

# A Propensity Score-Matched Analysis of Geographic Distance in Immediate Free Flap and Implant-Based Breast Reconstruction



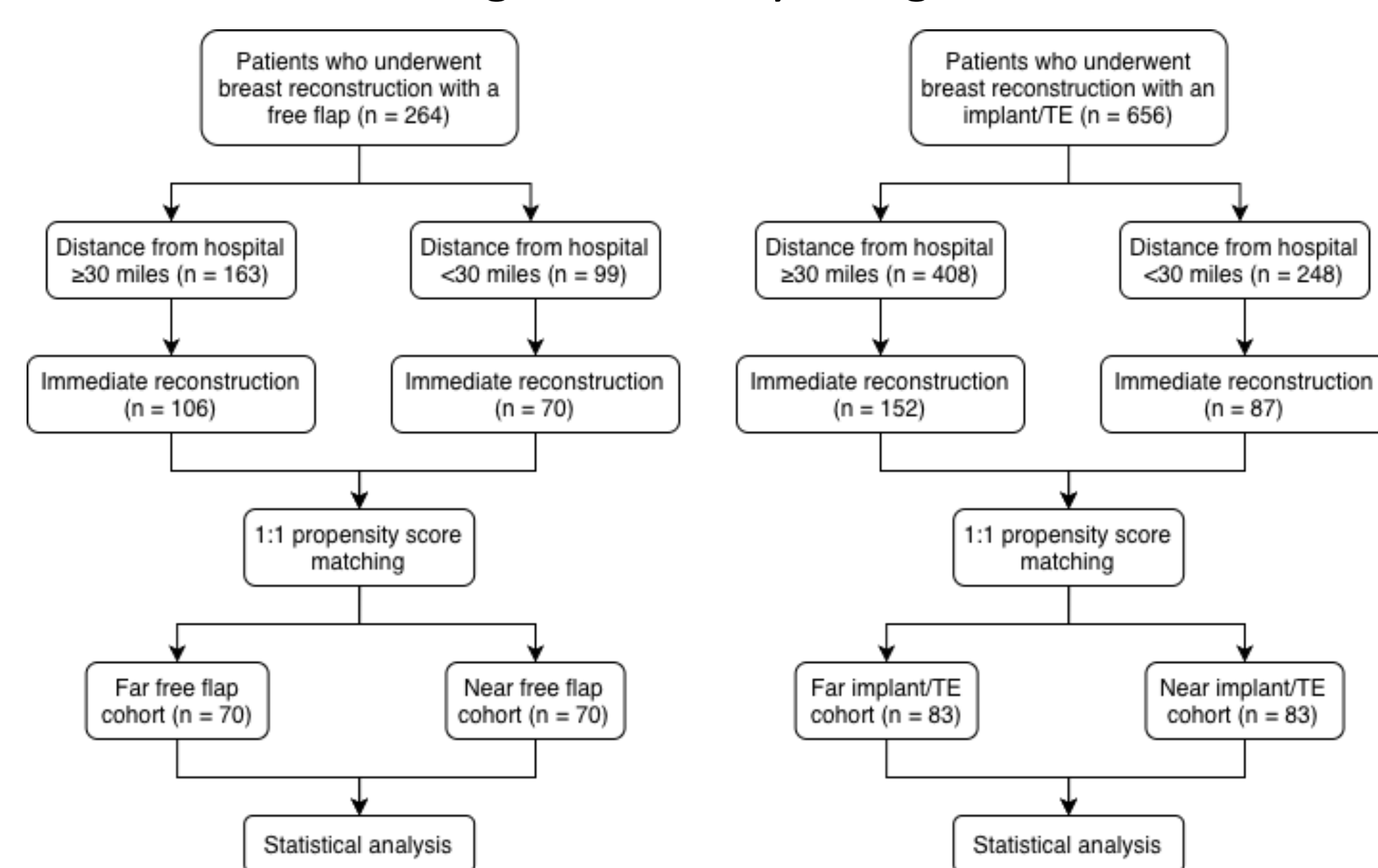
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## INTRODUCTION

- Immediate postmastectomy reconstruction helps avoid a second surgery and improves aesthetic and psychological outcomes.
  - Implant-based reconstruction is typically faster with shorter recovery.
  - Autologous reconstruction offers more natural and durable results.
- While microsurgery is more technically demanding, implants carry risks of device-related complications.
- Greater geographic distance is associated with reduced access to reconstruction, particularly autologous procedures.<sup>1</sup>
- Limited data exist exploring whether geographic distance influences postoperative outcomes, care utilization, and financial performance differently across reconstruction modalities.

## METHODS

Figure 1. Study design



- Single-center retrospective review from 2017 to 2023
- Inclusion criteria were immediate reconstruction.
- Patient home ZIP codes were geocoded, and great-circle (Haversine) distance to the hospital was calculated.
- Cohorts were separately propensity score matched based on laterality, chemotherapy, radiation, age, smoking status, diabetes, hypertension, heart disease, and vascular disease.
- Paired t-tests and McNemar's tests were used for statistical analysis with  $p < 0.05$  considered significant.

## RESULTS

Table 1. Free Flap Patient Characteristics

	Far (n = 70)	Near (n = 70)	P-Value
Age (Years)	51.0 ± 11.2	50.4 ± 11.1	0.78
BMI (kg/m <sup>2</sup> )	28.6 ± 5.6	29.7 ± 5.8	0.30
Smoking Status			0.10
Current	1.4% (1)	7.1% (5)	
Former/Never	98.6% (69)	92.9% (65)	
Hypertension	21.4% (15)	25.7% (18)	0.51
Type II Diabetes	11.4% (8)	7.1% (5)	0.26
Congestive Heart Failure	0% (0)	0% (0)	NA
Coronary Artery Disease	0% (0)	1.4% (1)	0.32
Vascular Disease	1.4% (1)	4.3% (3)	0.16
Chemotherapy	32.9% (23)	27.1% (19)	0.48
Radiation	8.6% (6)	5.7% (4)	0.48
Reconstruction Type			0.19
Unilateral	64.3% (45)	54.3% (38)	
Bilateral	35.7% (25)	45.7% (32)	

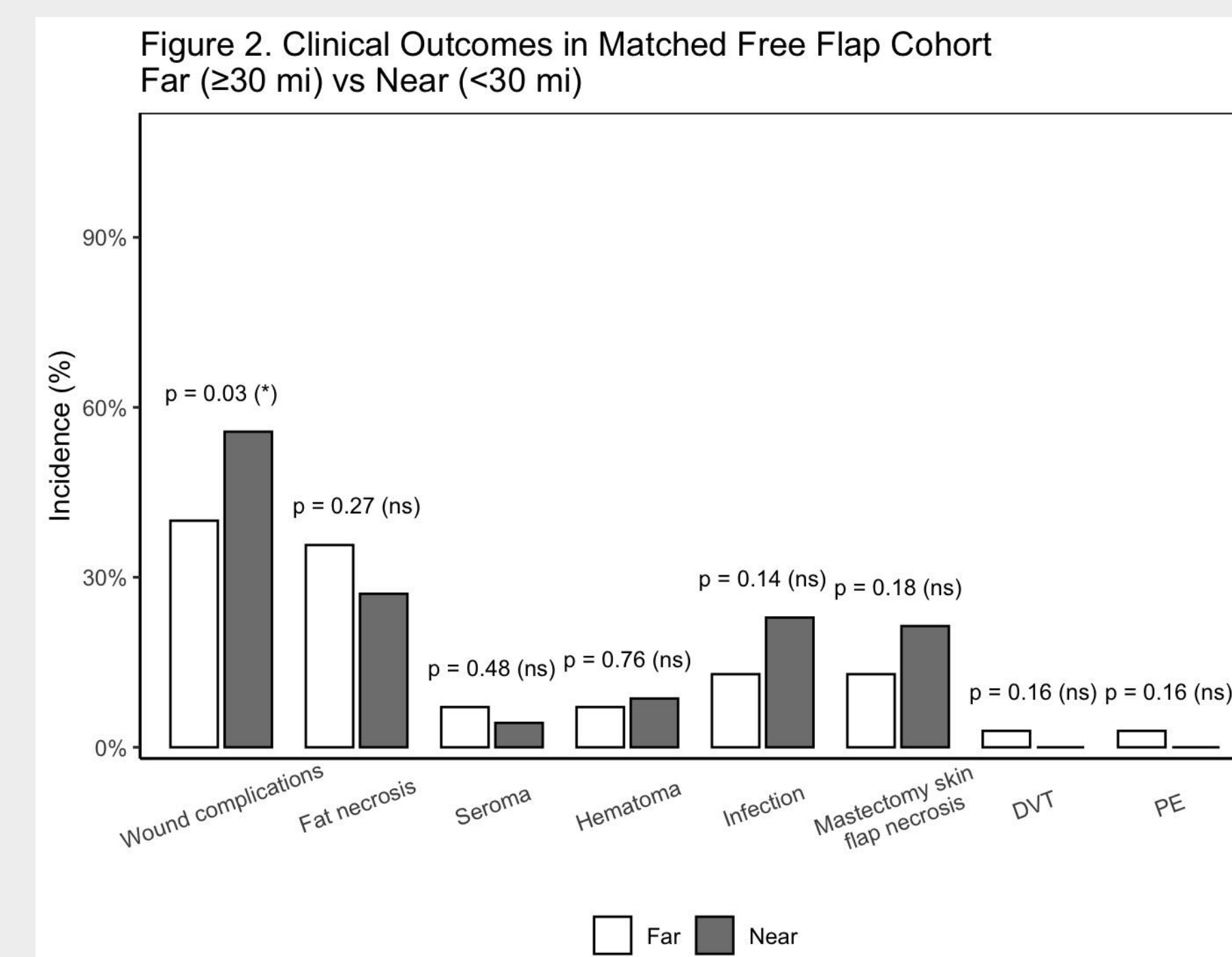


Table 2. Implant/TE Patient Characteristics

	Far (n = 83)	Near (n = 83)	P-Value
Age (Years)	47.8 ± 11.8	48.0 ± 11.6	0.89
BMI (kg/m <sup>2</sup> )	26.7 ± 5.2	26.4 ± 6.3	0.64
Smoking Status			0.32
Current	7.2% (6)	3.6% (3)	
Former/Never	92.3% (77)	96.4% (80)	
Hypertension	33.7% (28)	32.5% (27)	0.87
Type II Diabetes	14.5% (12)	18.1% (15)	0.53
Congestive Heart Failure	6.0% (5)	7.2% (6)	0.71
Coronary Artery Disease	8.4% (7)	9.6% (8)	0.74
Vascular Disease	0% (0)	0% (0)	NA
Chemotherapy	27.7% (23)	28.9% (24)	0.86
Radiation	12.0% (10)	7.2% (6)	0.29
Reconstruction Type			0.30
Unilateral	44.6% (37)	51.8% (43)	
Bilateral	55.4% (46)	48.2% (40)	

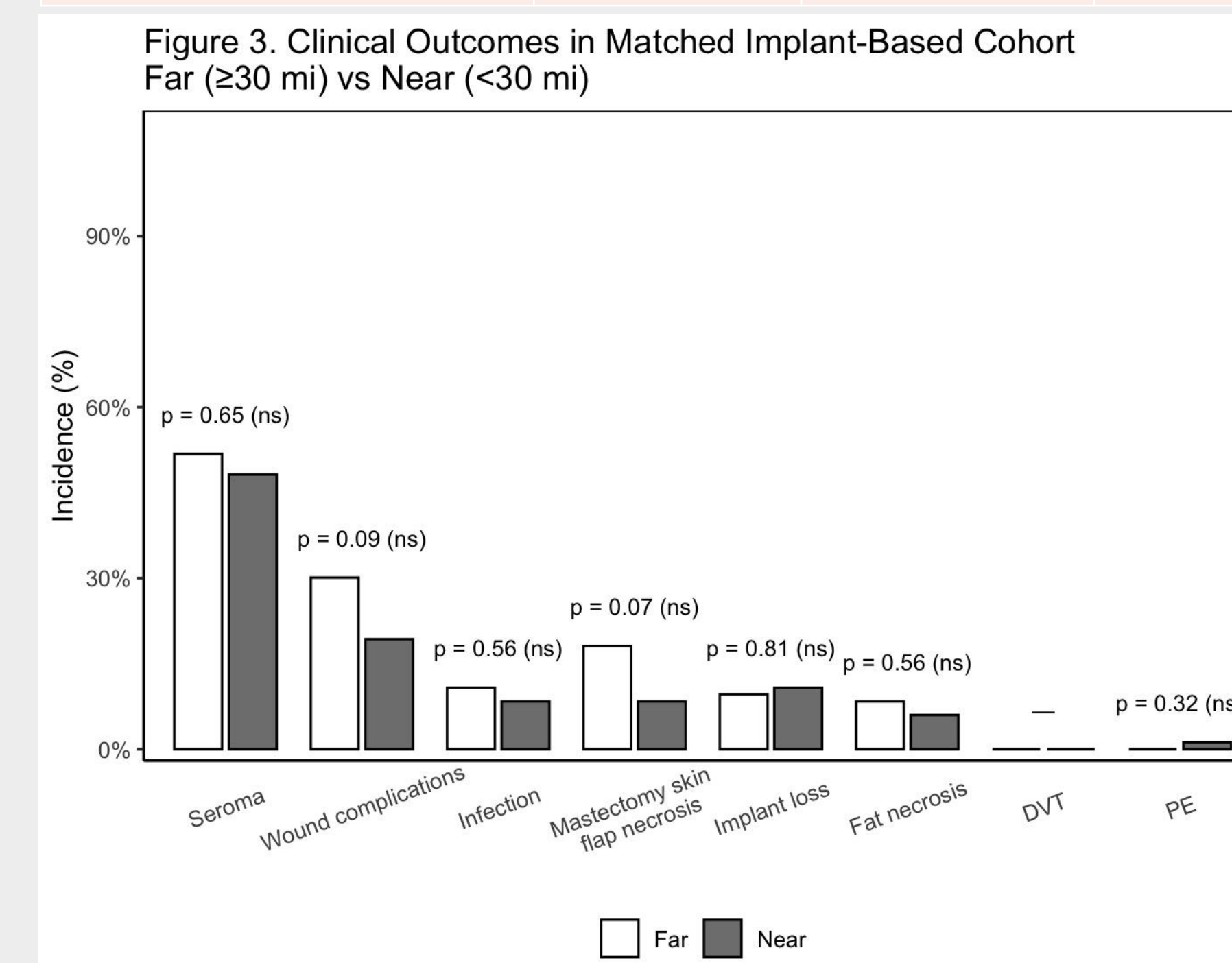


Figure 4. Financial Outcomes in Matched Free Flap Cohort Far (≥30 mi) vs Near (<30 mi)

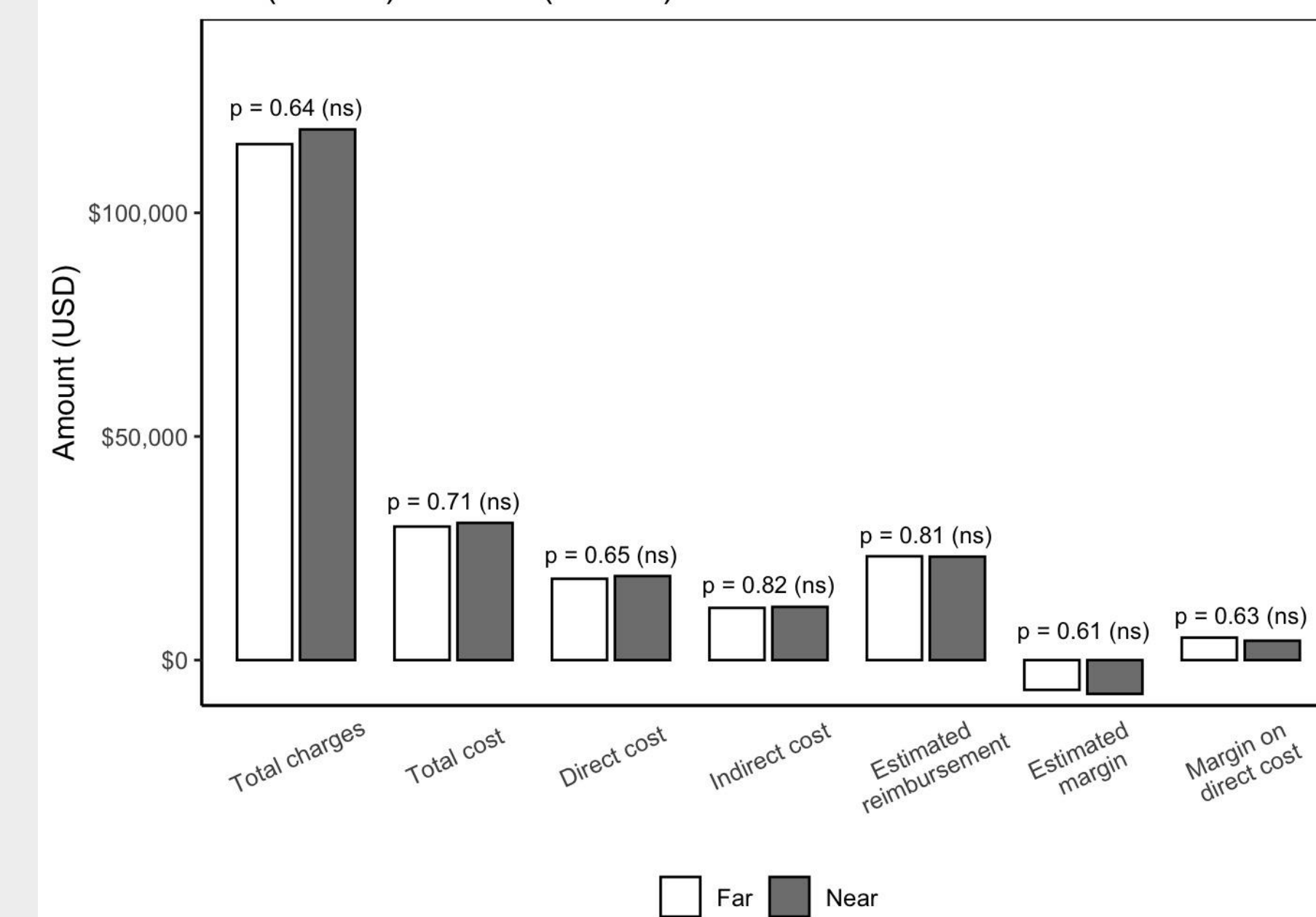
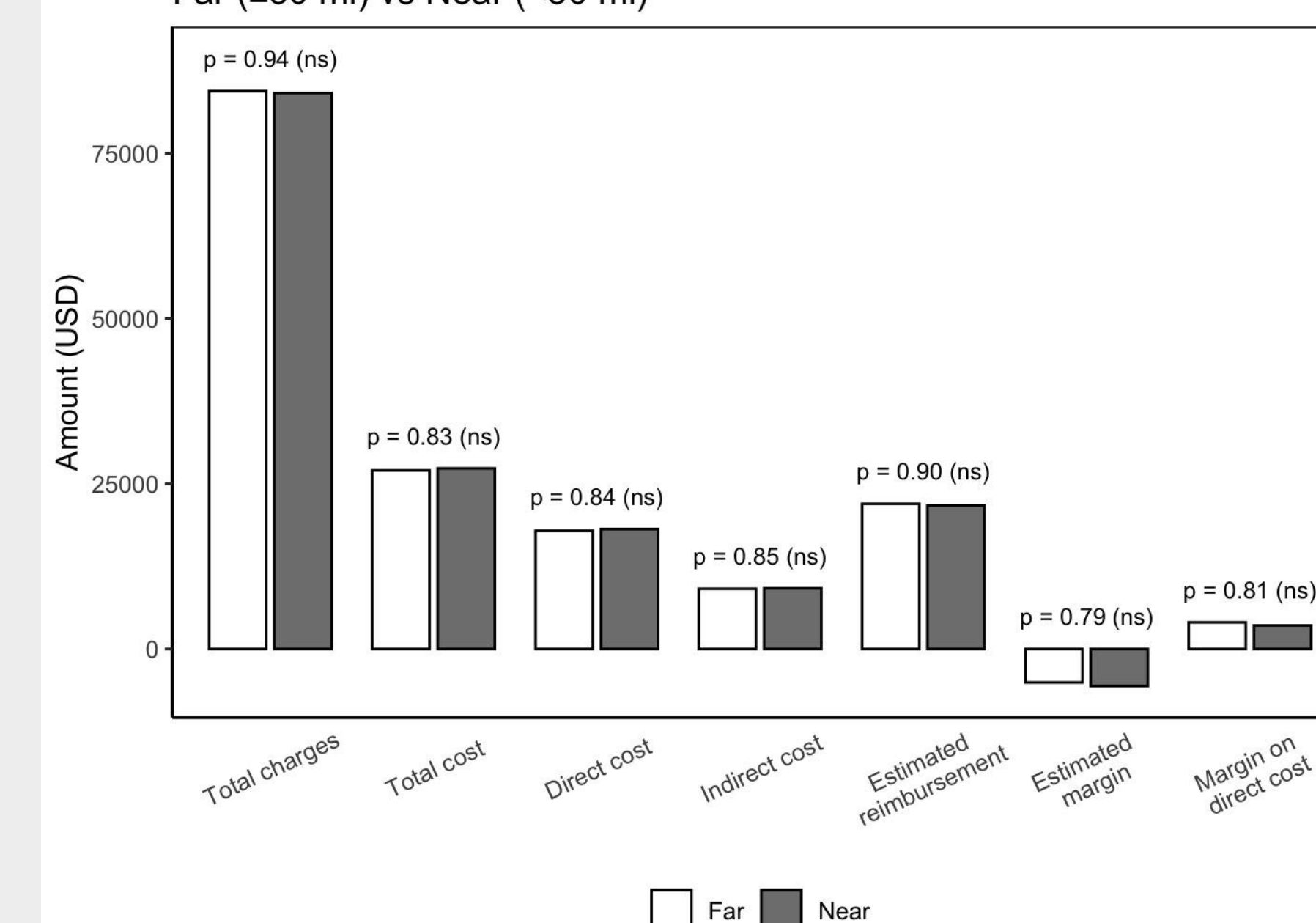


Figure 5. Financial Outcomes in Matched Implant-Based Cohort Far (≥30 mi) vs Near (<30 mi)



- **Operative duration and hospital stay** were similar between groups (case duration: 418.5 vs 429.4 minutes,  $p = 0.60$ ; length of stay: 2.9 vs 2.9 days,  $p = 0.91$ ).
- **Flap loss rates** were low and similar between groups (partial: 1.4% vs 1.4%; total: 2.9% vs 0%).
- Near patients experienced more **wound complications** (55.7% vs 40.0%,  $p = 0.03$ ) and underwent more **breast revision procedures** (1.0 vs 0.7,  $p = 0.04$ ).
- Postoperative utilization, including **30-day phone calls** and **ED visits**, was comparable between far and near cohorts.

- **Operative duration and hospital stay** were similar between far and near patients (case duration: 280.9 vs 288.7 minutes,  $p = 0.58$ ; length of stay: 1.1 vs 1.2 days,  $p = 0.32$ ).
- **Implant loss rates** were comparable between cohorts (9.6% vs 10.8%,  $p = 0.81$ ), with no distance-related differences in **revision frequency** (1.6 vs 1.6,  $p = 0.75$ ).
- Far-distance patients demonstrated greater **opioid use** (average daily MME: 65.9 vs 49.0,  $p < 0.01$ ; total MME: 74.4 vs 60.2,  $p < 0.01$ ).
- **Postoperative emergency department visits**, and **phone calls**, were not significantly different between groups.

## DISCUSSION & CONCLUSION

- Prior research has shown that women need to travel further for reconstruction compared to mastectomy alone.<sup>2</sup>
- Far and near-distance groups demonstrated similar operative times, resource utilization, major complications, and financial metrics.
- The higher wound complication and revision rates among near-distance flap patients may relate to increased surveillance and earlier detection during frequent in-person evaluations.<sup>3</sup>
- A recent study echoed the clinical findings as well as minimal association between travel distance and PROMs.<sup>4</sup>
- Geographic distance alone does not appear to compromise clinical or financial outcomes after breast reconstruction.
- Patterns in complication profiles suggest that distance primarily shapes how postoperative care is accessed and utilized rather than the overall quality of outcomes achieved.
- High-volume centers can provide consistent reconstructive outcomes regardless of distance, but there are opportunities to optimize postoperative follow-up and pain management.

## REFERENCES

1. Roughton MC, DiEgidio P, Zhou L, Stitzenberg K, Meyer AM. Distance to a Plastic Surgeon and Type of Insurance Plan Are Independently Predictive of Postmastectomy Breast Reconstruction. *Plast Reconstr Surg.* 2016 Aug;138(2):203e-211e. doi: 10.1097/PRS.0000000000002343. PMID: 27465180; PMCID: PMC5047793.
2. Albornoz CR, Cohen WA, Razdan SN, Mehrara BJ, McCarthy CM, Disa JJ, Dayan JH, Pusic AL, Cordeiro PG, Matros E. The Impact of Travel Distance on Breast Reconstruction in the United States. *Plast Reconstr Surg.* 2016 Jan;137(1):12-18. doi: 10.1097/PRS.0000000000001847. PMID: 26710002; PMCID: PMC4776632.
3. Silverstein ML, Nesbit RD, Collins MS, Wilson TD. The impact of geographical access challenges on outcomes of postmastectomy breast reconstruction. *Annals of Breast Surgery.* 2023;7:34. doi:10.21037/abs-22-3
4. Levy J, Wagner BD, Roberts A, Shammas RL, Palmroos M, Boe LA, Stern CS, Allen R Jr, Matros E, Mehrara B, Nelson JA. The Impact of Travel Distance on Patient Outcomes after Breast Reconstruction. *Ann Surg Oncol.* 2025 Sep;32(9):6629-6639. doi: 10.1245/s10434-025-17694-y. Epub 2025 Jun 28. PMID: 40581682; PMCID: PMC12739936.

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