and attitudes towards contralateral prophylactic mastectomy. *ANZ J Surg.* 2013;83(7–8):527–32.
11. Stacey D, Legare F, Lewis K, et al. Decision aids for people facing health treatment or screening decisions. Cochrane Database Syst Rev. 2017;4:CD001431.
12. Jagsi R, Hawley ST, Griffith KA, et al. Contralateral prophylactic mastectomy decisions in a population-based sample of patients with early-stage breast cancer. *JAMA Surg.* 2017;152(3):274–82.
13. Katz SJ, Janz NK, Abrahamse P, et al. Patient reactions to surgeon recommendations about contralateral prophylactic mastectomy for treatment of breast cancer. *JAMA Surg.* 2017;152(7):658–64.
14. Katz SJ, Hawley ST, Hamilton AS, et al. Surgeon influence on variation in receipt of contralateral prophylactic mastectomy for women with breast cancer. *JAMA Surg.* 2018;153(1):29–36.
15. Hawley ST, Newman L, Griggs JJ, Kosir MA, Katz SJ. Evaluating a decision aid for improving decision making in patients with early-stage breast cancer. *Patient.* 2016;9(2):161–9.
16. Whelan T, Levine M, Willan A, et al. Effect of a decision aid on knowledge and treatment decision making for breast cancer surgery: a randomized trial. *JAMA.* 2004;292(4):435–41.

17. Yao K, Belkora J, Bedrosian I, et al. Impact of an in-visit decision aid on patient knowledge about contralateral prophylactic mastectomy: a pilot study. *Ann Surg Oncol.* 2017;24:91–9.
18. Belkora J. 2016; www.scoped.com. Accessed July 2019.
19. Belkora JK, Loth MK, Volz S, Rugo HS. Implementing decision and communication aids to facilitate patient-centered care in breast cancer: a case study. *Patient Educ Couns.* 2009;77(3):360–8.
20. Joseph-Williams N, Newcombe R, Politi M, et al. Toward minimum standards for certifying patient decision aids: a modified delphi consensus process. *Med Decis Mak.* 2013;34(6):699–710.
21. Collins ED, Moore CP, Clay KF, et al. Can women with early-stage breast cancer make an informed decision for mastectomy? *J Clin Oncol.* 2009;27(4):519–25.
22. Bretscher M, Rummans T, Sloan J, et al. Quality of life in hospice patients. A pilot study. *Psychosomatics.* 1999;40(4):309–13.
23. Cella D, Riley W, Stone A, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *J Clin Epidemiol.* 2010;63(11):1179–94.
24. Sepucha KR, Belkora JK, Chang Y, et al. Measuring decision quality: psychometric evaluation of a new instrument for breast cancer surgery. *BMC Med Inform Decis Mak.* 2012;12:51.
25. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand.* 1983;67(6):361–70.
26. 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(2):345–53.
27. Kornblith AB, Powell M, Regan MM, et al. Long-term psychosocial adjustment of older vs younger survivors of breast and endometrial cancer. *Psychooncology.* 2007;16(10):895–903.
28. Greenberg DB, Kornblith AB, Herndon JE, et al. Quality of life for adult leukemia survivors treated on clinical trials of Cancer and Leukemia Group B during the period 1971–1988: predictors for later psychologic distress. *Cancer.* 1997;80(10):1936–44.
29. Hersch J, Barratt A, Jansen J, et al. Use of a decision aid including information on overdetection to support informed choice about breast cancer screening: a randomised controlled trial. *Lancet.* 2015;385(9978):1642–52.
30. Sepucha K, Ozanne E, Silvia K, Partridge A, Mulley AG Jr. An approach to measuring the quality of breast cancer decisions. *Patient Educ Couns.* 2007;65(2):261–9.
31. Abbott A, Rueth N, Pappas-Varco S, Kuntz K, Kerr E, Tuttle T. Perceptions of contralateral breast cancer: an overestimation of risk. *Ann Surg Oncol.* 2011;18(11):3129–36.