

# Epidemiologic Characteristics and Postoperative Complications following Augmentation Mammoplasty: Comparison of Transgender and Cisgender Females

Nicholas G. Cuccolo, BS\*†

Christine O. Kang, MD, MHS,  
MS\*†

Elizabeth R. Boskey, MPH, PhD\*

Ahmed M.S. Ibrahim, MD, PhD†

Louise L. Blankensteijn, MD†

Amir Taghinia, MD\*

Bernard T. Lee, MD, MPH, MBA†

Samuel J. Lin, MD, MBA†

Oren Ganor, MD\*

**Background:** Breast augmentation in transgender women can be an important first step in addressing gender incongruence and improving psychosocial functioning. The aim of this study was to compare postoperative outcomes of augmentation mammoplasty in transgender and cisgender females.

**Methods:** We queried the American College of Surgeons National Surgical Quality Improvement Program database from 2006 to 2017 to establish 2 cohorts: (1) transgender females undergoing gender-affirming breast augmentation (“top surgery”) and (2) cisgender females seeking cosmetic breast augmentation (CBA). Demographic characteristics and postoperative outcomes were compared between the 2 cohorts. Multivariable regression analysis was used to control for confounders.

**Results:** A total of 1,360 cases were identified, of which 280 (21%) were feminizing top surgeries and 1,080 (79%) were CBA cases. The transfeminine cohort was significantly older, had a higher average body mass index, and was more racially diverse than the CBA cohort. Transfeminine patients also had higher rates of smoking, diabetes, and hypertension. The rates of all-cause complications were low in both cohorts, and differences were not significant (1.6% transfeminine versus 1.8% CBA,  $P = 0.890$ ) for the first 30-days after operation. After controlling for confounding variables, transfeminine patients had postoperative complication profiles similar to their cisgender counterparts. Multivariable regression analysis revealed no statistically significant predictors for all-cause complications.

**Conclusions:** Transfeminine breast augmentation is a safe procedure that has a similar 30-day complication profile to its cisgender counterpart. The results of this study should reassure and encourage surgeons who are considering performing this procedure. (*Plast Reconstr Surg Glob Open* 2019;7:e2461; doi: 10.1097/GOX.0000000000002461; Published online 29 October 2019.)

For centuries, human beings have demonstrated an unwavering interest in external appearance.

Although the “ideal” body type has varied significantly across time and place, humans have a long history of working to achieve a physique that brings comfort and confidence. Innovations in medicine and surgery have evolved in parallel with society’s interests. The breast is arguably the best example of this concept, with descriptions

of aesthetic modifications dating as far back as 3,000 BC.<sup>1-5</sup> Primitive implant materials, including ivory, glass, metal, rubber, paraffin, petroleum jelly, beeswax, shellac, and epoxy resins, gained popularity during the 19th and early 20th centuries, but often left patients disfigured and with serious complications.<sup>6-12</sup> Persistence of breast augmentation procedures despite these poor and sometimes fatal outcomes provides context for understanding how

From the \*Department of Plastic and Oral Surgery, Boston Children’s Hospital, Harvard Medical School, Boston, Mass.; and †Division of Plastic and Reconstructive Surgery, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Mass. Received for publication July 4, 2019; accepted July 10, 2019.

Portions of this work will be presented as an oral podium presentation at the Plastic Surgery Research Council Annual Meeting, May 2-5, 2019, Baltimore, MD.

The ACS NSQIP databases are the source of information used in this study. Data extrapolated, statistical analysis performed, and conclusions reached have not been verified by the ACS NSQIP but rather are the result of the work done by the authors of this study.

The patient information in this study is de-identified and available to all institutions complying with the American College of Surgeons

National Surgical Quality Improvement Program (ACS NSQIP) Data Use Agreement.

Copyright © 2019 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: 10.1097/GOX.0000000000002461

**Disclosure:** The authors have no financial interest to declare in relation to the content of this article.

essential breasts are to the feminine physique, and therefore to the perception of femininity as a whole.

For many transgender women, lack of breasts contributes significantly to gender incongruence, body dissatisfaction, and psychological comorbidity.<sup>13–16</sup> Although hormone replacement therapy may result in some degree of breast development, it is typically insufficient to effectively address chest dysphoria,<sup>17</sup> thus necessitating augmentation mammoplasty (top surgery) to better approximate the cisgender female breast.<sup>18</sup> According to the 2015 United States Transgender Survey, 74% of transfeminine individuals either have had, or someday want to have breast augmentation surgery.<sup>14</sup> Benefits of breast augmentation in this population, including improvements in quality of life and psychosocial and sexual well-being, are well documented.<sup>15,16</sup> Breast augmentation may also be influential in facilitating a patient's social transition, and social transition is a prerequisite for vaginoplasty.<sup>19</sup>

Despite the seemingly exponential rise in feminizing operations performed annually,<sup>20,21</sup> the literature on this population is sparse. Prior studies have emphasized technical details, surgical anatomy, and postoperative aesthetic outcomes.<sup>15,16,22–28</sup> Major limitations to the body of existing literature include small sample size, lack of multi-institutional studies, and minimal data pertaining to postoperative complication profiles.

In contrast, cosmetic augmentation in the cisgender population, which has consistently been the most common aesthetic procedure performed in the United States,<sup>20,21,29–31</sup> has been extensively described in the literature.<sup>5,32–40</sup> Despite some natal sex differences in chest wall and mammary anatomy between cisgender and transgender females, the technical aspects of the operation are broadly similar.<sup>18</sup> Furthermore, with widespread use of testosterone blockers and estrogen therapy in transfeminine patients, the hormonal environment between these groups is also quite similar.

The objective of this study is to analyze nationally-reported demographic characteristics and postoperative outcomes relating to transfeminine augmentation mammoplasty in comparison to cosmetic augmentation in cisgender females. We used the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) to conduct this study because of its robust sample size and multi-institutional nature.

## METHODS

### Datasets

We conducted a retrospective analysis of the ACS NSQIP database from 2005 to 2017. The ACS NSQIP is a nationally validated, risk-adjusted, surgical outcomes program that collects information on approximately 240 variables from over 400 institutions nationwide.<sup>41</sup> The data contained in this cohort is deidentified and available to all institutions adhering to the ACS NSQIP data use agreement. Methods of data collection have been previously described.<sup>42</sup>

**Table 1. ICD-9 and ICD-10 Codes**

Description	ICD-9/ ICD-10 Code
Transgender cohort	
Transsexualism with unspecified sexual history	302.50
Transsexualism with asexual history	302/51
Transsexualism with homosexual history	302.52
Transsexualism with heterosexual history	302.53
Gender identity disorder in children	302.6
Gender identity disorder in adolescents or adults	302.85
Transsexualism	F64.0
Gender identity disorder in adults	F64.1
Gender identity disorder in children	F64.2
Other gender identity disorders	F64.8
Gender identity disorder, unspecified	F64.9
Cisgender cohort	
Plastic surgery for unacceptable cosmetic appearance	V50.1
Encounter for other procedures for purposes other than remedying health state	Z41.0
Encounter for cosmetic surgery	Z41.1

### Transgender Cohort Selection

International Classification of Diseases, Ninth Revision (ICD-9) and corresponding Tenth Revision (ICD-10) codes were used to identify patients with a primary diagnosis of gender dysphoria at the time of surgery (Table 1). We then used Current Procedural Terminology codes (19325) to identify patients undergoing augmentation mammoplasty with prosthetic implants and excluded subjects that also underwent concurrent operations unrelated to the breast procedure.

### Cisgender Cohort Selection

Patients undergoing cosmetic surgery were identified using ICD-9 and ICD-10 codes (Table 1). Within this cohort, we identified patients undergoing augmentation mammoplasty using Current Procedural Terminology codes (19325). Again, we elected to exclude from analysis any cases with concurrent procedures unrelated to the augmentation.

### Variables

Demographics such as age and race were collected along with clinical features, baseline health characteristics, past medical and surgical history, and American Society of Anesthesiologists physical status. Postoperative outcomes pertaining to morbidity and mortality were also collected and analyzed. A complete list of variables and corresponding definitions can be found on the National Surgical Quality Improvement Program website (<http://site.acsnsqip.org/>).

### Statistical Analysis

To assess the difference in means of continuous variables, the 2-sided unpaired *t*-test was used, whereas the Chi-square or Fisher's exact tests (where cell numbers were less than 5) were used to analyze categorical data. Univariate analysis was performed to evaluate for unadjusted differences in demographics, comorbidities, perioperative risk factors, and postoperative complications between the transgender and cisgender cohorts.

Statistical significance was reported as  $P < 0.05$ . Preidentified variables of interest as well as those with

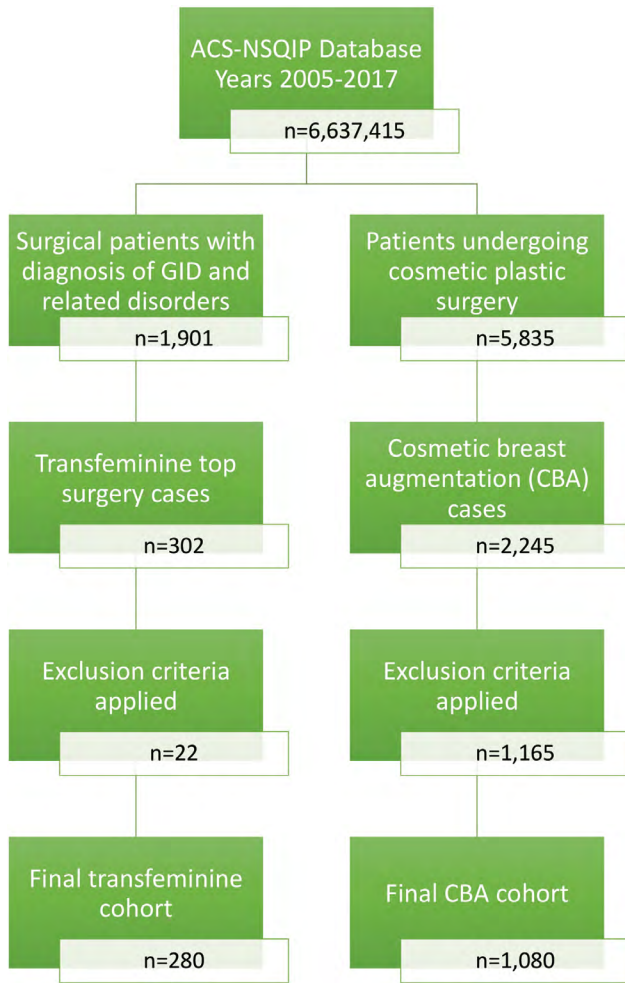


Fig. 1. Data extraction strategy.

unadjusted  $P < 0.05$  on univariate analysis were included in a multivariable binary logistic regression with all-cause complications as the dependent variable. Adjusted odds ratio and its corresponding 95% confidence interval were derived for each independent risk factor. All statistical analyses were performed using IBM SPSS version 24 for Windows (IBM Corp, Armonk, NY).

## RESULTS

### General

The 2005–2017 NSQIP databases were used to identify 2,547 augmentation cases out of 6.6 million total procedures (Fig. 1). Predetermined exclusion criteria were then applied, which removed 1,187 entries. The final study population consisted of 1,360 cases, of which 280 (21%) were feminizing top surgeries and 1,080 (79%) were cosmetic breast augmentations (CBAs). Increasing numbers of transfeminine top surgeries were noted each year (Table 2). This trend is apparent for numerous procedures recorded in the NSQIP and is often attributed to increased institutional enrollment.<sup>43</sup> To accurately assess trends in feminizing top surgeries while controlling for

Table 2. Demographic Characteristics

	Transfemal Augmentation	Cisfemal Augmentation	P
No. of patients	280	1,080	
Mean age ± SD (y)	36.8 ± 12.9	34.8 ± 10.6	0.020
Race			<0.001
White	128 (45.7%)	953 (88.2%)	
Black	46 (16.4%)	27 (2.5%)	
Asian	9 (3.2%)	33 (3.1%)	
AI or AN	1 (0.4%)	3 (0.3%)	
NH or PI	1 (0.4%)	1 (0.1%)	
Unknown/unreported	95 (33.9%)	63 (5.8%)	
Ethnicity			<0.001
Hispanic	40 (14.3%)	43 (4.0%)	
Non-Hispanic	157 (56.1%)	666 (61.7%)	
Unknown/not reported	83 (29.6%)	371 (34.4%)	
Admission year			<0.001
2017	120 (42.9%)	94 (8.7%)	
2016	108 (38.6%)	157 (14.5%)	
2015	37 (13.2%)	255 (23.6%)	
2014	6 (2.1%)	227 (21.0%)	
2013	8 (2.9%)	147 (13.6%)	
2012	1 (0.4%)	57 (5.3%)	
2011	0 (0%)	56 (5.2%)	
2010	0 (0%)	19 (1.8%)	
2009	0 (0%)	30 (2.8%)	
2008	0 (0%)	36 (3.3%)	
2007	0 (0%)	2 (0.2%)	
Surgical specialty			0.006
Plastic surgery	273 (97.5%)	1073 (99.4%)	
General surgery	7 (2.5%)	7 (0.6%)	

AI, American Indian; AN, Alaska Native; NH, Native Hawaiian; PI, Pacific Islander.

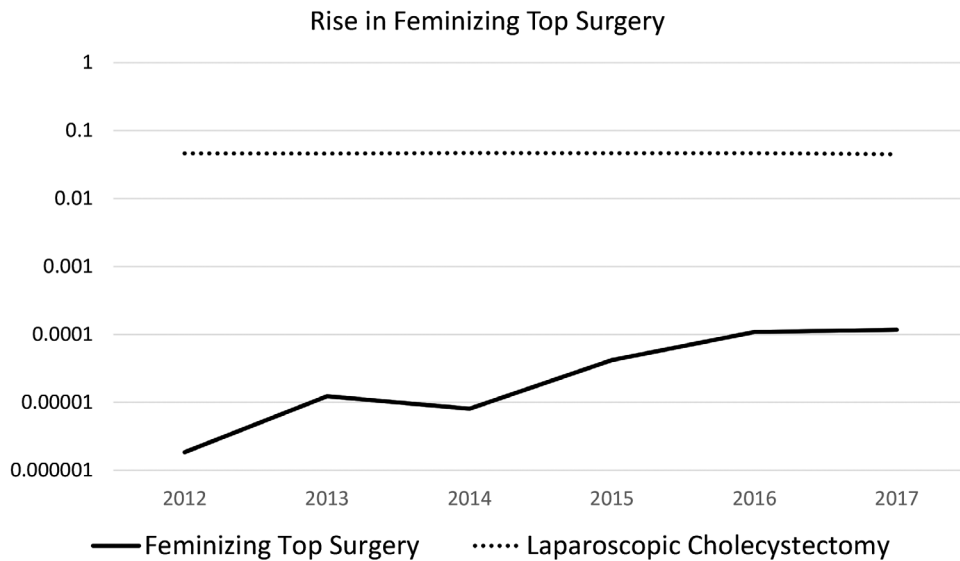
changes in enrollment; we compared the rate of reporting for transfeminine cases to that of laparoscopic cholecystectomy (Fig. 2). From 2012 to 2017, the proportion of cases in the NSQIP that involved laparoscopic cholecystectomy consistently ranged between 4.5% and 4.7%. In 2012, transfeminine top surgeries accounted for only 18 in 100,000 NSQIP cases. In 2017, that number rose to 11.7 in 1,000, which represents a 62-fold increase ( $P < 0.001$ ).

### Patient Demographics and Surgical Specialty

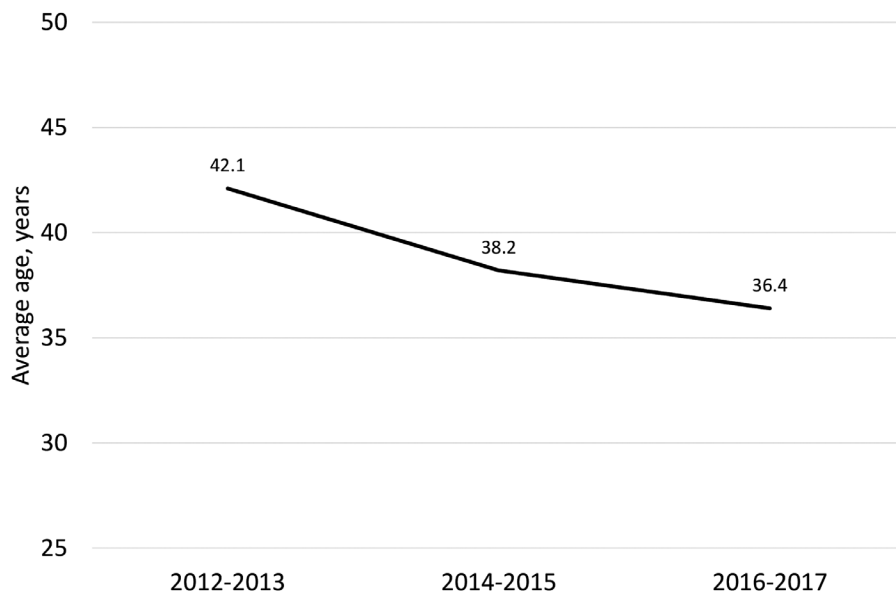
The mean age of the transfeminine cohort was older ( $36.8 \pm 12.9$  years versus  $34.8 \pm 10.6$ ,  $P = 0.02$ ) than the CBA cohort, and this was statistically significant. However, between 2012 and 2017, the average age of patients undergoing feminizing top surgery steadily decreased (Fig. 3). Plastic surgeons performed the majority of transfeminine [97.5% ( $n = 273$ )] and CBA [99.4% ( $n = 1,073$ )] cases, but the transfeminine cohort had more than 4 times the proportion of cases performed by general surgeons (2.5% versus 0.6%,  $P < 0.001$ ) (Table 2). Before exclusion of select cases, all concomitant operations were reviewed and categorized, as shown in Table 3.

### Comorbidities and Intraoperative Characteristics

The transfeminine cohort had a higher average body mass index (BMI) ( $26.7 \pm 5.6$  kg/m<sup>2</sup> versus  $22.3 \pm 3.4$  kg/m<sup>2</sup>,  $P < 0.001$ ) and a higher proportion of patients with ASA class 3 or greater [6.8% ( $n = 19$ ) versus 1.3% ( $n = 14$ ),  $P < 0.001$ ] compared to the CBA cohort Table 4. Additionally, the transfeminine cohort had higher rates of smoking [27.1% ( $n = 76$ ) versus 10.9% ( $n = 118$ ),  $P < 0.001$ ], diabetes [4.3% ( $n = 12$ ) versus 0.9% ( $n = 10$ ),  $P < 0.001$ ],



**Fig. 2.** Proportion of feminizing top surgery and laparoscopic cholecystectomy cases in the ACS NSQIP database from 2012 to 2017.



**Fig. 3.** Average age of patients undergoing feminizing top surgery from 2012 to 2017.

**Table 3. Summary of Gender Affirmation Operations**

Procedure	No. of Procedures
Total	335 (in 302 patients)
Breast augmentation	302
Genital reconstruction*	20
Vaginoplasty/clitoroplasty	14
Penectomy/orchiectomy	9
Facial feminization*	13
Rhinoplasty	4
Tracheal shaving	3
Malar augmentation	2
Blepharoplasty	1
Genioplasty	1
Orbital reduction	1
Forehead reduction	1

\*These cases were excluded from statistical analysis due to the potential for confounding of complications.

and hypertension [10.4% (n = 29) versus 3.1% (n = 34),  $P < 0.001$ ], compared with the CBA cohort. Operative time was significantly longer in the transfeminine cohort ( $95.9 \pm 69.1$  minutes versus  $75.5 \pm 49.6$  minutes,  $P < 0.001$ ).

**Postoperative Complications and Multivariable Regression**

The rate of all-cause complications (Table 5) was 1.8% (n = 5) in the transfeminine cohort and 1.6% (n = 18) in the CBA cohort ( $P = 0.890$ ). No significant differences were noted for any of the postoperative complication variables. Given the low number of outcomes of interest, only 3 preoperative factors were included in the multivariable regression analysis for all-cause complications: smoking status, BMI, and transfeminine procedure. The regression

**Table 4. Comorbidities and Intraoperative Characteristics**

	Transfemale Augmentation	Cisfemale Augmentation	P
No. of patients	280	1,080	
Mean BMI $\pm$ SD (kg/m <sup>2</sup> )	26.7 $\pm$ 5.6	22.3 $\pm$ 3.4	<0.001
Nonobese (BMI $\leq$ 29.9 kg/m <sup>2</sup> )	206 (75.7%)	1,027 (96.8%)	<0.001
Obese (BMI $\geq$ 30.0 kg/m <sup>2</sup> )	66 (24.3%)	34 (3.2%)	
ASA classification			<0.001
1. No disturbance	76 (27.1%)	663 (61.4%)	
2. Mild disturbance	184 (65.7%)	403 (37.3%)	
3. Severe disturbance	19 (6.8%)	14 (1.3%)	
Location of procedure			<0.001
Inpatient	13 (4.6%)	6 (0.6%)	
Outpatient	267 (95.4%)	1074 (99.4%)	
Smoking			<0.001
Yes	76 (27.1%)	118 (10.9%)	
No	204 (72.9%)	962 (89.1%)	
Diabetes (type I or type II)	12 (4.3%)	10 (0.9%)	<0.001
Hypertension	29 (10.4%)	34 (3.1%)	<0.001
Steroid use	2 (0.7%)	1 (0.1%)	0.048
Operative time (min)	95.9 $\pm$ 69.1	75.5 $\pm$ 49.6	<0.001
Length of stay (d)	0.31 $\pm$ 1.4	0.11 $\pm$ 4.5	0.479

ASA, American Society of Anesthesiologists.

analysis did not identify any of these as statistically significant predictors for all-cause complications (Table 7). Rates of readmission were higher in the trans-feminine cohort [1.4% (n = 4)] compared to the CBA cohort [0.5% (n = 5)], but the sample size was underpowered to detect a significant difference at such a low frequency of readmission (Tables 6).

## DISCUSSION

For centuries, breasts have been viewed as a powerful representation of femininity, often emphasized

**Table 5. Postoperative Outcomes in Transfemale Versus Cisfemale Augmentation**

	Transfemale Augmentation	Cisfemale Augmentation	P
No. of patients	280	1,080	
All-cause complications	5 (1.8%)	18 (1.6%)	0.890
Superficial surgical-site infection	0 (0%)	3 (0.3%)	0.377
Deep surgical-site infection	0 (0%)	1 (0.1%)	0.610
Wound dehiscence	0 (0%)	2 (0.2%)	0.471
Deep vein thrombosis	0 (0%)	0 (0%)	
Pulmonary embolism	0 (0%)	1 (0.1%)	0.610
Urinary tract infection	1 (0.4%)	2 (0.2%)	0.585
Unplanned reoperation	4 (1.4%)	10 (0.9%)	0.558
Unplanned readmission	4 (1.4%)	5 (0.5%)	0.076

**Table 6. Reason for Reoperation**

	Transfemale Augmentation	Cisfemale Augmentation
No. of patients	280	1,080
Rate of unplanned reoperation	4 (1.4%)	10 (0.9%)
Reasons for reoperation		
Hematoma	3 (1.1%)	8 (0.7%)
Abscess drainage	1 (0.4%)	0 (0.0%)
Explantation, unspecified	0 (0%)	2 (0.2%)

**Table 7. Multivariable Regression Analysis for All-cause Complications**

	OR	95% CI	P
Transfeminine procedure	0.754	0.244–2.331	0.624
BMI	1.045	0.952–1.147	0.358
Smoking	2.187	0.833–5.740	0.112

CI, confidence interval; OR, odds ratio.

throughout literature, fashion, art, and medicine.<sup>1–5</sup> Importantly, the relationship between breasts and the female construct exists regardless of one's natal sex. For transgender females yet to undergo surgical transition, the absence of breasts is often associated with negative body image, dissatisfaction with physical appearance, and lower quality of life.<sup>13,15,16</sup> Furthermore, prior studies have shown that transgender females have disproportionately higher rates of body dissatisfaction and psychological comorbidities, including anxiety and depression, compared with transgender males.<sup>13,44</sup>

For some transgender women, breast augmentation is an effective way to increase their bodily satisfaction and ability to move safely through the world.<sup>15,16</sup> Standards of care relating to breast augmentation, as described by the World Professional Association for Transgender Health, recommend 1 year of hormonal therapy before surgery. This provides a chance for women to maximize their breast growth, but also contributes to the already large fiscal burden in this population.<sup>19,45,46</sup> Although recent legislative changes have enabled wider access to care,<sup>47</sup> many patients still report difficulty with insurance coverage.<sup>14</sup>

Breast augmentation in transgender women has been shown to improve quality of life and psychosocial and sexual well-being.<sup>15,16</sup> Given the unique challenges facing these individuals and the well-documented improvements following chest surgery, persistent communication of demographic data and postoperative outcomes is essential to facilitating informed decision making, maintaining high standards of care, and establishing appropriate regulations regarding coverage of surgical intervention. To address this aim, we employed the ACS NSQIP database

to evaluate the nationally reported epidemiologic characteristics and postoperative complication profiles of breast augmentations performed for transfeminine transition in comparison to cosmetic augmentation in cisgender females.

Our study noted a sharp increase in the number of transfeminine augmentations performed between 2012 and 2017 (Fig. 2). This finding is consistent with the American Society of Plastic Surgeons procedural statistics reports, which noted a 79.9% increase in the number of transfeminine operations performed between 2015 and 2017.<sup>20,21</sup> In contrast, the frequency of cosmetic augmentations remained consistent throughout this period. We also noted a diverse spectrum of concomitant gender affirmation procedures in transfeminine patients undergoing augmentation, including genital reconstruction and facial feminization, although these were excluded from analysis to limit confounding.

Patients in the transfeminine cohort were older than those in the cosmetic augmentation cohort (37 years versus 35 years), which is consistent with prior studies from both populations.<sup>24,25,34,36,37</sup> However, our analysis noted a consistent decrease in transfeminine patient age from 2012 to 2017 (Fig. 3), likely a result of improvements in social climate and legislative changes<sup>47</sup> that together have enabled greater access to care. Furthermore, racial and ethnic minorities were adequately represented in our transfeminine dataset, with distributions similar to those noted by the William's Institute in 2016.<sup>48</sup>

Rates of comorbidities, including smoking, diabetes, hypertension, and obesity, were significantly higher in the transgender cohort. Numerous studies have indicated that transgender women have higher rates of obesity, smoking, and other problematic health behaviors as a result of "minority stress," a term used by social scientists to describe disparate mental and physical health characteristics seen in members of stigmatized minority populations.<sup>49–52</sup> Such behaviors maybe even more common in transgender women who are also racial and ethnic minorities.<sup>53,54</sup> In addition to the risks caused by minority stress and social stigma, there is also some suggestion that cross-sex hormone therapy may contribute to insulin resistance and weight gain in a subset of transgender women.<sup>55</sup>

Although some surgeons impose BMI limits or behavioral restrictions to determine surgical eligibility, differences in how cisgender and transgender augmentation are conceptualized may explain some of the risk differences noted in these cohorts of our study. In particular, the fact that augmentation, whereas still aesthetic in nature, is considered medically necessary in the transfeminine population,<sup>56</sup> but not in the cosmetic cisgender patient, may alter provider perceptions of the "ideal" surgical candidate. Furthermore, cosmetic augmentations are usually paid for as out-of-pocket expenses, whereas insurance coverage for medically necessary augmentation in transgender women is expanding. Given the well-documented association between higher incomes and improved health behaviors, including weight and smoking,<sup>57</sup> it is possible that socioeconomic factors may also be contributing to the apparent demographic discrepancy noted in our study.

Compared with a cisgender female, the chest wall anatomy of a transgender female who has gone through a male puberty has a few slight differences, including increased width, thicker pectoralis fascia (and generally a more developed pectoralis muscle), and a smaller, ovoid-shaped nipple which tends to be located more laterally on the chest wall.<sup>18</sup> Because of these structural differences in the chest, breast growth on hormonal therapy may not be sufficient to establish a satisfactory feminine physique. Breasts may seem to be too broadly spaced on the chest, or the nipples may seem to be too lateral. These issues can be addressed during augmentation surgery, through medial transposition of the NAC or lowering the inframammary crease. These operative technique differences may explain the slightly longer operative time seen in the transgender cohort.

Despite these differences, the surgical techniques for breast augmentation in transgender and cisgender women are broadly similar, and many of the same considerations remain relevant, including placement of incisions, and implant material, shape, size, and location.<sup>18</sup> In addition to the technical similarities, transgender and cisgender females also have relatively similar hormone environments, given the World Professional Association for Transgender Health recommendation for hormone therapy before augmentation.<sup>19</sup> As such, juxtaposition of these cohorts provides for an informative evaluation of postoperative outcomes.

Overall, our analysis noted favorable postoperative outcomes following transfeminine augmentation, with an all-cause complication rate of 1.8%. In 2018, Fakin et al.<sup>25</sup> published their 20-year experience with transfeminine augmentation in 138 patients with rates of all-cause complication and hematoma formation reported at 1.4% and 0.7%, respectively. Reoperation secondary to hematoma formation was also the most common complication in the transfeminine cohort of our analysis, occurring in 1.1% of patients. Hematoma, albeit rare overall, has been identified by multiple authors as one of the primary complications after transfeminine augmentation.<sup>18,27</sup> There was also a trend towards a higher (1.4% versus 0.5%) readmission rate in the transfeminine patients, although the study was underpowered to determine if this was a true difference given the extremely low rates of readmission in both groups.

Postoperative complications were similarly infrequent following cisgender augmentation in our study, occurring in 1.6% of patients. Rates of complications as reported in the literature are highly variable, ranging from 1% to 38%, depending on the definition.<sup>34,36–40</sup> Similar to our transfeminine cohort, the most common complication in the cisgender group was reoperation secondary to hematoma formation, occurring in 0.8% of patients. This finding is consistent with retrospective studies from Handel<sup>58</sup> and Araco,<sup>36</sup> that reported hematoma formation in 1%–2% of patients.

Infection has been frequently reported as an important complication following augmentation, with rates as high as 2.5%.<sup>5,33,35,59</sup> However, only 1 (0.4%) patient in our transfeminine cohort and 4 patients (0.4%) in the

cisgender cohort experienced an infectious complication. One possible explanation for this discrepancy is that postoperative outcomes are only collected for 30 days after the time of surgery, something that substantially limits our study. Investigation of postoperative infections by other authors suggests that more than 33% of infections in augmentation patients may not occur until months or even years after surgery.<sup>5,60,61</sup>

Overall, our study noted equivalent risk-adjusted 30-day postoperative complication profiles of breast augmentation in the transgender and cisgender populations. These findings have a number of important implications. For one, despite the many barriers facing the transgender population, these individuals are largely receiving quality care, with outcomes comparable to their cisgender counterparts. As such, these results may be encouraging to surgeons who are considering this procedure as part of their practice. Although the workforce of providers who specialize in transgender health has significantly expanded in the past decade, many patients still face incredibly, and sometimes prohibitively, long wait times for certain procedures. Thus, for procedures such as breast augmentation, wherein additional training in transgender surgery is not necessary, it would be useful for transgender patients to be able to access a broader range of surgeons.

Although the nature of our dataset precludes an assessment of secondary aesthetic revisions or long-term complications, such as cancer risk and screening, these topics should be noted. Fakin et al.<sup>25</sup> and Kanhai et al.<sup>26</sup> noted that secondary aesthetic revisions following transfeminine augmentation were performed in 16.7% and 15.9% of patients, respectively. Regarding incidence of breast adenocarcinoma in the transfeminine population, Brown and Jones<sup>62</sup> and Gooren et al.<sup>63</sup> found no difference when compared with age-standardized samples of natal males. Despite reports of breast implant-associated anaplastic large cell lymphoma,<sup>64,65</sup> there does not seem to be any increased risk in the transgender population. However, similar to natal females, continued mammographic and clinical screening for breast cancer is recommended in the transfeminine population.<sup>66</sup> Fortunately, many transgender women have been noted to be receptive to screening, viewing it as an opportunity to further embrace their femininity.<sup>66,67</sup>

In addition to the lack of aesthetic and long-term outcomes, our study has a number of important limitations. As with all studies using large databases, such as the ACS NSQIP, case selection is governed by diagnosis and procedural coding, and therefore comparisons of patients or operations are limited by the granularity of the specific codes. In our study, this precludes an analysis of specific incisions or implant size, shape, and location. Further, the ACS NSQIP does not capture patient-reported outcomes, which are especially important in procedures such as this. Additionally, data entry in the ACS NSQIP is susceptible to human error as well as variability in reporting practices amongst and within institutions. Finally, there are limitations associated with institutional enrollment in the ACS NSQIP. First, many augmentation procedures are performed in ambulatory facilities, and thus are not captured

by the ACS NSQIP. Second, institutional bias against transgender health may further contribute to smaller sample sizes. In addition, it should be noted that the number and composition of hospitals enrolled in the ACS NSQIP often changes from year-to-year and may be subject to sampling bias. In the absence of statistical weighting of the dataset, trend analyses should not be extrapolated onto a population level.

Despite these limitations, our study provides important information on nationally-reported demographic characteristics and postoperative outcomes following augmentation in transgender and cisgender females. Further investigation is needed to evaluate these trends on a long-term scale and also to correlate these findings with data pertaining to aesthetic and patient-reported outcomes.

## CONCLUSIONS

Breasts are intimately associated with feminine identity, and augmentation in transgender women can substantially improve subjective feelings of femininity. Our study illustrates that augmentation is a safe procedure, with a favorable 30-day postoperative complication profile. Notwithstanding natal sex differences, transgender females did not seem to be at an increased risk of short-term complications when compared with their cisgender counterparts. Overall, these results should be encouraging to patients who are considering this procedure and also to surgeons who are considering joining the transgender workforce.

*Elizabeth R. Boskey, MPH, PhD*

Center for Gender Surgery  
Boston Children's Hospital, Harvard Medical School  
300 Longwood Avenue  
Boston, MA 02215

E-mail: [Elizabeth.Boskey@childrens.harvard.edu](mailto:Elizabeth.Boskey@childrens.harvard.edu)

## REFERENCES

1. Grazer FM, Klingbeil JR, Courtiss EH. *Body Image. A Surgical Perspective*. 1980;66:648. St. Louis: Mosby
2. Sarwer DB, Nordmann JE, Herbert J. Cosmetic breast augmentation surgery: a critical overview. 2000;9:843-56 *J Women Health Gen-B*.
3. Demargne P. Naissance de l'Art Grec. In: Malraux A, Parrot A, eds. *L'Univers des Formes (no. 6)*. 2nd edn. Paris, France: Gallimard; 1974:102.
4. Yalom M. *A History of the Breast*. 1997. New York: Alfred A. Knopf; Distributed by Random House
5. Pittet B, Montandon D, Pittet D. Infection in breast implants. *Lancet Infect Dis*. 2005;5:94-106.
6. Fallon A. Culture in the Mirror: Sociocultural Determinants of Body Image. In: Cash T, Pruzinsky T, eds. *Body images: development, deviance and change*. New York, NY: Guilford Press 1990:80.
7. Haiken E. *Venus Envy: A History of Cosmetic Surgery*. Baltimore, MD: Johns Hopkins University Press; 1997.
8. Gersuny R. Harte und weiche Paraffinprothesen. *Zentralbl Chir* 1903;30:1-5.
9. Morestin H. Inconvénients et abus des injections de paraffine. *Bull Soc Chir (Paris)*. 1908; 34: 124-128.
10. Kach v. Uber gelegentliche Gefärfarhe kostmetischen Paraffin Injektion. *Munch Med Wochenschr*. 1919;34:965-967.

11. Bettmann H. Über Folgeerscheinungen subcutaner Paraffininjektionen. *Berl Klin Wochenschr.* 1922; 22: 1040–1041.
12. Bondurant S, Ernster V, Herdman RC, eds. *Safety of Silicone Breast Implants.* Washington, DC: National Academy Press; 2000.
13. van de Grift TC, Cohen-Kettenis PT, Steensma TD, et al. Body satisfaction and physical appearance in gender dysphoria. *Arch Sex Behav.* 2016;45:575–585.
14. James SE, Herman JL, Rankin S, Keisling M, Mottet M, Anafi M, The Report of the 2015 U.S. Transgender Survey. Washington, DC: National Center for Transgender Equality; 2016.
15. Weigert R, Frison E, Sessiecq Q, et al. Patient satisfaction with breasts and psychosocial, sexual, and physical well-being after breast augmentation in male-to-female transsexuals. *Plast Reconstr Surg.* 2013;132:1421–1429.
16. Lindqvist EK, Sigurjonsson H, Möllermark C, et al. Quality of life improves early after gender reassignment surgery in transgender women. *Eur J Plast Surg.* 2017;40:223–226.
17. Orentreich N, Durr NP. Proceedings: mammogenesis in transsexuals. *J Invest Dermatol.* 1974;63:142–146.
18. Claes KEY, D'Arpa S, Monstrey SJ. Chest surgery for transgender and gender nonconforming individuals. *Clin Plast Surg.* 2018;45:369–380.
19. Coleman E, Bockting W, Botzer M, et al. Standards of care for the health of transsexual, transgender, and gender-nonconforming people, version 7. *International journal of transgenderism* 2012;13:165–232.
20. American Society of Plastic Surgeons. 2017 Plastic Surgery Statistics Report. Available at: <https://www.plasticsurgery.org/documents/News/Statistics/2017/plastic-surgery-statistics-full-report-2017.pdf>. Accessed January 5, 2019.
21. American Society of Plastic Surgeons. 2016 Plastic Surgery Statistics Report. Available at: <https://www.plasticsurgery.org/documents/News/Statistics/2016/plastic-surgery-statistics-full-report-2016.pdf>. Accessed January 5, 2019.
22. Sigurjonsson H, Rinder J, Möllermark C, et al. Male to female gender reassignment surgery: surgical outcomes of consecutive patients during 14 years. *JPRAS Open.* 2015; 6:69–73.
23. Kanhai RC, Hage JJ, Asscheman H, et al. Augmentation mammoplasty in male-to-female transsexuals. *Plast Reconstr Surg.* 1999;104:542–549; discussion 550.
24. Kanhai RC, Hage JJ, Karim RB. Augmentation mammoplasty in male-to-female transsexuals: facts and figures from amsterdam. *Scand J Plast Reconstr Surg Hand Surg.* 2001;35:203–206.
25. Fakin RM, Zimmermann S, Kaye K, et al. Long-term outcomes in breast augmentation in trans-women: A 20-year experience. *Aesthet Surg J.* 2019;39:381–390.
26. Kanhai RC, Hage JJ, Mulder JW. Long-term outcome of augmentation mammoplasty in male-to-female transsexuals: a questionnaire survey of 107 patients. *Br J Plast Surg.* 2000;53:209–211.
27. Kanhai RC, Hage JJ, Karim RB, et al. Exceptional presenting conditions and outcome of augmentation mammoplasty in male-to-female transsexuals. *Ann Plast Surg.* 1999;43:476–483.
28. Ratnam SS, Lim SM. Augmentation mammoplasty for the male transsexual. *Singapore Med J.* 1982;23:107–109.
29. American Society of Plastic Surgeons. 2015 Plastic Surgery Statistics Report. Available at: <https://www.plasticsurgery.org/documents/News/Statistics/2015/plastic-surgery-statistics-full-report-2015.pdf>. Accessed January 5, 2019.
30. American Society of Plastic Surgeons. 2014 Plastic Surgery Statistics Report. Available at: <https://www.plasticsurgery.org/documents/News/Statistics/2014/plastic-surgery-statistics-full-report-2014.pdf>. Accessed January 5, 2019.
31. American Society of Plastic Surgeons. 2013 Plastic Surgery Statistics Report. Available at: <https://www.plasticsurgery.org/documents/News/Statistics/2013/plastic-surgery-statistics-full-report-2013.pdf>. Accessed January 5, 2019.
32. Alpert BS, Lalonde DH. MOC-PS(SM) CME article: breast augmentation. *Plast Reconstr Surg.* 2008;121(Suppl 4):1–7.
33. Codner MA, Cohen AT, Hester TR. Complications in breast augmentation: prevention and correction. *Clin Plast Surg.* 2001;28:587–595; discussion 596.
34. Hanwright PJ, Hirsch EM, Seth AK, et al. A multi-institutional perspective of complication rates for elective nonreconstructive breast surgery: an analysis of NSQIP data from 2006 to 2010. *Aesthet Surg J.* 2013;33:378–386.
35. Stutman RL, Codner M, Mahoney A, et al. Comparison of breast augmentation incisions and common complications. *Aesthetic Plast Surg.* 2012;36:1096–1104.
36. Araco A, Gravante G, Araco F, et al. A retrospective analysis of 3,000 primary aesthetic breast augmentations: postoperative complications and associated factors. *Aesthetic Plast Surg.* 2007;31:532–539.
37. Huang GJ, Wichmann JL, Mills DC. Transaxillary subpectoral augmentation mammoplasty: a single surgeon's 20-year experience. *Aesthet Surg J.* 2011;31:781–801.
38. Codner MA, Mejia JD, Locke MB, et al. A 15-year experience with primary breast augmentation. *Plast Reconstr Surg.* 2011;127:1300–1310.
39. Tebbetts JB. Axillary endoscopic breast augmentation: processes derived from a 28-year experience to optimize outcomes. *Plast Reconstr Surg* 2006; 118(Suppl 7):53s–80s.
40. Gabriel SE, Woods JE, O'Fallon WM, et al. Complications leading to surgery after breast implantation. *N Engl J Med.* 1997;336:677–682.
41. American College of Surgeons . User Guide for the 2012 ACS NSQIP Participant Use Data File. Chicago, IL: American College of Surgeons; 2014.
42. Birkmeyer JD, Shahian DM, Dimick JB, et al. Blueprint for a new American College of Surgeons: National Surgical Quality Improvement Program. *J Am Coll Surg.* 2008;207:777–782.
43. Simpson AM, Donato DP, Kwok AC, et al. Predictors of complications following breast reduction surgery: A national surgical quality improvement program study of 16,812 cases. *J Plast Reconstr Aesthet Surg.* 2019;72:43–51.
44. Claes L, Bouman WP, Witcomb G, et al. Non-suicidal self-injury in trans people: associations with psychological symptoms, victimization, interpersonal functioning, and perceived social support. *J Sex Med.* 2015;12:168–179.
45. Padula WV, Heru S, Campbell JD. Societal implications of health insurance coverage for medically necessary services in the U.S. Transgender population: A cost-effectiveness analysis. *J Gen Intern Med.* 2016;31:394–401.
46. Berli JU, Knudson G, Fraser L, et al. What surgeons need to know about gender confirmation surgery when providing care for transgender individuals: A review. *JAMA Surg.* 2017;152:394–400.
47. Departmental Appeals Board, Appellate Division. *Transsexual Surgery.* U.S. Department of Health and Human Services Washington, DC. 2014. Docket No. A-13–87, Decision No. 2576.
48. Flores AR, Brown TN, Herman J. *Race and Ethnicity of Adults Who Identify as Transgender in the United States: Williams Institute.* Los Angeles, CA: UCLA School of Law; 2016.
49. Diemer EW, Grant JD, Munn-Chernoff MA, et al. Gender identity, sexual orientation, and eating-related pathology in a national sample of college students. *J Adolesc Health.* 2015;57:144–149.
50. Guss CE, Williams DN, Reisner SL, et al. Disordered weight management behaviors, nonprescription steroid use, and weight perception in transgender youth. *J Adolesc Health.* 2017;60:17–22.
51. Hatzenbuehler ML, Pachankis JE. Stigma and minority stress as social determinants of health among lesbian, gay, bisexual, and transgender youth: research evidence and clinical implications. *Pediatr Clin North Am.* 2016;63:985–997.



52. Valentine SE, Shipherd JC. A systematic review of social stress and mental health among transgender and gender non-conforming people in the United States. *Clin Psychol Rev.* 2018;66:24–38.
53. Fields E, Morgan A, Sanders RA. The intersection of sociocultural factors and health-related behavior in lesbian, gay, bisexual, and transgender youth: experiences among young black gay males as an example. *Pediatr Clin North Am.* 2016;63:1091–1106.
54. Hatchel T, Marx R. Understanding intersectionality and resiliency among transgender adolescents: exploring pathways among peer victimization, school belonging, and drug use. *Int J Environ Res Public Health* 2018; 15:E1289.
55. Elbers JM, Giltay EJ, Teerlink T, et al. Effects of sex steroids on components of the insulin resistance syndrome in transsexual subjects. *Clin Endocrinol (Oxf).* 2003;58:562–571.
56. Salgado CJ, Fein LA. Breast augmentation in transgender women and the lack of adherence amongst plastic surgeons to professional standards of care. *J Plast Reconstr Aesthet Surg.* 2015;68:1471–1472.
57. Pampel FC, Krueger PM, Denney JT. Socioeconomic disparities in health behaviors. *Annu Rev Sociol.* 2010;36:349–370.
58. Handel N, Cordray T, Gutierrez J, et al. A long-term study of outcomes, complications, and patient satisfaction with breast implants. *Plast Reconstr Surg.* 2006;117:757–767; discussion 768.
59. Hardwicke JT, Bechar J, Skillman JM. Are systemic antibiotics indicated in aesthetic breast surgery? A systematic review of the literature. *Plast Reconstr Surg.* 2013;131:1395–1403.
60. De Cholnoky T. Augmentation mammoplasty. Survey of complications in 10,941 patients by 265 surgeons. *Plast Reconstr Surg.* 1970;45:573–577.
61. Kjøller K, Hölmich LR, Jacobsen PH, et al. Epidemiological investigation of local complications after cosmetic breast implant surgery in denmark. *Ann Plast Surg.* 2002;48:229–237.
62. Brown GR, Jones KT. Incidence of breast cancer in a cohort of 5,135 transgender veterans. *Breast Cancer Res Treat.* 2015;149:191–198.
63. Gooren LJ, van Trotsenburg MA, Giltay EJ, et al. Breast cancer development in transsexual subjects receiving cross-sex hormone treatment. *J Sex Med.* 2013;10:3129–3134.
64. Patzelt M, Zarubova L, Klener P, et al. Anaplastic large-cell lymphoma associated with breast implants: a case report of a transgender female. *Aesthetic Plast Surg.* 2018;42:451–455.
65. de Boer M, van der Sluis WB, de Boer JP, et al. Breast implant-associated anaplastic large-cell lymphoma in a transgender woman. *Aesthet Surg J.* 2017;37:NP83–NP87.
66. Hartley RL, Stone JP, Temple-Oberle C. Breast cancer in transgender patients: a systematic review. Part 1: male to female. *Eur J Surg Oncol.* 2018;44:1455–1462.
67. Tang SS, Gui GP. A review of the oncologic and surgical management of breast cancer in the augmented breast: diagnostic, surgical and surveillance challenges. *Ann Surg Oncol.* 2011;18:2173–2181.