

Research

A 10-Year Review of Surgical Outcomes at the Johns Hopkins and University of Maryland Resident Aesthetic Clinic

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Abstract

Background: In 2014, the Plastic Surgery Residency Review Committee of the Accreditation Council for Graduate Medical Education (ACGME) increased minimum aesthetic surgery requirements. Consequently, the resident aesthetic clinic (RAC) has become an ever more important modality for training plastic surgery residents.

Objectives: To analyze demographics and long-term surgical outcomes of aesthetic procedures performed at the Johns Hopkins and University of Maryland (JH/UM) RAC. A secondary objective was to evaluate the JH/UM RAC outcomes against those of peer RACs as well as board-certified plastic surgeons.

Methods: We performed a retrospective chart review of all patients who underwent aesthetic procedures at the JH/UM RAC between 2011 and 2020. Clinical characteristics, minor complication rates, major complication rates, and revision rates from the JH/UM RAC were compared against 2 peer RACs. We compared the incidence of major complications between the JH/UM RAC and a cohort of patients from the CosmetAssure (Birmingham, AL) database. Pearson's chi-square test was used to compare complication rates between patient populations, with a significance set at 0.05.

Results: Four hundred ninety-five procedures were performed on 285 patients. The major complications rate was 1.0% (n = 5). Peer RACs had total major complication rates of 0.2% and 1.7% ($P = .07$ and $P = .47$, respectively). CosmetAssure patients matched to JH/UM RAC patients were found to have comparable total major complications rates of 1.8% vs 0.6% ($P = .06$), respectively. At JH/UM, the minor complication rate was 13.9%, while the revision rate was 5.9%.

Conclusions: The JH/UM RAC provides residents the education and training necessary to produce surgical outcomes comparable to peer RACs as well as board-certified plastic surgeons.

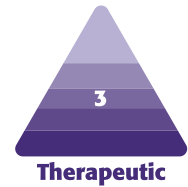
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Teaching aesthetic surgery principles is a key goal of plastic surgery training programs. In 2014, the Accreditation Council for Graduate Medical Education (ACGME) increased the minimum requirement for aesthetic procedures by nearly 3-fold from 55 to a total of 150.¹ However, integrating aesthetic surgery training in academic programs poses a myriad of challenges.² While a team-oriented approach with rotating resident coverage works well in reconstructive surgery, the fee-for-service nature of aesthetic surgery comes with the expectation of privacy and personalized attention exclusively from 1 attending surgeon.¹ As a result, resident education in aesthetic disciplines can be inferior to other aspects of training when relegated to an observational or assisting role with no independent decision-making capability and limited hands-on surgical experience.³

The resident aesthetic clinic (RAC) model addresses these concerns by providing residents graduated autonomy in the clinical and operative setting under an attending surgeon's supervision. In the RAC, residents perform preoperative evaluations, develop operative skills, and manage postprocedural complications. Patients benefit by paying markedly reduced fees for elective procedures while still enjoying the benefits of university-level care.²⁻⁴ This model can also increase the accessibility of aesthetic services to broader socioeconomic demographics.^{5,6} The RAC model was first reported by the University of Toronto in 1989 and has since been shown to be a significantly beneficial educational experience in many institutions in the United States without sacrificing patient outcomes.^{4,5,7,8} In fact, over two-thirds of plastic surgery residency training programs in the United States now have a dedicated RAC.⁹ However, there are few up-to-date, long-term analyses of outcomes and experiences of RACs at major academic medical centers. Better understanding of the strengths and deficiencies of RACs is integral to the continued evolution and adoption of this increasingly popular educational modality.

The Johns Hopkins and University of Maryland RACs were created in 1990 by Drs P.N.M. and N.H.G., respectively, and are collectively referred to as the Johns Hopkins and University of Maryland (JH/UM) RAC. For the last 3 decades, these 2 clinics have provided plastic surgery residents in the JH/UM integrated residency program the opportunity to develop the confidence, independence, and surgical skills needed for competent aesthetic care. The purpose

of this study was to characterize demographics and surgical outcomes for all patients who underwent aesthetic surgery at the JH/UM RAC from 2011 to 2020. A secondary aim of this study was to evaluate patient safety by comparing the JH/UM RAC outcomes to published outcomes from peer RACs, as well as to national outcomes from board-certified plastic surgeons as derived from the CosmetAssure (Birmingham, AL) database.

METHODS

Study Characteristics

This study was approved by the Johns Hopkins Institutional Review Board (IRB#00280933). We conducted a 10-year retrospective chart review of all patients who underwent aesthetic procedures at the JH/UM RAC from 2011 to 2020. The primary variables of interest were postoperative complication rates and revision rates. The JH/UM RAC outcomes were compared against the literature published by 2 peer RACs from (1) Wake Forest Baptist Health and (2) Washington University St. Louis. These 2 RACs were selected for reporting: range of study in years, number of patients, follow-up time, number of each type of procedure, rates of major and minor complications, and rates of revision surgery. A third RAC that fulfilled these requirements was excluded for not being based in the United States.¹⁰

Rates of major complications were compared between the JH/UM RAC and the CosmetAssure database. CosmetAssure is an insurance program that has been used since 2008 to cover unexpected medical expenses due to postaesthetic surgery complications.¹¹ CosmetAssure defines a major complication as an event requiring an emergency room visit, hospital admission, or reoperation within 30 days of the procedure. These events include, but are not limited to, venous thromboembolism, deep venous thrombosis, and infection; all complications managed in a clinic setting are considered minor and therefore are not recorded in the CosmetAssure database. The definition of major complications was comparable between the CosmetAssure database and the 3 RACs. Rates of major complications from CosmetAssure were considered benchmarks for national outcomes from board-certified plastic surgeons.

Clinic and Administrative Structure

From 1990 to 2009, the JH/UM RAC allowed chief residents to perform clinic sessions and surgeries under the supervision of 12 part-time, private practice, aesthetic surgery faculty who maintained affiliations with the Division of Plastic Surgery. A patient's initial consultation and operation often had different staffing surgeons. In 2009, a single full-time faculty surgeon (A.N.R., senior author) was appointed Director of the JH/UM RAC and supported by 2 other full-time faculty. The Director performed approximately 80% of the cases, while the other faculty performed approximately 10% of the cases. Operations were performed in a procedure room at the Johns Hopkins Outpatient Center and anesthesia was administered via intravenous sedation by a certified registered nurse anesthetist. Surgeries were limited to a maximum of 5 h of operative time. Generally, liposuction was limited to 5 L of lipoaspirate, no intranasal or turbinate work was performed, and only side-to-side positioning was allowed (ie, no prone positioning).

In 2011, all JH/UM RAC activities were moved to a free-standing surgicenter at which chief residents completed a 3-month rotation. Anesthesia was switched to general endotracheal anesthesia. One day each week was dedicated to a half-day of clinic and a half- or full-day of surgery. The chief resident acted as the primary surgeon whose responsibilities included preoperative assessment, formulation of the surgical plan, execution of surgery, and postoperative care.

From 2009 to 2012, the JH/UM policy was abstinence from nicotine-containing products for a minimum of 6 weeks prior to surgery and with blood cotinine level testing in higher risk cases such as body contouring to confirm compliance. Because compliance can never be verified with 100% assurance, the decision to proceed with surgery was made on a case-by-case basis: daily/heavy smokers desiring procedures associated with the high risk of wound healing problems (ie, abdominoplasty) were routinely denied surgery, whereas relatively low-risk procedures (ie, facial) were much more likely to be performed even when the patient was an active smoker.

Today, the JH/UM RAC is run by the PGY6 plastic residents (approximately 5 total), although residents at all levels participate in the clinic and assist the chief residents in the operating room (OR). Two board-certified attendings act as the supervising faculty with the support of 1 PA. At least 1 attending is in the OR for the majority of each surgery. The chief residents continue to be responsible for preoperative assessment, formulation of the surgical plan, and postoperative care with attending oversight. Insurance coverage is available in the event of a complication requiring a return to the OR or hospital admission. Performing surgery on patients who actively smoke is a

case-by-case decision from both the preceptors and the resident. Patients are warned of the risks associated with smoking and surgery but do not undergo tests to ensure compliance. For high-risk procedures, such as facelifts, patients are routinely told to quit smoking 4 to 6 weeks before surgery. Overall, decision to operate is driven by a discussion of the risks, request to quit, and patient reports of their smoking status.

Patient Population and Data Collection

Patient characteristics were reviewed via electronic medical records. Patients were included in this study if: (1) they underwent an aesthetic procedure at the JH/UM RAC and (2) the procedure occurred between January 1, 2011, and December 31, 2020. Patients with incomplete operative details were excluded. For each patient, data were collected on age, gender, BMI, comorbidities, procedure type (breast, body contouring, or facial) and subtype (specific operation performed), complications, revision surgeries, and follow-up time. All procedures were treated as separate events.

Complications were classified as either minor or major. Minor complications consisted of seroma/hematoma, delayed wound healing (not requiring reoperation), infection requiring oral antibiotics, ectropion, and temporary nerve dysfunction. Major complications consisted of emergent/unplanned return to the OR, in-patient hospitalization, pneumothorax (requiring/not requiring chest tube placement), pulmonary embolism, and mortality.

All revision surgeries were performed at the request of the patient. Revisions for procedures done at outside hospitals were not recorded. Common revisions included excision of postsurgical contour and scar abnormalities, and revision liposuction. Surgeons recommended the patient wait 12 months after the original procedure before undergoing revision. Most revision surgeries were performed in the clinic under local anesthesia. Reasons for revision surgery to be performed in the OR included facial procedures, 1 breast implant malposition, and revisions that were performed at the same time as other surgeries. All events were recorded from the day of surgery until the last day of follow-up.

Statistical Analysis

Descriptive statistics were used to summarize demographic and surgical outcomes. The mean and standard deviation were reported for continuous variables; incidence rate and percentages were reported for categorical variables. To compare surgical outcomes and complication rates between the different patient populations, a Pearson's chi-square test was used with alpha set to 0.05. A chi-square test of independence was used with

Table 1. Patient Demographics

Demographic	N (%)
Mean age in years	47.1 (13.3)
Gender	
Female	271 (95.1)
Male	14 (4.9)
BMI	
Mean BMI (SD)	27.7 (5.5)
Obese, BMI \geq 30	83 (29.9)
Smoking	
Current	18 (6.3)
Former	79 (27.2)
Non-smoker	186 (65.3)
Unknown	2 (0.7)
Diabetes	17 (6.0)
Hypertension	44 (15.4)
Follow-up in days (SD)	129.2 (162.2)

SD, standard deviation

alpha set to 0.05 to evaluate the association between active smoking and adverse surgical outcomes. All statistical analysis was done using STATA v15.0 (College Station, TX).

RESULTS

The JHUM Resident Aesthetic Clinic

After a thorough chart review and data extraction, 285 patients who underwent a total of 495 aesthetic surgeries were included in the study. The study population had a mean age of 47.1 ± 13.3 years, was predominantly female ($n=271$, 95.1%), and had a mean BMI of 27.7 ± 5.5 (Table 1). Comorbidities included active smoking ($n=18$, 6.3%), diabetes ($n=17$, 6.0%), and hypertension ($n=44$, 15.4%). The mean follow-up time was 129.2 ± 162.2 days.

Regarding procedure type, 73 (25.6%) patients underwent a total of 79 aesthetic procedures for the breast, 169 (59.3%) patients underwent 203 body contouring procedures, and 95 (33.3%) underwent 213 facial procedures (Figure). The most common breast-related procedure was breast augmentation ($n=33$, 41.8%) (Table 2). Similarly, the most common body contouring procedure was abdominoplasty with or without liposuction ($n=119$, 58.6%) (Table 3). The most common facial procedure was blepharoplasty ($n=55$, 25.8%) closely followed by rhytidectomy ($n=47$, 22.1%) (Table 4).

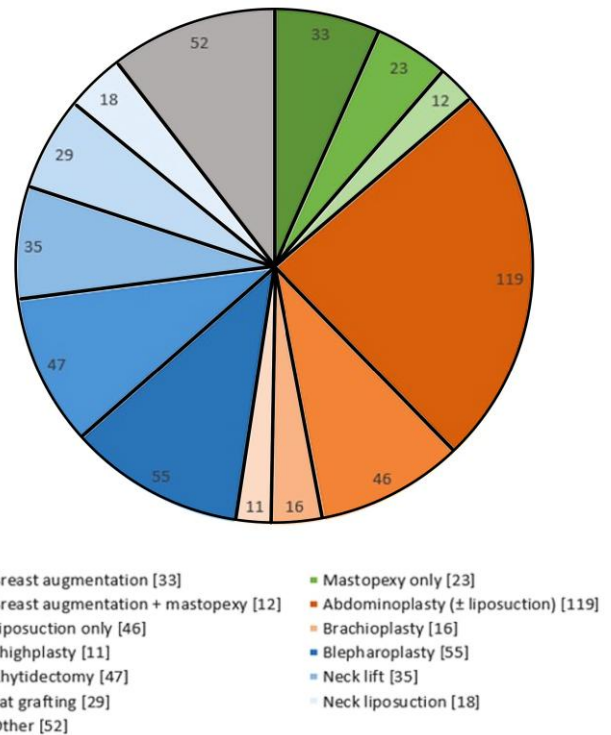


Figure. A pie chart of the aesthetic procedures performed on 285 patients at the Johns Hopkins and University of Maryland resident aesthetic clinic from 2011 to 2020. “Other (52)” includes all procedures that were performed less than 10 times (brow lift [9], canthoplasty [6], rhinoplasty [6], capsulotomy/implant removal [6], lower body lift [3], and reduction mammoplasty [2]).

The overall incidence of major complications among all procedures was 1.0% ($n=5$), while there was an overall minor complications rate of 13.9% ($n=69$) (Table 5). For breast-related procedures, the overall minor and major complication rates were 12.7% ($n=10$) and 1.3% ($n=1$), respectively. For body contouring procedures, the minor and major complication rates were 14.8% ($n=30$) and 1.0% ($n=2$), respectively. Finally, for facial procedures, the minor and major complication rates were 13.6% ($n=29$) and 0.9% ($n=2$), respectively.

The most common complications with breast-related procedures were delayed wound healing and infection requiring antibiotics, each occurring at a rate of 4.1% ($n=3$). Similarly, for body contouring procedures, the most common complications were seroma or hematoma (5.9%, $n=10$), and infection requiring antibiotics (5.3%, $n=9$). For facial procedures, the most common complications were ectropion, temporary facial nerve dysfunction, and in-patient hospitalization, each reported at a rate of 3.2% ($n=3$). A chi-square test of independence showed there was a significant association between being an active smoker and minor complications ($P=.0235$). As such, active smokers were more likely than nonsmokers to experience minor complications following

Table 2. Complication and Revision Rates of Breast Surgeries

Surgery	Number performed	Minor complications ^a (%)	Major complications ^b (%)	Revisions (%)
Breast augmentation	33	2 (6.1)	0 (0.0)	1 (3.0)
Mastopexy	23	5 (21.7)	1 (4.3)	0 (0.0)
Breast augmentation + mastopexy	12	1 (8.3)	0 (0.0)	0 (0.0)
Capsulotomy/implant removal	6	0 (0.0)	0 (0.0)	0 (0.0)
Other	4	1 (25.0)	0 (0.0)	0 (0.0)
Breast reduction	2	1 (50.0)	0 (0.0)	0 (0.0)
Total	79	10 (12.7)	1 (1.3)	1 (1.3)

Major complication, minor complication, and revision rates of breast procedures performed at the Johns Hopkins and University of Maryland RAC from 2011 to 2020. RAC, resident aesthetic clinic. ^aMinor complication classified as seroma/hematoma, delayed wound healing (not requiring reoperation), infection requiring oral antibiotics, ectropion, or temporary nerve dysfunction. ^bMajor complications classified as emergent/unplanned return to the operating room, in-patient hospitalization, pneumothorax (requiring/not requiring chest tube placement), pulmonary embolism, and mortality.

Table 3. Complication and Revision Rates of Body Contouring Surgeries

Surgery	Number performed	Minor complications ^a (%)	Major complications ^b (%)	Revisions (%)
Abdominoplasty (\pm liposuction)	119	17 (14.3)	2 (1.7)	2 (10.1)
Liposuction	46	4 (8.7)	0 (0.0)	1 (2.1)
Brachioplasty	16	3 (18.75)	0 (0.0)	3 (18.8)
Thighplasty	11	4 (36.4)	0 (0.0)	3 (27.3)
Other	8	1 (12.5)	0 (0.0)	0 (0.0)
Lower body lift	3	1 (33.3)	0 (0.0)	0 (0.0)
Total	203	30 (14.8)	2 (1.0)	19 (9.4)

Major complication, minor complication, and revision rates of breast procedures performed at the Johns Hopkins and University of Maryland RAC from 2011 to 2020. RAC, resident aesthetic clinic. ^aMinor complication classified as seroma/hematoma, delayed wound healing (not requiring reoperation), infection requiring oral antibiotics, ectropion, or temporary nerve dysfunction. ^bMajor complications classified as emergent/unplanned return to the operating room, in-patient hospitalization, pneumothorax (requiring/not requiring chest tube placement), pulmonary embolism, and mortality.

surgery. However, using tobacco products was not shown to increase the likelihood of experiencing major complications, revisions, or emergency department visits.

The overall revision rates for each procedure type were: 1.3% ($n = 1$) for breast, 9.4% ($n = 19$) for body contouring, and 4.2% ($n = 9$) for facial. The top 3 procedure subtypes that required revision surgery were: thighplasty (27.3%, $n = 2$), brachioplasty (18.8%, $n = 3$), and brow lift (11.1%, $n = 1$). Rhytidectomies had the greatest total number of revisions ($n = 5$, 10.6%). The overall revision rate for all procedures was 5.9% ($n = 29$).

Comparison Against Peer Resident Aesthetic Clinics

We assessed the JH/UM RAC demographics and surgical outcomes against those of 2 peer institutions' RACs: the Wake Forest Baptist Health (Wake Forest RAC)¹² and

Washington University St. Louis (WashU RAC).¹³ The 2 RACs were selected based on their reporting patient characteristics, procedures performed, rates of minor complications, and rates of revision surgeries (Table 6).

Patient Characteristics

Patient characteristics from the JH/UM RAC were comparable to those from the Wake Forest RAC and WashU RAC. From 2000 to 2013, the Wake Forest RAC performed 578 major procedures on 326 patients who had a mean age of 40.8 years. The WashU RAC performed 175 procedures on 112 patients with a mean age of 39.9 years from 2010 to 2015. From 2011 to 2020, the JH/UM RAC clinic performed 495 procedures on 285 patients who averaged 47.1 years. The average number of procedures per year for the Wake Forest, WashU, and JH/UM RACs was 45, 35, and 50, respectively, while the average number of patients per year was 25, 22, and 29, respectively. The follow-up time for

Table 4. Complication and Revision Rates of Facial Surgeries

Surgery	Number performed	Minor complications ^a (%)	Major complications ^b (%)	Revisions (%)
Blepharoplasty	55	10 (18.2)	1 (1.8)	2 (3.6)
Rhytidectomy	47	8 (17.0)	1 (2.1)	5 (10.6)
Neck lift	35	2 (5.7)	0 (0.0)	1 (2.9)
Fat grafting	29	3 (10.3)	0 (0.0)	0 (0.0)
Neck liposuction	18	0 (0.0)	0 (0.0)	0 (0.0)
Brow lift	9	1 (11.1)	0 (0.0)	1 (11.1)
Other	8	2 (25.0)	0 (0.0)	0 (0.0)
Canthoplasty	6	3 (50.0)	0 (0.0)	(0.0)
Rhinoplasty	6	0 (0.0)	0 (0.0)	(0.0)
Total	213	29 (13.6)	2 (0.9)	9 (4.2)

Major complication, minor complication, and revision rates of breast procedures performed at the Johns Hopkins and University of Maryland RAC from 2011 to 2020. RAC, resident aesthetic clinic. ^aMinor complication classified as seroma/hematoma, delayed wound healing (not requiring reoperation), infection requiring oral antibiotics, ectropion, or temporary nerve dysfunction. ^bMajor complications classified as emergent/unplanned return to the operating room, in-patient hospitalization, pneumothorax (requiring/not requiring chest tube placement), pulmonary embolism, and mortality.

Table 5. Complications and Revisions

Procedure	Major complications (%)	Minor complications (%)	Revisions (%)
Breast procedures	1 (1.3)	10 (12.7)	1 (1.3)
Body contouring procedures	2 (1.0)	30 (14.8)	19 (9.4)
Facial procedures	2 (0.9)	29 (9.4)	9 (4.2)
Total procedures	5 (1.0)	69 (13.9)	29 (5.9)

Wake Forest, WashU, and JH/UM RACs was 76.2, 245, and 129.2 days, respectively.

Procedure Diversity

The Wake Forest and WashU RACs performed a diverse range of aesthetic procedures similar to those done at the JH/UM RAC. The procedure type was sorted into 3 categories (breast, body contouring, and facial) for more accurate comparison across the different clinics. The most common breast-related procedure for all 3 resident clinics was breast augmentation with the Wake Forest RAC performing 58 (out of 119 total breast-related procedures, 48.7%), the WashU RAC performing 28 (out of 55, 51%), and the JH/UM RAC performing 33 (out of 79, 41.8%).

Liposuction was the most common body contouring procedure for the Wake Forest (110 out of 230 cases, 47.8%) and WashU (38 out of 110 cases, 34.5%) RACs, closely followed by abdominoplasty. Abdominoplasty with or without liposuction was by far the most common body contouring

procedure at the [REDACTED] RAC (119 out of 203 cases, 58.6%) followed by liposuction. These data support previous findings that RACs most commonly perform abdominoplasty, breast augmentation, and liposuction.¹⁴

Blepharoplasty was the most common facial procedure for both the Wake Forest (87 out of 185, 47%) and the [REDACTED] RACs (55/213, 25.8%), while the WashU RAC performed 10 facelifts/necklifts out of a total of 19 facial-related procedures (53%). The next most common facial procedure for the WashU RAC was blepharoplasty (6/19, 32%). These data suggest that one of the most common facial procedures performed at a RAC is the blepharoplasty.

Rates of Minor Complications

Minor complications are difficult to compare across the different RACs due to a nonstandardized definition; however, a general understanding of what constituted a minor complication allowed for an approximate comparison between the JH/UM RAC and the 2 peer clinics. The rates of minor complications for each clinic were: 5.9% at Wake Forest, 22.9% at WashU, and 13.9% at the JH/UM RAC. [Tables 7](#) and [8](#) display a general comparison of minor complication rates between the JH/UM and peer RACs.

Rates of Revision Procedures

Revision rates among the RACs may not be accurate due to differing thresholds for revision necessity, as well as uncertainty of the patient returning to the same clinic for the revision surgery. For example, the WashU RAC defined a revision surgery as an OR procedure that was deemed appropriate by the patient and attending to achieve the aesthetic

Table 6. Resident Aesthetic Clinic Characteristics

Study	Study range (years)	Number of procedures	Duration of follow-up (days)	Minor complications ^a (%)	Major complications ^b (%)	Revision surgeries (%)
Qureshi et al ¹²	13	578	76.2	34 (5.9)	1 (0.2)	74 (12.8)
Walker et al ¹³	5	175	245	40 (22.9)	3 (1.7)	5 (2.9)
Taylor et al	10	495	129.2	69 (13.9)	5 (1.0)	29 (5.9)

Selected clinical and surgical outcomes from the Wake Forest, WashU, and Johns Hopkins and University of Maryland RACs. RAC, resident aesthetic clinic. ^aMinor complication classified as seroma/hematoma, delayed wound healing (not requiring reoperation), infection requiring oral antibiotics, ectropion, or temporary nerve dysfunction. ^bMajor complications classified as emergent/unplanned return to the operating room, in-patient hospitalization, pneumothorax (requiring/not requiring chest tube placement), pulmonary embolism, and mortality.

Table 7. Rates of Minor Complications and Revisions Between the Wake Forest RAC and the Johns Hopkins and University of Maryland RAC

Minor complications and revisions by location	N (%)
Minor complications	
Johns Hopkins and University of Maryland RAC	69 (13.9)
Wake Forest RAC	34 (5.9)
<i>P</i> value	0.00005
Revisions	
Johns Hopkins and University of Maryland RAC	29 (5.9)
Wake Forest RAC	74 (12.8)
<i>P</i> value	0.0005

RAC, resident aesthetic clinic.

goals of the patient and was performed no earlier than 1 year from the initial operation. This resembled the JH/UM RAC definition of what constituted a revision. On the other hand, the Wake Forest RAC defined revision surgery “based on a collection of outcome measures for each procedure defined by the literature.” Revision rates were most similar between the JH/UM and WashU RACs at 5.9% and 2.9%, respectively. The overall revision rate for the Wake Forest RAC was 12.8%. Tables 7 and 8 display a general comparison of revision rates between the JH/UM and peer RACs.

Comparison Between Resident Aesthetic Clinics and CosmetAssure

CosmetAssure is a national insurance company that covers complications for patients undergoing aesthetic surgery. Its database has been utilized for outcome assessments in various studies as a national benchmark for attending-level physician care.^{15–19} Here, we compare CosmetAssure rates of major complications against the JH/UM, Wake Forest, and WashU RACs.

Table 8. Rates of Minor Complication and Revisions Between the WashU RAC and the Johns Hopkins and University of Maryland RAC

Minor complications and rates by location	N (%)
Minor complications	
Johns Hopkins and University of Maryland RAC	69 (13.9)
WashU RAC	40 (22.9)
<i>P</i> value	0.02
Revisions	
Johns Hopkins and University of Maryland RAC	29 (5.9)
WashU RAC	5 (2.9)
<i>P</i> value	0.14

RAC, resident aesthetic clinic.

Rates of Major Complications

Gupta et al utilized the CosmetAssure database to compile a data set of procedures and their complications from a cohort of 127,961 patients who underwent aesthetic surgeries from May 2008 to May 2013.¹⁷ We compared the CosmetAssure data set from Gupta et al’s study against that of the JH/UM RAC patient population, respectively (Table 9). For breast procedures (breast augmentation, breast augmentation + mastopexy, and mastopexy), there was a total of 52,885 vs 68 procedures with major complication rates of 1.5% (n = 771) vs 1.5% (n = 1) (*P* = .99). For body contouring procedures (liposuction, abdominoplasty, abdominoplasty + liposuction, brachioplasty, lower body lift, and thigh lift), there was a total of 35,610 vs 206 procedures for major complications rates of 1.9% (n = 684) vs 0.5% (n = 1) (*P* = .14). Lastly, for facial procedures (blepharoplasty, facelift, and facelift + blepharoplasty), there was a total of 12,081 vs 102 procedures with major complications rates of 2.5% (n = 300) vs 1.0% (n = 1) (*P* = .34). The overall major complications rates from the breast, body contouring, and facial procedures listed above were 1.8% (1755/100,576) vs 0.6% (3/475) (*P* = .06).

Table 9. Major Complication Rates Between CosmetAssure (Birmingham, AL) and the Johns Hopkins and University of Maryland RAC

Major complications by location	N (%)
Major complications, breast	
CosmetAssure	771 (1.5)
Johns Hopkins and University of Maryland RAC	1 (1.5)
<i>P</i> value	0.99
Major complications, body	
CosmetAssure	684 (1.9)
Johns Hopkins and University of Maryland RAC	1 (0.5)
<i>P</i> value	0.14
Major complications, facial	
CosmetAssure	300 (2.5)
Johns Hopkins and University of Maryland RAC	1 (1.0)
<i>P</i> value	0.34
Major complications, total	
CosmetAssure	1744 (1.8)
Johns Hopkins and University of Maryland RAC	3 (0.6)
<i>P</i> value	0.06

RAC, resident aesthetic clinic.

As such, there was no difference in rates of major complications between the residents of the JH/UM RAC and the board-certified surgeons of CosmetAssure.

There was no difference in the rate of major complications for breast, body contouring, facial, and total procedures between the JH/UM RAC, and the Wake Forest and WashU RACs (Tables 10, 11, respectively). The major complications rates were 0.2% at the Wake Forest RAC and 1.7% at the WashU RAC, when compared with the overall major complications rate of 1.0% at the JH/UM RAC ($P = .07$ and $P = .47$, respectively). The procedure with the greatest rate of major complications was different among all 3 RACs. For the WashU RAC, abdominoplasty was reported as having the greatest rate of major complications (8.1%, $n = 3$). The Wake Forest RAC's greatest rate of major complications was for liposuction (0.9%, $n = 1$). Finally, the JH/UM RAC had a 4.3% ($n = 1$) greatest major complications rate for mastopexy.

DISCUSSION

The ACGME recently increased the number of aesthetic cases as well as the types of procedures that plastic

Table 10. Major Complication Rates Between the Wake Forest RAC and the Johns Hopkins and University of Maryland RAC

Major complications by location	N (%)
Major complications, breast	
Johns Hopkins and University of Maryland RAC	1 (1.3)
Wake Forest RAC	0 (0.0)
<i>P</i> value	N/A
Major complications, body	
Johns Hopkins and University of Maryland RAC	2 (1.0)
Wake Forest RAC	1 (0.4)
<i>P</i> value	0.46
Major complications, facial	
Johns Hopkins and University of Maryland RAC	2 (0.9)
Wake Forest RAC	0 (0.0)
<i>P</i> value	N/A
Major complications, total	
Johns Hopkins and University of Maryland RAC	5 (1.0)
Wake Forest RAC	1 (0.2)
<i>P</i> value	0.07

RAC, resident aesthetic clinic.

surgery residents must complete, making the RAC an ever more important model in residency training. For over 30 years, the JH/UM RAC has provided a dedicated space to learn about and practice these procedures while maintaining high standards of patient safety and quality. In this study, we reported on the clinical characteristics and surgical outcomes of patients who underwent aesthetic surgery at the JH/UM RAC from 2011 to 2020. We reviewed the JH/UM RAC in relation to 2 peer RACs that had published similar long-term analyses. And finally, we compared the rates of major complications between the JH/UM RAC and the CosmetAssure database. Now, we will discuss resident and program director perspectives on the RAC model, as well as the feasibility and challenges of expanding the resident clinic model to procedures beyond aesthetic surgery.

Resident and Program Direction Perspective

Ingargiola et al surveyed resident-run plastic surgery clinics to better characterize program director satisfaction with the RAC model attached to their respective institutions.¹⁴

Table 11. Major Complication Rates Between the WashU RAC and the Johns Hopkins and University of Maryland RAC

Major complications by location	N (%)
Major complications, breast	
Johns Hopkins and University of Maryland RAC	1 (1.3)
WashU RAC	0 (0.0)
<i>P</i> value	N/A
Major complications, body	
Johns Hopkins and University of Maryland RAC	2 (1.0)
WashU RAC	3 (3.0)
<i>P</i> value	0.21
Major complications, facial	
Johns Hopkins and University of Maryland RAC	2 (0.9)
WashU RAC	0 (0.0)
<i>P</i> value	N/A
Major complications, total	
Johns Hopkins and University of Maryland RAC	5 (1.0)
WashU RAC	3 (1.7)
<i>P</i> value	0.47

RAC, resident aesthetic clinic.

Out of a total of 34 respondents, they found most program directors ($n = 26$) felt satisfied or very satisfied with their institution's RAC, while 3 reported they felt unsatisfied or very unsatisfied. A second survey by Walker et al reported that 96% of chief residents who participated in RAC felt "very comfortable" performing key procedures in aesthetic surgery.¹³ Furthermore, all respondents reported the resident clinic to be a positive resident educational experience. However, when a study by Morrison et al compared survey answers from senior residents and program directors on the topic of resident preparedness in aesthetic surgery, they found that there was a significant difference in opinion.²⁰ The paper concluded that changes in training should be made and should include ways to increase volume and education for facial cosmetics and body contouring. Of note, the majority of residents did feel prepared to integrate cosmetic surgery into their practice upon graduating.

Weissler et al found that residents perceived resident clinics as helpful for both graduation requirements and for raising confidence in aesthetic procedures.⁵ These respondents were also most comfortable (88.5% confidence level) performing breast procedures. They reported the least confidence (66.7%) with face/neck procedures.

However, it should be noted that the level of preparedness was significantly associated with the number of cases performed, such that the more commonly performed facial surgeries of blepharoplasty and rhytidectomy had higher levels of confidence (83.8% and 78.7%, respectively) while the least commonly performed surgeries (brow lifts, otoplasties, and genioplasties) had confidence levels ranging from 52.3 to 64.8%. The study suggests that residents need to perform a minimum of 20 cases to reach a high confidence level for a specific procedure. Moreover, this study reflects the potent educational ability of the RAC—simply increasing the number of procedures performed to 20 increased the residents' confidence in being able to perform that surgery independently. For the JH/UM RAC specifically, we do not observe worse surgical outcomes with facial procedures, despite reports that indicate these procedures are associated with lower levels of confidence. Indeed, the highest rates of major complications were from breast and body surgeries, not face/neck. In other words, a low confidence in a procedure type does not equate to an increase in complication for that procedure type; ultimately, patient safety at the JH/UM RAC is preserved in facial procedures. Overall, the respondents in this study strongly agreed their clinic experience prepared them (mean = 88.4/100) for performing cosmetic procedures independently in practice.

Similarly, Hashem et al found that plastic surgery residents felt most confident with abdominoplasty, breast reduction, and augmentation mammoplasty, while rhinoplasty and facelift were perceived to be more challenging.²¹ Both residents and program directors felt a need for additional training in all facial procedures. This study observed that most residents felt that at least 10 cases should be performed in both rhinoplasty and facelift to achieve confidence. Regardless, the JH/UM RAC once again demonstrates that face/neck surgeries have comparable patient safety profiles as breast and body procedures. A sense of increased challenge in a procedure type does not equate to higher rates of complications or a decrease in patient safety. This study also found that resident clinics were the most preferred modality for aesthetic education, followed by staff aesthetic patients and cadaver dissections.

A recent systematic review by Chen et al assessed 4 national surveys from the literature that evaluated resident perspectives toward the RAC.²² Based on these findings—as well as 6 single-site RAC studies—they proposed a 6-step curriculum framework on how to establish and sustain a successful RAC that maximizes educational value for residents. Novel studies such as this emphasize the growing importance of RACs in achieving AGMCE's increased aesthetic surgical training while also providing actionable data for programs looking to create or improve their own RAC.

Feasibility and Challenges for Resident Clinics Beyond Aesthetic Surgery

RACs are very effective education models for plastic surgery residents to develop operative confidence and independent clinical decision-making. Furthermore, several studies report that these models produce excellent patient outcomes, high patient satisfaction, and improved resident autonomy.^{8,15,23,24} The success of the RAC has prompted several medical institutions to investigate the feasibility of developing similar clinic models beyond aesthetic procedures to increase resident procedural autonomy without sacrificing patient safety.

For example, the Massachusetts General Hospital General (MGHG) created a resident-run minor surgery clinic in 2014, for which Wojcik et al compared surgical outcomes between third-year general surgery residents vs staff surgeons from 2014 to 2018.²⁵ They found no significant difference in the 30-day complication rate when the surgery was performed by a resident vs attending surgeon (2.5% vs 1.9%, $P = .49$), nor a significant difference in patient satisfaction as measured by the quality of care (87.5% top-box rating vs 93.1%, $P = .15$). Finally, a pre- and postrotation survey from the residents found an improved ability to perform a variety of patient care tasks within the rotation. As such, Wojcik et al concluded that a procedure clinic run by mid-level general surgery residents can independently perform office-base procedures without detriment to patient safety or satisfaction. The success of this minor surgery clinic encourages investigation into and development of other specialty-based resident-run clinics among peer medical institutes.

However, resident-run clinics are not without challenges. In the same minor surgery clinic that was praised for increasing resident operative confidence without sacrificing patient safety or satisfaction, Wojcik et al reported that multiple residents felt the clinic model to be a “stressed,” “hectic,” and “rushed” learning environment due to a dense daily procedure schedule. In addition, the model failed to smoothly graduate the residents from a learning capacity to a confident autonomy, as several residents felt like they were not provided enough time to watch or practice a procedure before operating independently. In response to this early feedback, a prerequisite online module was introduced in 2017 for residents to take before starting the clinic. Interventions such as these, coupled with regular critical feedback, can help combat the novel challenges of maintaining a resident-run clinic. Early literature such as the pilot case study of this resident clinic is important in providing a framework for implementing similar clinic models, while recent studies such as Chen et al provide refined protocols for RACs that can be adapted for resident-run clinics outside the field of plastic surgery.^{22,25}

Limitations

Our study has several limitations. The first limitation is its retrospective design, such that we are unable to control exposure or outcome assessment at the JH/UM RAC and instead must rely on accurate recordkeeping. Careful documentation of this patient population and exclusion of patients with incomplete operative details will have helped to minimize this limitation.

A second inherent limitation is that this study is from a single, high-volume, east coast academic institution, which may limit generalizability to other schools. However, outcome comparisons with 2 peer RACs have served to increase generalizability.

A third limitation is our uncertainty as to whether the JH/UM RAC patients went to a surgeon outside the JH/UM RAC for the management of complications or to undergo a revision surgery. As such, the JH/UM RAC complication rate may underestimate the true incidence of complications. Conversely, a high confidence in the JH/UM RAC may have encouraged these patients to return for postprocedural management and, therefore, a comparably higher complication and revision rate may be a good indicator of patient satisfaction with the medical staff and facility. As these patients are not tracked, the accuracy of the JH/UM RAC complication and revision rates falls under question.

A fourth limitation of this study was the inability to assess patient satisfaction with individual procedure outcomes or their experiences with the JH/UM RAC. The lack of subjective patient data limits our analysis to objective procedure outcomes. Future studies may address these limitations by assessing patient satisfaction at the JH/UM RAC to better elucidate clinical outcomes and educational value to residents.

CONCLUSIONS

The JH/UM RAC provides plastic surgery residents a structured space to achieve operative skills and confidence in a diverse range of aesthetic surgeries that ultimately supports the fulfillment of the increased ACGME. Residents of the JH/UM RAC gain this technical expertise without sacrificing patient safety. The rates of major complications are comparable between the JH/UM RAC and (1) the Wake Forest RAC, (2) the WashU RAC, and (3) the CosmetAssure database. No difference in adverse surgical outcomes suggests that residents at the JH/UM RAC perform aesthetic surgeries at both resident and board-certified levels in terms of patient safety. Future studies may include a subjective assessment of patient outcomes at the JH/UM RAC in order to qualify satisfaction with their short- and long-term changes in appearance. One way to

obtain this assessment would be to provide patients with an electronic survey to complete at selected times pre- and postsurgery. This survey would be part of their electronic health record and accessible for study.

Peer institutions should consider structuring their RACs in a similar manner to the JH/UM RAC to help promote comparable surgical outcomes. Accordingly, the clinic structure should include (1) at least 2 board-certified plastic and reconstructive surgeons as supporting faculty and (2) at least 1 mid-level healthcare provider, such as a Physician Assistant. The inclusion of a diverse range of procedures and large but manageable case volume will increase resident confidence in procedures that are classically seen as challenging, such as facial procedures. A stricter smoking cessation policy may prevent minor complications postsurgery. Overall, an RAC should balance plastic surgery resident education with patient safety and satisfaction.

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