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# Morphometric Analysis of Gender-affirming Breast Augmentation

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**Background:** According to cisgender respondents, the “preferred” feminine breast has a 45:55 upper-to-lower pole ratio. Preferred breast ratios have not been evaluated for transgender women undergoing breast augmentation. Therefore, this study aimed to determine the preferred breast ratio according to the transgender population and, thus, better inform surgeon planning.

**Methods:** Patients diagnosed with gender dysphoria were sent a survey with morphed breast images of four different upper-to-lower pole ratios: 35:65, 45:55, 50:50, and 55:45. Respondents ranked the images according to aesthetic preference. Rankings were analyzed by the Condorcet method.

**Results:** 298 survey responses were analyzed: 197 (66.1%) respondents identified as transgender women and 31 (10.4%) as transgender men. Most respondents were younger than 40 (64.8%). Eighty-one (27.2%) had undergone breast augmentation, 136 (45.6%) had not and were not considering it, and 81 (27.2%) had not but were considering it. Across all subgroups, the most preferred ratio was 45:55 ( $P = 0.046$ ). Those with more masculine genders and assigned female at birth preferred the 45:55 and 50:50 ratios equally. Those in their 30's and younger preferred the 45:55 and 50:50 ratios equally.

**Conclusions:** The 45:55 ratio, established as the most preferred morphometrics for breast augmentation by cisgender respondents, is also the most aesthetically preferred proportion among transgender patients. Interestingly, the 50:50 ratio, which projects a larger upper bust compared to the 45:55 ratio, may be equally or more appealing to younger patients and those with more masculine genders. We hope these results improve patient-physician shared decision-making and post-operative expectations. (*Plast Reconstr Surg Glob Open* 2022;10:e4691; doi: 10.1097/GOX.0000000000004691; Published online 29 November 2022.)

## INTRODUCTION

In the United States, 1.4 million people identify as being transgender.<sup>1</sup> The number of gender-affirming surgical procedures is increasing and is predicted to rise at a compound annual growth rate of 14.4%.<sup>2</sup> Of all gender-affirming

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procedures, gender-affirming breast augmentation is one of the most common,<sup>3</sup> with over 4000 people undergoing this surgery in 2020.<sup>4</sup> Breasts may be important components for the feminine physique for many women and often help to alleviate gender dysphoria in transgender patients.<sup>5</sup> Therefore, preoperative planning is critical to align patient postoperative outcomes and expectations.

Understanding patient preferences and providing guidelines for procedures will help achieve more predictable postoperative outcomes and provide a framework that can be assessed objectively.<sup>6</sup> According to the 2011 US FDA update on the safety of silicone gel-filled implants, reoperation following primary breast augmentation is 20%, and poor preoperative planning contributes to high rates of complications and reoperations.<sup>6,7</sup>

The preferred aesthetic breast has been extensively studied in cisgender women.<sup>5,8–10</sup> In the 1950s, Penn et

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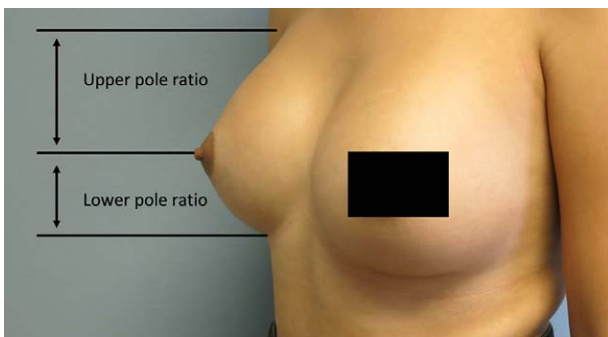
al defined the perfect breast and evaluated the optimal placement of the nipple-areolar complex (NAC) after breast reduction.<sup>8</sup> Since then, various plastic surgeons have sought reliable parameters and measurements to recreate the preferred aesthetic breast. In 2014, Mallucci and Branford<sup>11</sup> published a sentinel study investigating the preferred upper-to-lower pole ratio of the breast. The upper pole refers to a vertical distance above the NAC to the chest wall and the lower pole refers to a vertical distance from the NAC to the inframammary fold (Fig. 1). The authors reported that across all breast volumes and cultures, the 45:55 upper-to-lower pole ratio was the most preferred breast ratio with a 20-degree angulation of the nipple.<sup>11</sup> However, this study was specific to cisgender women undergoing cosmetic breast augmentation with cisgender respondents.

To date, no similar studies have evaluated the most preferred breast ratios for preoperative planning of gender-affirming breast augmentation with transgender respondents. Anecdotally, there are often differences in the preferred, desired appearance for the gender-affirming augmentation compared to the cosmetic cis-augmentation. Therefore, the goal of our study was to objectively characterize preferences regarding the aesthetics of the breast in transgender patients. Understanding the transgender patient populations' preferred aesthetic upper-to-lower pole ratio of the trans female breast in gender-affirming breast augmentation according to the transgender patient population can inform surgical planning to achieve patient-centered goals.

## METHODS

### Study Design

An anonymous, deidentified questionnaire was developed to evaluate various upper-to-lower pole ratios in trans female augmentation, with patient photographs morphed to four different ratios as detailed below. Surveys were distributed to patients identified through our institution with a diagnosis of gender dysphoria, via ICD 10 codes F64.2, F64.8, and F64.9. All participants older than 18 years were emailed the survey link through Qualtrics



**Fig. 1.** Diagram of the upper to lower pole. From the top of the breast mound to the nipple is the upper pole. From the nipple to the inframammary fold is the lower pole. This is an original patient photograph and has not yet been morphed.

### Takeaways

**Question:** To determine the preferred breast ratio according to the transgender population, and thus, improve surgical planning.

**Findings:** A survey was sent to patients diagnosed with gender dysphoria at our institution. Across all subgroups, the most preferred breast ratio was 45:55 ( $P = 0.046$ ) compared to the other breast ratios (35:65, 50:50, 55:45).

**Meaning:** Similar to cisgender respondents, the 45:55 ratio is the most preferred morphometrics for breast augmentation by transgender respondents. The 50:50 ratio, which projects a larger upper bust, may be equally or more appealing to younger and more masculine patients.

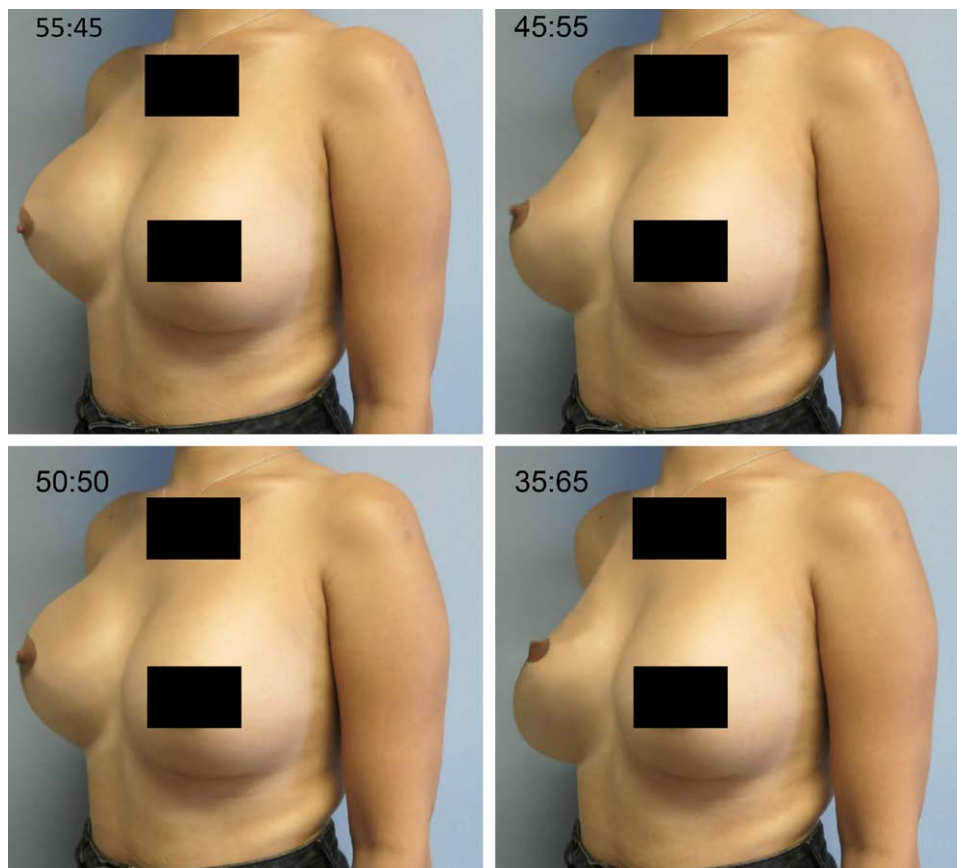
(Qualtrics Inc, Seattle, Wash.), and their implied consent was obtained by their acceptance to proceed with the survey. Cisgender respondents were not surveyed as we were primarily interested in evaluating breast morphometric preferences from the perspectives of transgender individuals. Cisgender responses have been previously evaluated by other studies.<sup>11,12</sup> This study was approved by the University of California San Francisco institutional review board.

Survey responses were included if respondents self-identified as trans or had discrepancies between their answers to sex assigned at birth and gender identity. Self-identified demographic details were collected, including gender identity, identification with being transgender, sex assigned at birth, ethnicity, age, education level, housing status, and marital status. Gender identity and ethnicity were free-response questions to allow for greater diversity of responses. Respondents were then shown images with varying upper-to-lower pole ratios and asked to rank their most to least preferred ratio of 16 breast image panels.

### Morphed Image Panels

Four postoperative trans female patient images were morphed into a 35:65, 45:55, 50:50, and 55:45 ratio of upper to lower pole following the methodology by Mallucci and Branford (Figures 2–5).<sup>11</sup> The four original images were of patients who had undergone gender-affirming augmentation at our institution with the senior author, and explicitly consented to the use of their images for this study. These images were chosen to provide a sampling of varying BMI, breast volume, skin tone, and age.

Each breast image was morphed into four different panels with different upper-to-lower pole ratios of 35:65, 45:55, 50:50, and 55:45. Image panels were created using the Liquefy Filter tool in Adobe Photoshop CS4 (Adobe Systems Inc., San Jose, Calif.). The Forward Warp, Twirl, Pucker, and Push tools were used to create the various breast ratios. Accuracy of the stated proportions was confirmed with the ruler function in photoshop within 1% of the stated ratios. The breasts were positioned in



**Fig. 2.** Randomized panel images for different upper-to-lower pole ratios. The upper-to-lower pole ratios are shown in the top left-hand corner of each panel. These ratios were replaced by letters (ie, A, B, C, and D) in the survey. This panel demonstrates a larger breast size.

a three-quarters profile pose with the left breast shaded out with a gray box to emphasize the right breast with the appropriate ratio (Fig. 1). They were then randomized in order of appearance to prevent bias. Respondents ranked each panel from first to fourth for each patient image. The three-quarters profile pose better illustrates the upper-to-lower pole ratio than the frontal pose. Therefore, images in the frontal pose were not used in order to limit survey fatigue and length.

#### Statistical Analysis

Rankings were analyzed by the Condorcet method that evaluates the most and least preferred ratios from pairwise comparisons.<sup>13</sup> The Condorcet method is an election method that elects the candidate (ie, ratio) who receives the majority of the vote in every head-to-head election against the other candidates.<sup>13</sup> The overall winner was the most preferred ratio in the majority of image panels. This method was chosen over the means and percentage method used by Mallucci and Branford et al,<sup>11</sup> as using the mean number of votes each ratio received across all panels introduces bias when the preference proportions are widely variable. All data analyses were performed through the R Project for Statistical Computing.<sup>14</sup> *P* values were calculated using binomial tables. *P* values less than 0.05 were considered statistically significant.

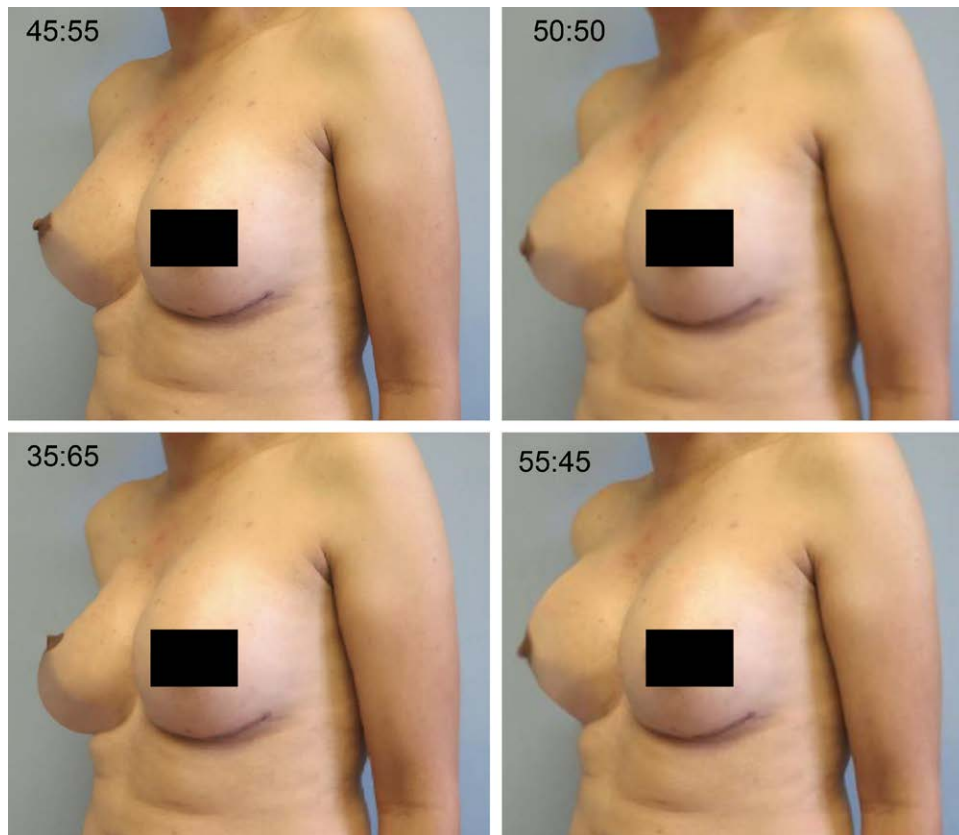
## RESULTS

Surveys were sent to 850 patients with an ICD 10 code of gender dysphoria at our institution. A total of 363 (42.7%) survey responses were received. Exclusion criteria included participants younger than 18 years of age, nontransgender patients, and those who did not complete the entire survey, resulting in 298 (82.1%) survey responses in the final analysis. Twenty-one individuals had a diagnosis code of gender dysphoria but did not identify as being transgender. (See table, Supplemental Digital Content 1, which displays the demographic data for included survey respondents [n = 298], <http://links.lww.com/PRSGO/C288>.)

#### Respondent Demographics

As shown in Supplemental Digital Content 1, 90.3% of respondents identified as being transgender, with the majority identifying as transgender women (66.1%). Over a quarter of respondents had already undergone breast augmentation or were considering it (27.2% and 27.2%, respectively). Nearly two-thirds (64.8%) of respondents were in their 30's or younger, and 54.7% identified as White.

Figure 6 depicts the distribution of respondents who identified with a gender identity for each age range. One hundred twenty-nine transgender women and 29 transgender men were in their 30's or younger (65.5% and 93.6%, respectively).



**Fig. 3.** Randomized panel images for different upper-to-lower pole ratios of a medium breast size. The upper-to-lower pole ratios are shown in the top left-hand corner of each panel. These ratios were replaced by letters (ie, A, B, C, and D) in the survey.

### Image Ratios

#### Overall

When all responses were pooled together, the 45:55 ratio was significantly ranked as the most aesthetically pleasing breast across all four ratios ( $P = 0.046$ ) by the transgender patient population (Table 2). The 50:50 ratio was the next most preferred ratio, and the 35:65 ratio was the least preferred.

#### Gender Identity

The 45:55 ratio was ranked as the highest or equally highest ratio among all respondents (Table 1) but there were some interesting differences. Those who identified as transgender women or nonbinary most preferred the 45:55 ratio. Those who identified as transgender men or other equally preferred the 45:55 and 50:50 ratios, although the difference was not significant. Those who identified as nonbinary or other least preferred the 55:45 ratio.

#### Gender Identity and Age

Overall, those who were in their 30's or younger equally preferred the 45:55 and 50:50 ratios, whereas those who were in their 40's or older preferred the 45:55 ratio the most. When categorized by gender and age, younger transgender women in their 20's and 30's equally preferred the 45:55 and 50:50 ratios (Table 2). Transgender men who

were 30 and older preferred the 50:50 ratio the most, but those who were younger than 30 actually preferred the 45:55 ratio the most. All nonbinary respondents, regardless of age, most preferred the 45:55 ratio and least preferred the 55:45 ratio.

#### Breast Augmentation History

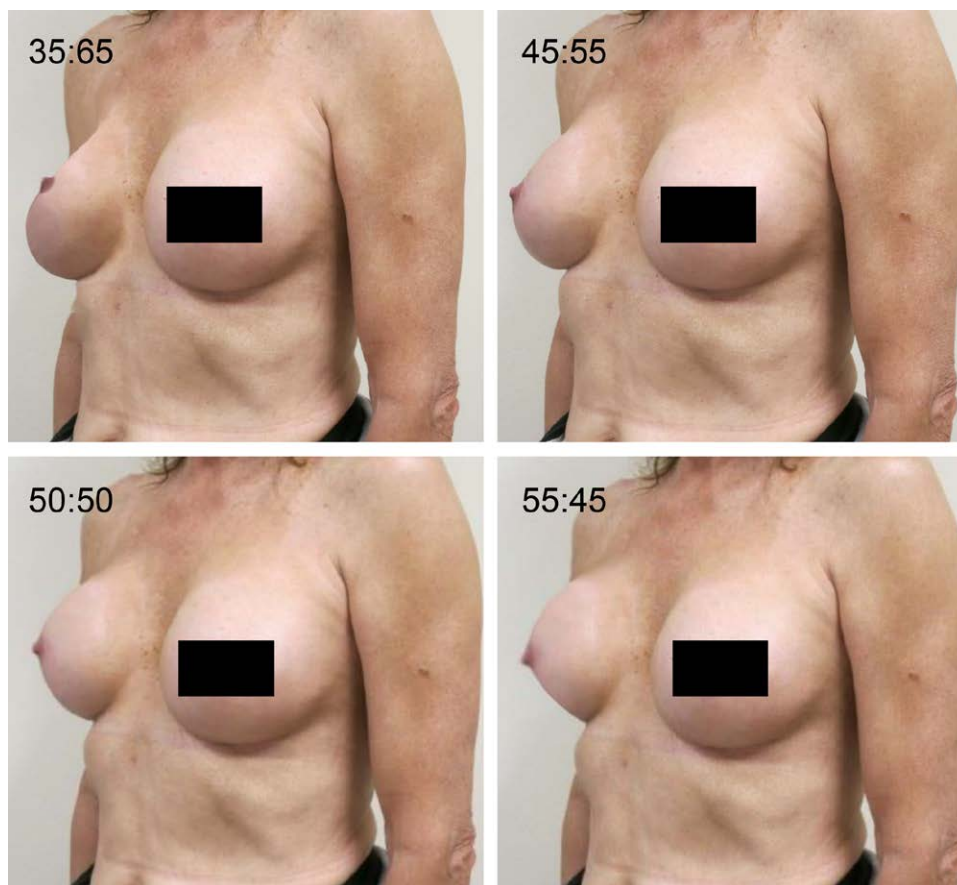
Respondents who already had a breast augmentation equally preferred the 45:55 and 50:50 ratios (Table 1). Those who did not have a prior breast augmentation ranked the 45:55 ratio the highest. When responses from those who did have a prior breast augmentation were pooled with those who were considering a breast augmentation, the 45:55 ratio was the most preferred ratio.

#### Ethnicity

All ethnicities preferred the 45:55 ratio, except for those who identified as Black (Table 1). Those who were Black most preferred the 50:50 ratio, and Pacific Islanders equally preferred the 45:55 and 50:50 ratios.

## DISCUSSION

This study is the first to evaluate preferences of breast ratios for gender-affirming breast augmentation in the transgender population. As in previous cisgender augmentation studies, the 45:55 ratio was the most aesthetically preferred ratio overall, with the 50:50 the next preferred



**Fig. 4.** Randomized panel images of different upper-to-lower pole ratios of a smaller breast size. The upper-to-lower pole ratios are shown in the top left-hand corner of each panel. These ratios were replaced by letters (ie, A, B, C, and D) in the survey.

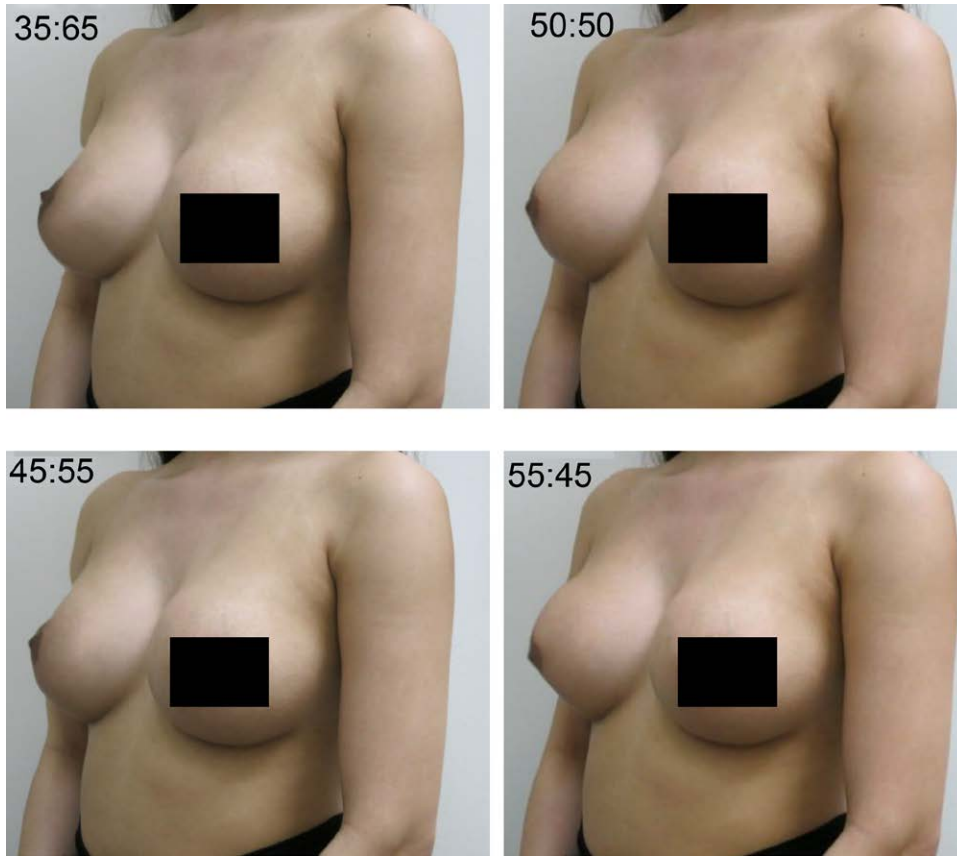
ratio, and the 35:65 ratio being the least preferred ( $P = 0.046$ ). These findings are in alignment with previous cis-gender studies that report greater deviation from the 45:55 aesthetic that is associated with decreasing attractiveness.<sup>6,11</sup>

Investigating the “preferred” aesthetic morphology is not a new concept in plastic surgery. Since the 1950s, plastic surgeons have sought to define and create standardized methods to achieve the aesthetic breast.<sup>8</sup> Atiye et al<sup>15</sup> tactfully described the importance of defining aesthetic proportions: “body proportions can vary greatly... nevertheless, understanding geometric anthropometric proportions and their relationship with beauty as well as defining objectively the ideal aesthetic morphology constitute invaluable and fundamental guidelines for setting the goals of surgery.” After establishing 45:55 as the ideal breast ratio, Mallucci and Branford<sup>16</sup> later published an article detailing a mathematical formula and surgical techniques to achieve the 45:55 ratio with different implant types. When these aesthetic proportions are respected with proper measurements, perceived beauty is enhanced and optimal aesthetics are achieved.<sup>17,18</sup>

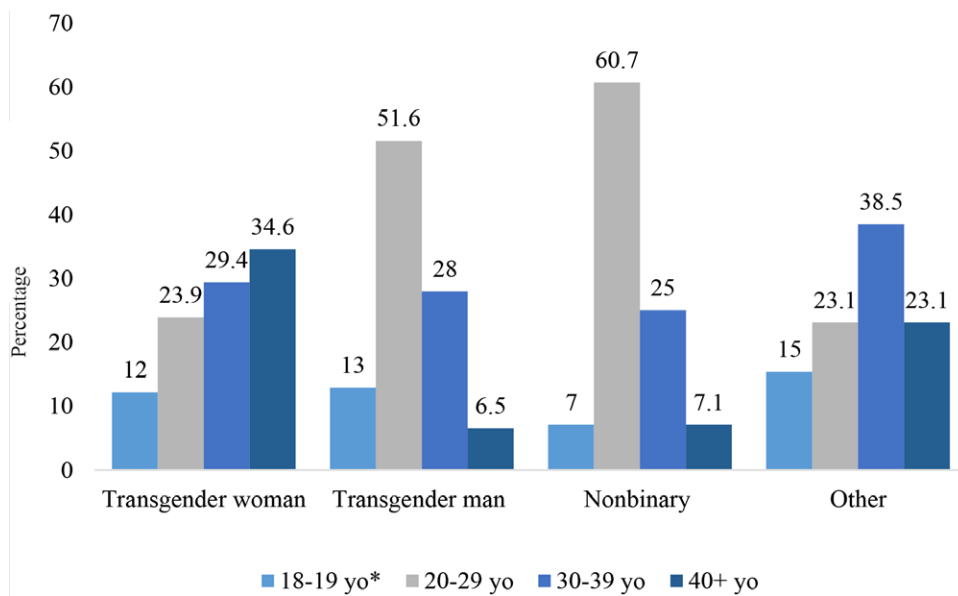
As beauty is in the eye of the beholder, breast aesthetics may differ based on geographic location and culture. Several studies have examined the preferred breast aesthetics in various countries, such as Colombia, Turkey, Malaysia, New Zealand, and Poland, to name a few.<sup>12,19–22</sup> In our study,

respondents of all ethnicities, except those who identified as Black, ranked the 45:55 ratio the highest. However, this was a small sample size and not significant. This finding could be indicative of a potential relationship among aesthetic preferences, geographic region, and culture.

Interestingly, although all subgroups ranked the 45:55 ratio as a preferred ratio, those who identified with less feminine gender identities and were assigned female at birth equally preferred the 50:50 ratio, which has a larger upper pole projection. This finding is in contrast to what was reported by Mallucci and Branford,<sup>11</sup> as male respondents in their study overwhelmingly preferred the 45:55 over the 50:50 ratio. Our data aligns more with other studies that have suggested that more masculine-identifying individuals prefer a larger upper pole.<sup>19,21,23</sup> The preference toward a larger sized bust or upper pole may stem from evolutionary biology, wherein a larger bust is associated with higher levels of estradiol, progesterone, and chances of conception.<sup>21,23,24</sup> However, when stratified by age, transgender men younger than 30 actually prefer the 45:55 ratio, whereas those who were older prefer the larger upper pole ratio (50:50). Therefore, for transgender individuals, the preference toward a larger upper pole may be more affected by life experiences and societal expectations than subconscious evolutionary pressures.



**Fig. 5.** Randomized panel images of different upper-to-lower pole ratios of a larger breast size. The upper-to-lower pole ratios are shown in the top left-hand corner of each panel. These ratios were replaced by letters (ie, A, B, C, and D) in the survey.



**Fig. 6.** Distribution of respondents by age and gender identity. Percentages are listed above each bar. \*Years old.

From a widely distributed Colombian survey for cosmetic augmentation mammoplasty in 2021, Jimenez and

Gómez<sup>12</sup> reported that respondents who were younger than 30, female, and had a history of breast augmentation

**Table 1. The Most and Least Preferred Ratios for Respondents by Demographic Subtype**

Demographic	No.	35:65	45:55	50:50	55:45	<i>P</i>
All responses	298	L	M			0.046
Gender						
Transgender woman	197	L	M			0.057
Transgender man	31	L	MT	MT		0.12
Nonbinary	28		M		L	0.15
Other	13		MT	MT	L	0.21
Sex assigned at birth						
Male	168		M		L	0.062
Female	125	L	MT	MT		0.071
Other*	5		M			0.31
Age						
18–19	36	L	MT	MT		0.13
20–29	95		MT	MT	L	0.081
30–39	89	L	MT	MT		0.84
40–49	39	L	M			0.13
50 and older	39		M		L	0.13
History of breast augmentation						
Yes	81		MT	MT	L	0.088
No, not considering	136	L	M			0.068
No, but considering	81	LT	M		LT	0.088
Ethnicity						
White	163	L	M			0.062
Latinx	41		M		L	0.12
Asian	26	L	M			0.16
Mixed	17	L	M			0.19
Black*	11			M		0.23
Pacific Islander	3		MT	MT	L	0.38
Middle Eastern*	2		MT	MT		0.50
Native American	2		M		L	0.50
Other	4	LT	M		LT	0.38
Marriage status						
Single	180	L	MT	MT		0.059
Living with partner	46		M		L	0.12
Married	39	L	MT	MT		0.13
Divorced	22		M		L	0.17
Separated	9	L	M			0.25
Widowed	2		M		L	0.50

L, least preferred ratio; LT, equally least preferred ratio; M, most preferred ratio; MT, equally most preferred ratio.

\*A least preferred ratio could not be reported because the three remaining ratios were equally tied.

A *P* value <0.05 (indicated in bold) was considered statistically significant.

**Table 2. The Most and Least Preferred Ratios for Respondents by Gender and Age**

Gender and age	No.	35:65	45:55	50:50	55:45	<i>P</i>
Transgender woman	197					
18–19	24	LT	M		LT	0.16
20–29	47		MT	MT	L	0.11
30–39	58	LT	MT	MT	LT	0.10
40–49	34	L	M			0.14
50 and older	34		M		L	0.14
Transgender man	31					
18–19	4	L	M			0.38
20–29	16	L	M			0.20
30–39	9	L		M		0.25
40 and older	2	L		M		0.50
Nonbinary	28					
18–19	2		M		L	0.062
20–29	17		M		L	0.071
30–39	7		M		L	0.31
40 and older	2		M		L	0.50
Other	13					
18–19	2		MT	MT	L	0.13
20–29	3		M		L	0.081
30–39	5		MT	MT	L	0.84
40 and older	3			M	L	0.13

L, least preferred ratio; LT, equally least preferred ratio; M, most preferred ratio; MT, equally most preferred ratio.

preferred the 50:50 proportion, while those older than 30 preferred a more natural looking breast of 40:60. Similarly, our results indicate that those who are younger than 30 and identify with more feminine gender identities equally prefer the 45:55 and 50:50 ratios. Respondents who had a prior history of breast augmentation also equally prefer

the 45:55 and 50:50 ratios. After breast augmentation, breast implants naturally settle over time by dropping further down the chest wall due to gravity. Therefore, patients who have undergone a breast augmentation may desire the 50:50 ratio since they perhaps prefer that initial fuller upper pole projection that is seen immediately after the



procedure. Respondents who had not undergone surgery and were considering breast augmentation only ranked the 45:55 ratio the highest, since they most likely have not experienced a fuller upper bust that comes from initial implant placement.

From the principal investigator's experience, larger implants are often needed to compensate for wider chest and breast widths in trans women to achieve adequate breast volume. Often times, patients may also desire larger breasts and upper pole fullness to compensate for misgendering, which can be a cause of significant gender dysphoria. However, the results of this study still showed the 45:55 ratio as the most preferred ratio.

We acknowledge there are several limitations to this study. First, the primary editing focus of the morphed images was on the upper-to-lower pole ratios, and less so on the NAC. Sizing, shaping, and angulation of the nipple and areola may have looked less natural as the rest of the breast mound was altered. Additionally, the shading of the breast skin may have been distorted during the alteration, possibly influencing respondents to prefer or dislike a panel. Although we followed the technique outlined by Mallucci and Branford to create the image panels, several studies have commented on the subjective limitations of this method.<sup>15,25,26</sup> Measuring the vertical length of the upper pole is dependent on the upper margin of the breast. Determining where the upper border of the breast mound stops and the chest wall starts in photographs is subjective.<sup>15</sup> In order to develop the different breast ratios, the nipple had to be placed on the breast mound that allocated the correct proportional volumes to the upper and lower poles. We acknowledge that nipple placement could have influenced respondents' preferences.

Second, our study primarily focused on the nude breast and did not evaluate aesthetic preferences for breasts in clothes, which could significantly alter aesthetic preferences. We also tried to use photographs from patients who varied in BMI, body habitus, adiposity, and breast implant size. These were the best representations accounting for these variables.

Images were also only depicted in the three-quarters profile pose, which may not fully translate into real-life perceptions. Finally, because all respondents were seen at a single institution, our results may not reflect preferences from various geographic locations and cultures.

Despite these limitations, this is the first investigation of the aesthetic preferences from transgender patients and provides greater insight to inform preoperative planning and shared decision-making with patients undergoing gender-affirming breast augmentation. Ultimately, we acknowledge that the surgical approach and outcome of gender-affirming breast augmentation are best discussed between the individual patient and their provider. As with all surgical consultations, we recommend surgeons to continue engaging in shared decision-making with patients, eliciting their goals, expectations, and concerns. Although the upper-to-lower pole ratio is just one component of a vast array of parameters that are discussed in preoperative planning, patients can still be educated about this ratio when discussing options to best achieve their desired outcome.

## CONCLUSIONS

Similar to previous studies with cisgender respondents, our study found that the 45:55 ratio is the most preferred among transgender patients for breast augmentation. These results may serve as a guide to improve shared decision-making with transgender patients and help surgeons better serve their patients' goals for improved outcomes. This study is the first to consider how transgender patients view breast aesthetics and further enrich the ongoing discussion of gender-affirming surgery.

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*This study was approved by the University of California, San Francisco Institutional Review Board and conforms to the Declaration of Helsinki.*

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