HHS Public Access

Author manuscript

Plast Reconstr Surg. Author manuscript; available in PMC 2020 August 01.

Published in final edited form as:

Plast Reconstr Surg. 2019 August ; 144(2): 303–313. doi:10.1097/PRS.0000000000005803.

Patterns and Correlates of Knowledge, Communication, and Receipt of Breast Reconstruction in a Modern Population-Based Cohort of Patients with Breast Cancer

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Abstract

Background: Disparities persist in the receipt of breast reconstruction after mastectomy and little is known about the nature of communication received by patients and potential variations that may exist.

Methods: Women with early stage breast cancer (stages 0-II) diagnosed between July 2013 and September 2014 were identified through the Georgia and Los Angeles SEER registries and surveyed to collect additional data on demographics, treatment and decision-making experiences. Treating general/oncologic surgeons were also surveyed. Primary outcomes measures included self-reported communication-related measures on receipt of information on breast reconstruction and on the receipt of breast reconstruction.

Results: We analyzed 936 women who underwent mastectomy for unilateral breast cancer. 484 (51.7%) underwent mastectomy with reconstruction. Women who were older and for whom English was not their primary spoken language had lower odds of being informed by a doctor about breast reconstruction. Ultimately, women who were older, were Asian, had invasive disease, had bronchitis/emphysema, and had lower income were less likely to undergo breast reconstruction. Breast reconstruction was performed more often in patients undergoing bilateral

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mastectomies (OR, 3.27; 95% CI, 2.26–4.75). Women cared for by surgeons with higher volumes of breast cancer patients (51+ patients per year) were more likely to undergo breast reconstruction (OR 2.43, 95% CI 1.40–4.20).

Conclusions: To eliminate existing disparities, increased efforts should be made in consultations for surgical management of breast cancer to provide information to all patients regarding the option of breast reconstruction, the possibility of immediate reconstruction, and insurance coverage of all stages of reconstruction.

INTRODUCTION

The use of post-mastectomy breast reconstruction in the United States has increased in recent years. In the late 1990s, concerns existed regarding low reconstruction rates with a report of reconstruction in less than 20% of eligible patients (1). A decade after the passing of the 1998 Women's Health and Cancer Rights Act (WHCRA), breast reconstruction rates increased by 17% (2), suggesting some effectiveness of the legislation mandating insurance coverage for reconstruction.

An appreciation of the benefits of breast reconstruction in women undergoing mastectomy has been pivotal in garnering improved acceptance amongst physicians and patients. These benefits include improvements in satisfaction with breast, body image, psychosocial well-being, sexual well-being and overall quality of life (6–8). Unfortunately, disparities in the receipt of breast reconstruction have been documented, with notable variations based on geography, income, insurance type, age and race (9–13). A potential reason for variations in post-mastectomy reconstruction centers on the initial physician-patient discussion (14). There is limited data in the surgical literature investigating the nature of communication with patients regarding breast reconstruction and whether such communication may be less robust in patients who have been historically under-represented amongst those receiving reconstruction following mastectomy.

Thus, the purpose of this study was to evaluate the patterns and correlates of receipt of information about breast reconstruction, along with immediate reconstruction rates in a diverse modern cohort of women with breast cancer. Specifically, we focus on understanding patterns of communication about breast reconstruction in the hopes of guiding future efforts to improve the equitable provision of information so that all breast cancer patients may consider the meaningful intervention of reconstruction after mastectomy.

METHODS

Study Population

After IRB approval, women with early stage breast cancer (stages 0 to II) reported to the Georgia and Los Angeles County Surveillance, Epidemiology, and End Results (SEER) registries between July 2013 and September 2014 were identified as a part of the previously described Individualized Cancer Care Study (15). Women were ineligible if they had Stage III or IV disease, their tumors were larger than 5cm, if they had 4 or more positive lymph nodes or could not complete a questionnaire in Spanish or English. As previously described, women were identified by rapid case ascertainment of their initial surgical pathology reports,

obtained from a list of definitive surgical procedures performed with the goal of excising the tumor in its entirety while achieving clear margins (16).

Surveys were sent by mail to eligible patients on average two months after the tumor resection and the median (SD) time from diagnosis to survey completion was 6.4 (3.0) months. A $20 cash incentive was provided to encourage response and a modified Dillman approach to recruitment was employed, which included reminders to non-responders (17). As detailed in the supplementary figure (See Figure, Supplemental Digital Content 1, which shows a diagram of the flow of patients into the study. Individualized Cancer Care study participants (N=936), INSERT HYPER LINK), 3,880 women were identified and mailed surveys. We selected 3880 of whom 249 women were later deemed ineligible due to having a prior cancer diagnosis or stage III or IV disease; residing outside the SEER registry area; being deceased, too ill or unable to complete a survey in Spanish or English. Of 3631 eligible women remaining, 1053 did not return mailed surveys, refused to participate or were lost to follow-up. Nine hundred thirty-six (36%) respondents underwent mastectomy and represent the main analytic sample used herein; of whom 906 (97%) identified the surgeon responsible for their mastectomy surgeries. For 720 (77%) respondents, the treating general/oncologic surgeon completed a surgeon-specific survey which serves as a source of data on surgeon characteristics.

Measures

Questionnaires were developed using an iterative design process (18). We employed standard techniques to assess content validity. This included review by survey design experts and cognitive interviewing with patients and clinicians outside our target sample (19). The four primary outcomes measures were three self-reported communication-related measures and one self-reported measure of receipt of breast reconstruction.

The first communication-related measure was reporting having been told by a doctor that “breast reconstruction is an option for women who have a mastectomy.” The second was reporting having been told by a doctor that “your insurance should cover most of the cost of breast reconstruction.” The third was whether the respondent knew that breast reconstruction could be done immediately after mastectomy as part of the same surgery.

In addition to receipt of reconstruction, type of reconstruction was also evaluated by self-report. Women were asked to describe the type of reconstruction received by choosing between 1) an implant (silicone or saline) or 2) a DIEP flap, TRAM flap, or latissimus dorsi flap (uses your own tissue from the abdomen or back).

Covariates

Patient-level covariates included sociodemographic characteristics measured through the surveys: age at diagnosis, race, primary spoken language, marital status, education, income, and insurance coverage. Clinical and treatment variables included SEER-derived tumor stage, along with a number of patient-reported measures: breast cup size, comorbidities, body mass index, and surgical treatment. Surgeon-level characteristics considered included annual breast cancer patient volume, whether or not the practice teaches residents or fellows, and the surgeon’s number of years in practice since completing residency.

Statistical Analysis

Survey weights were calculated to adjust for the differential probability of selecting patients by race/ethnicity, cancer stage, and SEER site due to our sampling design. Additionally, to the extent that respondents differed from non-respondents in these characteristics, weights were adjusted to compensate for survey nonresponse and normalized to the observed sample size to reduce the risk of bias. In order to correct for the potential bias that may be introduced by complete-case methods, values for missing items were imputed using sequential multiple imputation (20, 21). We first described the characteristics of the sample, second determined associations of the patient and surgeon-level covariates with the three communication measures, and third determined associations of the patient and surgeon-level covariates with receipt of reconstruction. Weighted logistic regression models were constructed using all the pre-specified characteristics listed above. Models were adjusted for patient sociodemographic and clinical/treatment factors, and when significant, clustering of patients within surgeons and key surgeon-level covariates. *P*-values are two sided and values at or below 5% are considered significant. All analyses were performed using the SAS system, version 9.4 [Cary, NC, USA].

RESULTS

Patient demographics and treatment variables are presented in Table 1. The average age of respondents was 57.7 years (range, 24.3 to 80.2 years). Overall, 484 women (51.7%) underwent mastectomy with reconstruction and 452 (48.3%) mastectomy alone. Implant-based breast reconstruction was performed in nearly three quarters of the patients who received reconstruction (72.0%), with autologous reconstructions performed in 19.1% of the patients. The vast majority of the patients in the cohort (92.3%) reported being told by a doctor that breast reconstruction was an option following mastectomy. Fewer reported knowing about the possibility of immediate reconstruction (73.4%) or having been informed by a doctor that insurance should cover most of the cost of breast reconstruction (71.1%). We compared the distributions between non-respondents and respondents for age, race, grade, ER status, site and stage. Whites were significantly more likely to respond than minorities. Women with stage 1 disease were significantly more likely to respond than those with stage 0 or 2 disease. Other factors did not differ significantly.

Figure 1 presents findings from a multivariable model evaluating associations between patient variables and having been told by a doctor that breast reconstruction was an option. Women who were older (+1 year, OR 0.92; 95% CI 0.89–0.95) had significantly lower odds of being informed by a doctor about breast reconstruction as an option. Women who did not speak English as their primary language (English primary spoken language, No vs Yes, OR 0.33; 95% CI 0.11–0.94) had significantly lower odds of being informed about reconstruction as an option (See table, Supplemental Digital Content 2, which shows a multiple variable model explaining if patient reports that a doctor told her that breast reconstruction was an option for her, INSERT HYPER LINK). Without the inclusion of language in the multivariable model, women who are Asian or Latina (Asian vs White, OR 0.31; 95% CI 0.09–1.01; and Latina vs White, OR 0.32; 95% CI 0.10–1.00), underweight (underweight vs normal, OR 0.18; 95% CI 0.04–0.90) and without private insurance

(Medicaid vs private, OR 0.31; 95% CI 0.10–0.92 and other or no insurance vs private, OR 0.16; 95% CI 0.03–0.83) had significantly lower odds of being informed by a doctor about breast reconstruction as an option (See table, Supplemental Digital Content 2, INSERT HYPER LINK).

Figure 2 presents findings from a multivariable model evaluating the association between patient and surgeon variables and having been told by a doctor that insurance should cover the cost of breast reconstruction. Women who were older were less likely to report being told by a doctor that insurance should cover most of the cost of breast reconstruction (OR 0.96; 95% CI 0.94–0.98). Language was not significantly associated with communication about insurance coverage of reconstruction. The surgeon performing mastectomy also had a significant association with having been told about insurance coverage. Evaluation by a surgeon with a practice pattern one standard deviation above the average surgeon for communication about insurance coverage increased the likelihood that women reported having been told about insurance coverage with an OR of 1.37; 95% CI 1.00–1.87 (See table, Supplemental Digital Content 3, which shows a multiple variable model explaining if patient reports that a doctor told her that insurance should cover most of the costs of breast reconstruction, INSERT HYPER LINK).

Figure 3 presents findings from a multivariable model evaluating the association between patient variables and knowledge that reconstruction can be performed immediately after mastectomy. Women who were older (OR 0.97; 95% CI 0.95–0.99), and those who were non-white (Asian vs White, OR 0.34; 95% CI 0.17–0.69, Black vs White, OR 0.40; 95% CI 0.24–0.66 and Latina vs White, OR 0.48; 95% CI 0.24–0.96) had decreased odds of knowing that immediate reconstruction was an option. Women with bronchitis/emphysema were also less likely to know about immediate reconstruction (OR 0.45; 95% CI 0.22–0.91). Those undergoing bilateral mastectomy had 1.59 times greater odds of knowing about immediate reconstruction (95% CI 1.05–2.41). Women who were uninsured (OR 0.25; 95% CI 0.06–0.98) had significantly decreased odds of knowing that reconstruction can be performed immediately after mastectomy. In contrast, women with at least some college education (OR 1.81; 95% CI 1.16–2.80) and with incomes over $40K (40K-<90K vs <40K, OR 2.11; 95% CI 1.25–3.54 and 90K+ vs <40K, OR 2.43; 95% CI 1.36–4.34) had increased odds of knowing that reconstruction can be performed in the immediate setting. Language was not significantly associated with knowing about the possibility of immediate breast reconstruction. Women evaluated by surgeons with teaching responsibilities were significantly more likely to know that immediate breast reconstruction after mastectomy was an option (OR 2.12; 95% CI 1.23–3.65) (See table, Supplemental Digital Content 4, which shows a multiple variable model explaining if patient knew that reconstruction could be performed immediately after mastectomy, INSERT HYPER LINK).

Finally, Figure 4 presents findings from a multivariable model evaluating associations between patient and surgeon variables and the receipt of reconstruction. Older women were less likely to undergo reconstruction (OR 0.95 (+1 year of age); 95% CI, 0.93–0.97). Women with comorbid bronchitis/emphysema were less likely to undergo breast reconstruction (OR 0.35; 95% CI 0.13 to 0.92). Women with invasive disease were significantly less likely to undergo reconstruction than those with non-invasive disease (OR 0.50; 95% CI, 0.27–0.92).

Those who underwent bilateral mastectomies had three times the odds of receiving reconstruction than patients undergoing unilateral mastectomies (OR, 3.85; 95% CI, 2.24–6.63). The odds of women with higher annual income (≥$90,000) to receive reconstruction was 2.65 times higher (95% CI, 1.22 to 5.77) than the odds of women with lower annual income (<$40,000). Here also, language was not significantly associated with receipt of reconstruction. Women managed by surgeons with a high breast cancer patient volume (51+ patients per year) were more likely to undergo breast reconstruction (OR, 2.43; 95% CI, 1.40 to 4.20) than women managed by surgeons with lower volumes (See table, Supplemental Digital Content 5, which shows a multiple variable model explaining receipt of breast reconstruction, INSERT HYPER LINK).

DISCUSSION

In this study of a modern population-based cohort of women with breast cancer, about half received breast reconstruction, and the vast majority stated that they had been told by a doctor that reconstruction was an option for them. Unfortunately, we observed a number of disparities in both communication and receipt of breast reconstruction in this sample. Increasing age was associated with lower rates of reconstruction receipt and also consistently associated with poorer communication about reconstruction. Women for whom English was not their primary spoken language were less likely to have been told that reconstruction was an option. Racial differences also existed, with Asian, black, and Latina women being less likely to know about immediate reconstruction, and Asian women less likely to receive breast reconstruction after controlling for other factors. Socioeconomic vulnerability factors also showed important associations. Those who were uninsured were less likely to know about immediate reconstruction, whereas those with greater education and higher income were more likely to know about immediate reconstruction, and those with higher income were more likely to receive it. These findings suggest that disparities continue to exist, both in terms of reconstruction receipt and also notably with respect to access to the information necessary for all women to share in the important decision regarding whether to pursue breast reconstruction after mastectomy.

There appears to have been some improvement over time in the proportion of patients who receive some information on reconstruction. In 2008, it was reported that only 33% of patients surveyed through specific SEER registries had a discussion about breast reconstruction with their general surgeon (22). A survey of surgeons in 2007 revealed that only 24% of surgeons had a high referral propensity, defined as referring >75% of their patients to plastic surgeons prior to breast surgery (23). Surgeons with a high propensity for referrals to plastic surgeons were more likely to be female, had high clinical breast surgery volumes (>50 procedures per year) and worked in cancer centers. Almost 10 years later, we show that many more women who receive mastectomy are at least informed about the option of post-mastectomy breast reconstruction (92.3% of the current sample), but fewer know about the possibility of immediate reconstruction or have been told about insurance coverage of costs, and disparities in access to information continue to warrant attention. The specific surgeon performing mastectomy had a significant impact—both regarding communication and receipt of reconstruction—suggesting that interventions to target the communication practices of general/oncologic surgeons might be fruitful approaches to ensure equitable

access of all women to this option with important consequences for quality of life during survivorship. The plastic surgery community should continue to increase outreach efforts to raise awareness of the benefits of breast reconstruction among general and oncologic surgeons and consider creating easily accessible educational tools and decision aids for breast reconstruction that could potentially bridge the existing information gap on breast reconstruction. These tools should, however, supplement and not replace consultations with reconstructive surgeons.

Breast reconstruction rates have risen over the years, with some variability in reported immediate reconstruction rates from large national databases (24). We found a 51.7% rate of immediate breast reconstruction based on responses to surveys sent to patients identified through the SEER database. Alongside the overall increase in breast reconstruction rates, it is important to note the concomitant rise in CPM rates among women with early stage unilateral breast cancer. SEER registry data show an increase in CPM rates among women undergoing mastectomy, with stage 0-II breast cancer, from 13.5% to 33.6% between 2004 and 2014 (25). Reconstruction rates in patients undergoing CPM increased from 46.2% to 62.5% over that time period. Women in this study cohort who underwent CPM were significantly more likely to know about immediate reconstruction and undergo reconstruction. This is likely a reflection of the fact that though the choice for CPM is primarily based on women's oncologic concerns, a secondary desire for symmetry with reconstruction is prominent (26). Symmetry can be effectively achieved in women undergoing CPM with either implant or autologous forms of breast reconstruction as similar materials are utilized on both sides. In contrast, in women undergoing unilateral mastectomy, symmetry is best achieved with autologous tissue reconstructions, given the concept of matching the natural breast with "like tissue", a soft primarily adipose tissue-based reconstruction (27). In the long term, satisfaction with autologous reconstruction from the patient's perspective tends to be greater even with natural soft tissue changes that occur with aging (28). Implant based reconstructions were the predominant form of reconstruction received by women in this study cohort (70%), consistent with the reported distribution on reconstruction types in other studies (29, 30). The relationship between the decision for CPM and breast reconstruction is a complex one, but here again to avoid decisions made for additional oncologic surgery (CPM) based primarily on a desire for symmetry, it is important to inform patients that symmetry can be achieved with unilateral mastectomies with appropriately selected reconstructive procedures.

Beyond the quality of information provided is the need for an equitable delivery of information to all women considering mastectomy. We found that women who fit a certain demographic (young, white, private insurance) were more likely to be informed about and receive reconstruction. Disparities in breast reconstruction based on age, race, insurance type and socioeconomic status have been well documented (31–33). We, however, did not find a significant difference in the likelihood of reconstruction amongst black, Latina and Asian women relative to white women in the present sample. Our finding of greater odds for breast reconstruction in patients with non-invasive disease has also been previously reported by others and might be attributed to the fact that the adjuvant post-mastectomy treatment of DCIS tends not to be a limiting factor for immediate breast reconstruction (9,31). Less is known about the correlates of communication in this context in the modern era and whether

improved communication will influence uptake of reconstruction. A study of the more recent 2011 New York Public Health Law (NY PBH Law 2803-o), which mandates that physicians communicate about breast reconstruction with patients undergoing mastectomy, showed some reduction in disparities in reconstruction receipt between Hispanic and white patients (9% decrease) and other minorities and white patients (13% decrease), a year after enactment; no improvements were found in the disparities between African American and white patients (34). Some reasons suggested for the limited effect of the law aside from a short follow-up period include potential differences in effective communication style for specific patient groups, a lack of patient trust based on past experiences, language barriers, and limited physician knowledge about the benefits of breast reconstruction. Interestingly, we found that language plays a role in the receipt of information, with women who did not have English as their primary language being less likely to know about breast reconstruction. Of note, differences by race and insurance status appeared to be mediated by communication challenges of failure to speak English as a native language. Addressing this will likely require delivery of information about reconstruction using the primary language of the patient to ensure proper provider-patient communication. This will require additional resources in the form of translated educational materials and interpreters. Also equally important would be encouraging consultations with family members present and asking pointed questions afterwards to assess understanding.

This study has a number of strengths, including the large, diverse population of patients and high survey response rate, but limitations are also inherent in its design. As women were surveyed from two regions of the United States, our findings, though significant, might not be generalizable to patients in all locations. Exclusion of women who could not complete questionnaires in Spanish or English also limits generalizability to non-English speaking populations beyond Latinas. Additionally, given the several months that elapsed from the preoperative consultations to filling out the surveys, there is a potential for recall bias amongst women in the study. In particular, we were limited in our ability to evaluate associations between communication and reconstruction receipt because women who actually received reconstruction would be expected to be more likely to recall conversations with providers about it being an option for them or insurance coverage, and to have knowledge regarding options for timing. We limited our analyses in order to avoid fallacies of causal inference that could result from analyzing associations between the communication variables and reconstruction receipt. It is possible that information on immediate reconstruction and on insurance coverage of reconstruction may not have been presented to women who expressed disinterest with initial information on the option of breast reconstruction. Nevertheless, even a woman who expresses disinterest with initial information on the option of breast reconstruction might be driven by misconceptions about the cost or burden of requiring a separate surgical procedure, so this seems to be important information to provide to all women.

CONCLUSIONS:

Increased efforts should be made early in consultations for surgical management of breast cancer to provide information, in a language understood by the patient, on the option of reconstruction, about insurance coverage of reconstruction, and regarding the possibility of

immediate breast reconstruction. Acknowledging that not all women want reconstruction, this information should be provided to all women, and not preferentially to those who might be presumed to have greatest interest, such as whites, those with private insurance, or younger patients, as this can perpetuate meaningful disparities in long-term quality of life outcomes for breast cancer survivors. The current study suggests the potential value in developing and evaluating communication interventions targeting surgeons who perform mastectomy, to ensure dissemination of critical information regarding reconstruction to all patients in a concerted attempt to eliminate existing disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

We acknowledge the work of our project staff (Mackenzie Crawford, M.P.H. and Kiyana Perrino, M.P.H. from the Georgia Cancer Registry; Jennifer Zelaya, Pamela Lee, Maria Gaeta, Virginia Parker, B.A. and Renee Bickerstaff-Magee from USC; Rebecca Morrison, M.P.H., Alexandra Jeanpierre, M.P.H., Stefanie Goodell, B.S., Irina Bondarenko, M.S., Paul Abrahamse, M.A., and Rose Juhasz, Ph.D. from the University of Michigan).

This work was funded by grant P01 CA163233 to the University of Michigan from the National Cancer Institute. The collection of Los Angeles County cancer incidence data used in this study was supported by the California Department of Public Health pursuant to California Health and Safety Code Section 103885; Centers for Disease Control and Prevention's (CDC) National Program of Cancer Registries, under cooperative agreement 5NU58DP003862–04/DP003862; the National Cancer Institute's Surveillance, Epidemiology and End Results Program under contract HHSN261201000140C awarded to the Cancer Prevention Institute of California, contract HHSN261201000035C awarded to the University of Southern California, and contract HHSN261201000034C awarded to the Public Health Institute.

REFERENCES

1. Alderman AK, McMahon L, Wilkins EG. The national utilization of immediate and early delayed breast reconstruction and the impact of sociodemographic factors. Plast Reconstr Surg. 2003;11:695–703.
2. Jagsi R, Jiang J, Momoh AO, et al. Trends and variations in use of breast reconstruction in patients with breast cancer undergoing mastectomy in the United States. J Clin Oncol. 2014; 32:919–926. [PubMed: 24550418]
3. 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;25:5203–5209. [PubMed: 17954711]
4. 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;27:1362–1367. [PubMed: 19224844]
5. Agarwal S, Kidwell KM, Kraft CT, et al. Defining the relationship between patient decisions to undergo breast reconstruction and contralateral prophylactic mastectomy. Plast Reconstr Surg. 2015; 135:661–670. [PubMed: 25719688]
6. 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;106:1014–1025. [PubMed: 11039373]
7. Atisha D, Alderman AK, Lowery JC, et al. 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(6):1019–28. [PubMed: 18520230]

8. Pusic AL, Matros E, Fine N, et al. Patient-reported outcomes 1 year after immediate breast reconstruction: Results of the Mastectomy Reconstruction Outcomes Consortium Study. J Clin Oncol. 2017;35(22):2499–2506. [PubMed: 28346808]
9. Christian CK, Niland JC, Edge SB, et al. A multi-institutional analysis of the socioeconomic determinants of breast reconstruction: a study of the National Comprehensive Cancer Network. Ann Surg 2006;243:241–249. [PubMed: 16432358]
10. Tseng JF, Kronowitz SJ, Sun CC, et al. The effect of ethnicity on immediate reconstruction rates after mastectomy for breast cancer. Cancer. 2004;101(7):1514–1523. [PubMed: 15378473]
11. Kruper L, Holt A, Xu XX, Duan L, et al. Disparities in reconstruction rates after mastectomy: patterns of care and factors associated with the use of breast reconstruction in Southern California. Ann Surg Oncol. 2011;18(8):2158–65 [PubMed: 21308486]
12. Morrow M, Li Y, Alderman AK, et al. Access to Breast Reconstruction and Patient Perspectives on Decision Making. JAMA Surg. 2014;149(10):1015–1021. [PubMed: 25141939]
13. Butler PD, Nelson JA, Fischer JP, et al. Racial and age disparities persist in immediate breast reconstruction: an updated analysis of 48,564 patients from the 2005 to 2011 American College of Surgeons National Surgery Quality Improvement Program data sets. Am J Surg. 2016;212(1):96–101. [PubMed: 26545345]
14. Greenberg CC, Schneider EC, Lipsitz SR, et al. Do variations in provider discussions explain socioeconomic disparities in postmastectomy breast reconstruction? J AmColl Surg. 2008;206(4): 605–615.
15. Wallner LP, Abrahamse P, Uppal JK, et al. Involvement of primary care physicians in the decision making and care of patients with breast cancer. J Clin Oncol. 2016;34:3969–3975 [PubMed: 28440678]
16. Wallner LP, Li Y, Furgal AKC, et al. Patient preferences for primary care provider roles in breast cancer survivorship care. J Clin Oncol. 2017;35:2942–2948 [PubMed: 28700276]
17. Dillman DA: Mail and Internet Surveys: The Tailored Design Method. New York, NY, Wiley, 2007
18. Fowler FJ. Survey Research Methods. 4th Ed. Thousand Oaks, CA: Sage Publication; 2008
19. Willis GB. Cognitive Interviewing: A tool for improving questionnaire design. Thousand Oaks, CA: Sage Publication; 2005.
20. Raghunathan T, Lepkowski J, Van Hoewyk J, Solenberger P. A multivariate technique for multiply imputing missing values using a sequence of regression models. Surv Methodol. 2001;27(1):85–95.
21. Rubin DB. Multiple Imputation for Nonresponse in Surveys. Hoboken, NJ: John Wiley & Sons; 1987.
22. Alderman AK, Hawley ST, Waljee J, Mujahid M, Morrow M, Katz SJ. Understanding the impact of breast reconstruction on the surgical decision-making process for breast cancer. Cancer. 2008;112:489–94. [PubMed: 18157830]
23. Alderman AK, Hawley ST, Waljee J, Morrow M, Katz SJ. Correlates of referral practices of general surgeons to plastic surgeons for mastectomy reconstruction. Cancer. 2007;109(9):1715–20. [PubMed: 17387715]
24. Kamali P, Zettervall SL, Wu W, et al. Differences in the Reporting of Racial and Socioeconomic Disparities among Three Large National Databases for Breast Reconstruction. Plast Reconstr Surg. 2017;139(4):795–807. [PubMed: 28350648]
25. Surveillance Epidemiology, and Results End (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2016 Sub (1973–2014 varying) - Linked To County Attributes - Total U.S., 1969–2015 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, released April 2017, based on the November 2016 submission.
26. Buchanan PJ, Abdulghani M, Waljee JF, et al. An analysis of the decisions made for contralateral prophylactic mastectomy and breast reconstruction. Plast Reconstr Surg. 2016; 138:29–40. [PubMed: 27348637]
27. Momoh AO, Cohen WA, Kidwell KM, et al. Tradeoffs associated with contralateral prophylactic mastectomy in women choosing breast reconstruction: Results of a prospective multicenter cohort. Ann Surg. 2017;266(1):158–164. [PubMed: 27355266]

28. 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.

29. Ballard TN, Kim Y, Cohen WA, et al. Sociodemographic predictors of breast reconstruction procedure choice: analysis of the Mastectomy Reconstruction Outcomes Consortium study cohort. Plast Surg Int. 2015; 2015:150856. [PubMed: 26605082]

30. Kamali P, Paul MA, Ibrahim AMS, et al. National and Regional Differences in 32,248 Postmastectomy Autologous Breast Reconstruction Using the Updated National Inpatient Survey. Ann Plast Surg. 2017;78(6):717–722. [PubMed: 28079533]

31. Kruper L, Xu X, Henderson K, Bernstein L. Disparities in reconstruction rates and mastectomy for ductal carcinoma in situ (DCIS): Patterns of care and factors associated with the use of breast reconstruction for DCIS compared with invasive cancer. Ann Surg Oncol. 2011;18:3210–3219 [PubMed: 21863363]

32. Sisco M, Du H, Warner JP, et al. Have we expanded the equitable delivery of postmastectomy breast reconstruction in the new millennium? Evidence from the National Cancer Data Base. J Am Coll Surg. 2012;215:658–667. [PubMed: 22921327]

33. Roughton MC, DiEgidio P, Zhou L, Stitzenberg K, Meyer AM. Distance to a plastic surgeon and type of insurance plan are independently predictive of postmastectomy breast reconstruction. Plast Reconstr Surg. 2016;138(2):203e–211e.

34. Mahmoudi E, Lu Y, Metz AK, Momoh AO, Chung KC. Association of a policy mandating physician-patient communication with racial/ethnic disparities in postmastectomy breast reconstruction. JAMA Surg. 2017;152(8):775–783. [PubMed: 28564674]

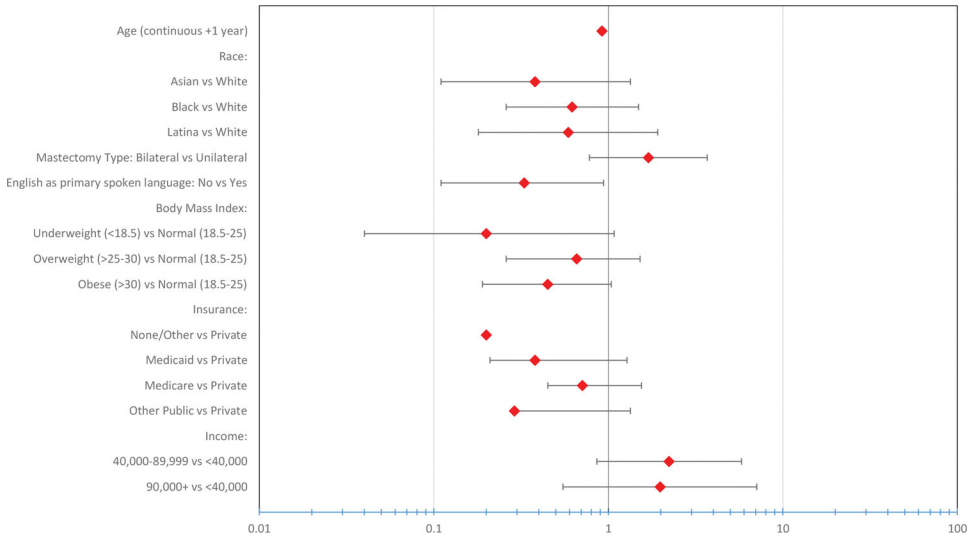

Figure 1:

Forest Plot for the multiple variable model explaining if patient reports that a doctor told her that breast reconstruction was an option for her. Full details of model provided in Supplemental Digital Content 2, INSERT HYPER LINK.

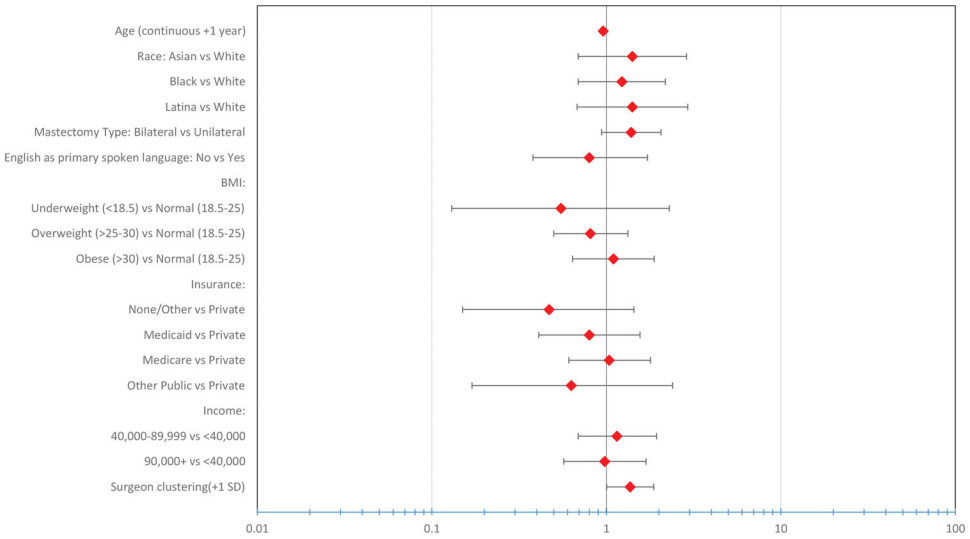

Figure 2:

Forest Plot for the multiple variable model explaining if patient reports that a doctor told her that insurance should cover most of the costs of breast reconstruction. Full details of model provided in Supplemental Digital Content 3, INSERT HYPER LINK.

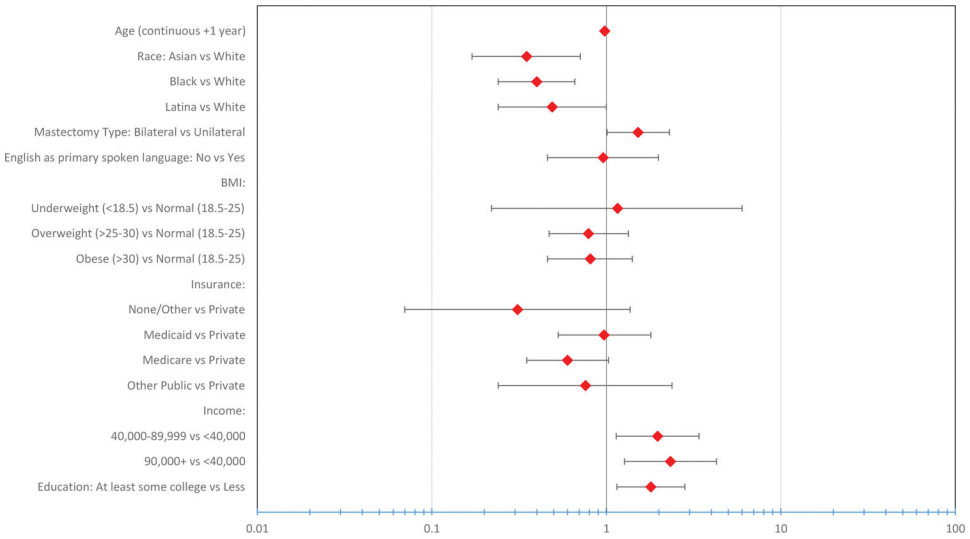

Figure 3:

Forest Plot for the multiple variable model explaining if patient knew that reconstruction could be performed immediately after mastectomy. Full details of model provided in Supplemental Digital Content 4, INSERT HYPER LINK.

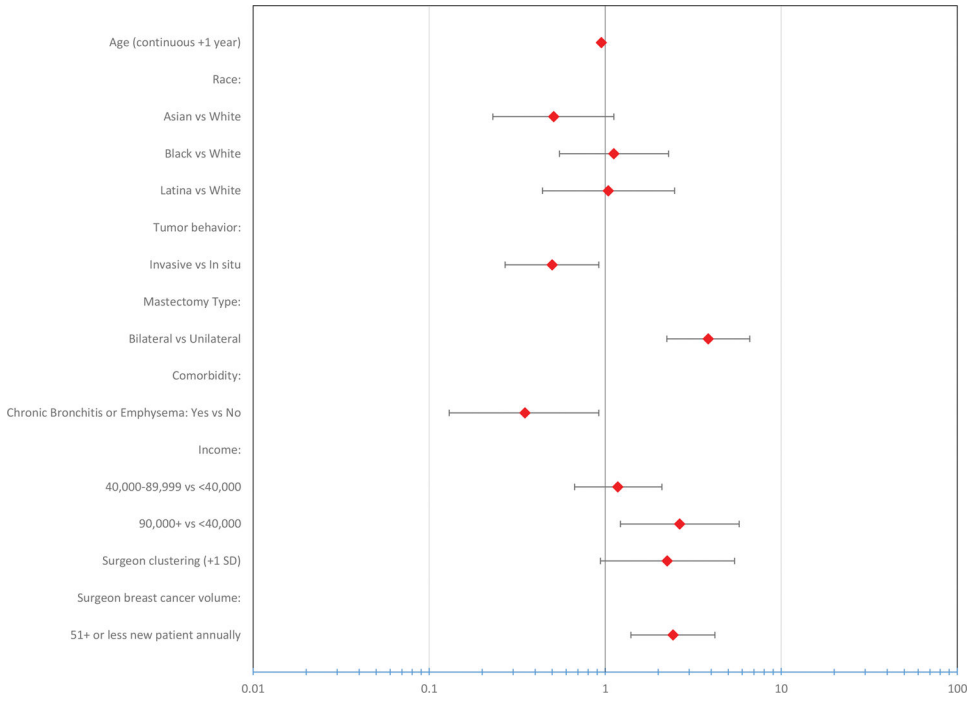

Figure 4:

Forest Plot for the multiple variable model explaining receipt of breast reconstruction. Full details of model provided in Supplemental Digital Content 5, INSERT HYPER LINK.

Table 1:

Characteristics of the sample population, total and by reconstruction status.

Characteristic	Level	All women N (%†) or Mean† (SE†)	Women with Reconstruction N (%†) or Mean† (SE†)	Women without Reconstruction N (%†) or Mean† (SE†)
Site	State of Georgia	536 (58.75)	335 (64.08)	201 (51.3)
	LA County, California	400 (41.25)	192 (35.92)	208 (48.70)
Stage	Not reported	46 (3.73)	23 (3.34)	23 (4.27)
	0 (DCIS)	159 (24.07)	108 (28.30)	51 (18.17)
	1	427 (40.34)	250 (41.28)	177 (39.02)
	2	304 (31.86)	146 (27.08)	158 (38.54)
Age	(Continuous)	57.72 (0.37)	54.45 (0.46)	62.3 (0.53)
Diabetes	Not reported	7 (0.69)	3 (0.64)	4 (0.75)
	No	764 (82.41)	466 (89.50)	298 (72.52)
	Yes	165 (16.90)	58 (9.86)	107 (26.73)
Bronchitis/Emphysema	Not reported	7 (0.63)	3 (0.52)	4 (0.79)
	No	868 (92.68)	503 (95.32)	365 (88.99)
	Yes	61 (6.69)	21 (4.16)	40 (10.22)
BMI	(Continuous)	28.03 (0.25)	27.2 (0.29)	29.22 (0.42)
Body Mass Index	Not reported	34 (3.58)	15 (2.72)	19 (4.77)
	Underweight (<18.5)	12 (1.22)	4 (0.79)	8 (1.83)
	Normal weight (18.5–25)	340 (37.89)	213 (41.45)	127 (32.91)
	Overweight (>25–30)	247 (26.05)	148 (27.72)	99 (23.71)
	Obese (>30)	303 (31.26)	147 (27.32)	156 (36.78)
Race	White	503 (56.26)	316 (61.95)	187 (48.31)
	Black	156 (17.00)	84 (16.85)	72 (17.22)
	Latina	146 (12.52)	71 (10.89)	75 (14.80)
	Asian	104 (11.43)	45 (8.22)	59 (15.93)
	Other/unknown/missing	27 (2.79)	11 (2.10)	16 (3.74)
English as primary spoken language	Yes	840 (91.21)	492 (94.38)	348 (86.77)
	No	96 (8.79)	35 (5.62)	61 (13.23)
Breast Cup Size	Not reported	30 (3.14)	13 (2.53)	17 (3.98)
	A/B	323 (34.02)	162 (30.01)	161 (39.61)
	C	278 (30.12)	159 (30.39)	119 (29.74)
	D	172 (17.96)	107 (19.9)	65 (15.25)
	DD+	133 (14.77)	86 (17.16)	47 (11.41)
Education	Not Reported	7 (0.69)	3 (0.46)	4 (1.02)
	High school or less	242 (24.40)	88 (16.21)	154 (35.83)
	At least some college	687 (74.91)	436 (83.33)	251 (63.14)
Income (USD)	<40,000	262 (26.71)	110 (20.04)	152 (36.01)
	40,000–89,999	274 (30.81)	165 (32.69)	109 (28.18)
	90,000+	243 (26.99)	192 (36.60)	51 (13.56)

Characteristic	Level	All women N (%†) or Mean† (SE†)	Women with Reconstruction N (%†) or Mean† (SE†)	Women without Reconstruction N (%†) or Mean† (SE†)
	Not reported	157 (15.50)	60 (10.67)	97 (22.25)
Insurance	Not Reported	35 (3.15)	15 (2.09)	20 (4.62)
	None	4 (0.39)	1 (0.17)	3 (0.69)
	Medicaid	118 (11.64)	40 (7.42)	78 (17.55)
	Medicare	220 (23.42)	83 (15.76)	137 (34.12)
	Other public	15 (1.64)	9 (1.81)	6 (1.39)
	Private	544 (59.76)	379 (72.74)	165 (41.63)
Marital Status	Not Reported	8 (0.74)	4 (0.61)	4 (0.91)
	Not Married	317 (33.58)	157 (30.26)	160 (38.2)
	Married	611 (65.69)	366 (69.12)	245 (60.88)
Surgical Treatment	Unilateral Mastectomy	508 (54.96)	198 (39.90)	310 (76.00)
	Bilateral Mastectomy	428 (45.04)	329 (60.10)	99 (24.01)
Was told by a doctor that breast reconstruction is an option for women who have mastectomy	Not reported	12 (1.23)	3 (0.53)	9 (2.21)
	No	67 (6.50)	12 (2.51)	55 (12.07)
	Yes	857 (92.27)	512 (96.95)	345 (85.72)
Was told by a doctor that insurance should cover most of the cost of breast reconstruction	Not reported	63 (7.06)	19 (4.03)	44 ((11.29)
	No	204 (21.88)	79 (15.50)	125 (30.80)
	Yes	669 (71.06)	429 (80.47)	240 (57.91)
Knew that breast reconstruction can be done immediately after mastectomy as part of the same surgery	Not reported	13 (1.38)	5 (0.84)	8 (2.13)
	No	81 (9.11)	41 (8.06)	40 (10.58)
	Yes	683 (73.42)	455 (85.83)	228 (56.07)
	Don’t Know	159 (16.09)	26 (5.26)	133 (31.22)
Type of breast reconstruction for the subset reporting Reconstruction	Not reported		37 (8.9)	
	A Diep Flap, Tram Flap, Or Latissimus Dorsi Flap		95 (19.10)	
	An Implant (Silicone Or Saline)		389 (72.00)	

†Weighted for sample design and survey non-response.