



Comparable Outcomes Across The Lifespan: A Propensity-matched National Cohort Analysis Of Pediatric And Adult Microsurgical Reconstruction



Robin T. Wu, MD; Derrick C. Wan, MD; Michael T. Longaker, MD, MBA; Arash Momeni, MD

Introduction

Outcomes following free microsurgical tissue transfer are well characterized in the adult population. Pediatric free flaps remain underrepresented in the literature, in part due to lower case volumes and heterogeneous indications² Thus, pediatric microsurgery is often **perceived as technically demanding and high risk**. Smaller vessel caliber, limited physiologic reserve, and the potential impact of growth on reconstructive durability are often cited as concerns.

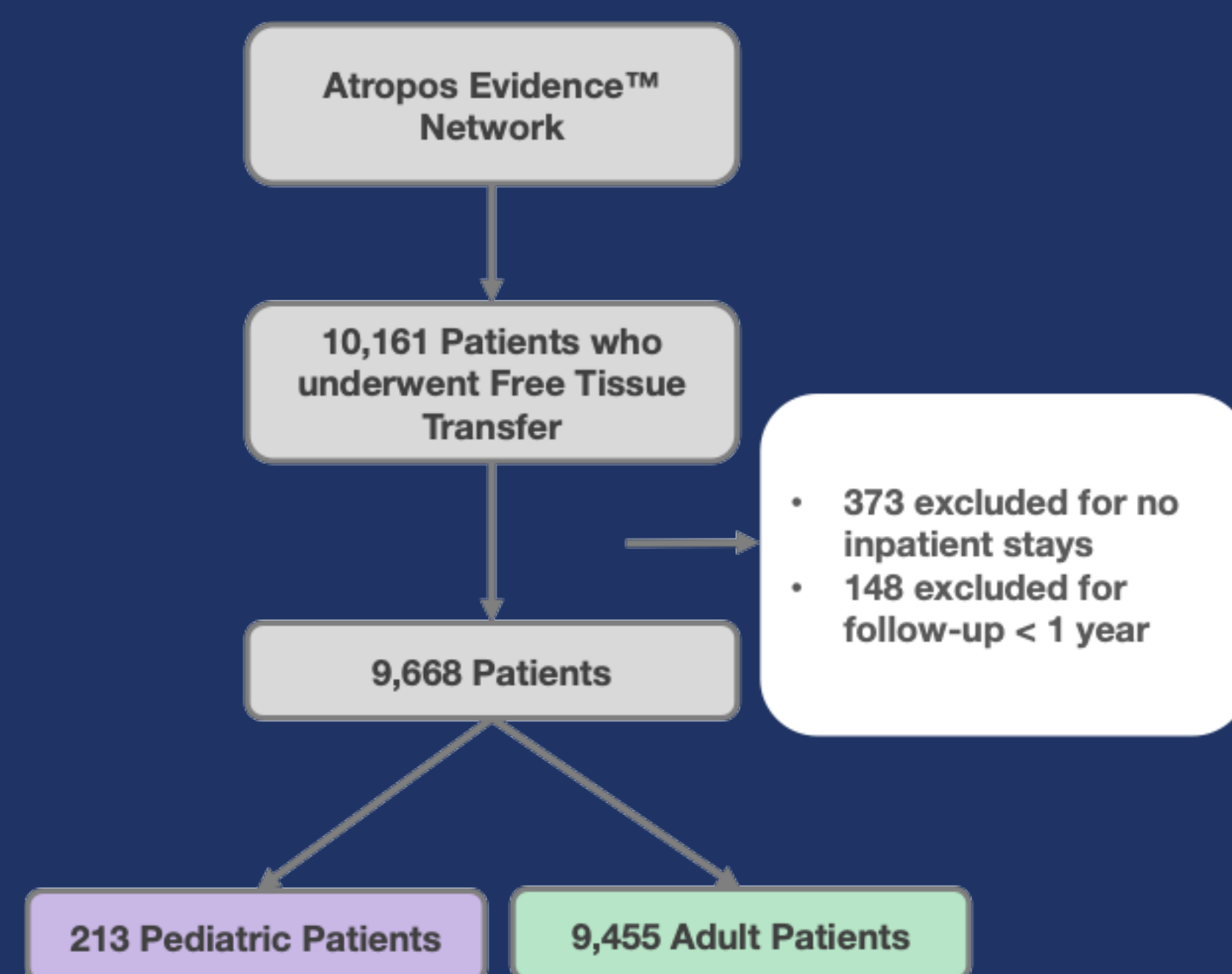
Flap success rates range between 95-99%, with reported complication rates between 7-16%. However, these studies are limited by small sample sizes, narrow indications, and lack of direct comparison to adults. There remains a critical evidence gap regarding whether age meaningfully influences microsurgical outcomes, or whether perceived differences are driven instead by indications or reconstructive strategies.

Purpose

This study compares short-term outcomes following microsurgical reconstruction in pediatric and adult patients using **a large longitudinal national cohort**. By evaluating outcomes across the lifespan, this study aims to provide objective, **age-stratified benchmarks that inform surgical decision-making, reduce age-based bias in reconstructive planning, and reinforce the safety and reproducibility** of microsurgical reconstruction in pediatric patients.³

Methods

- Retrospective database study using the Atropos Evidence Network (2015–2024), including inpatient and outpatient encounters across the U.S.
- Dataset includes longitudinal diagnoses, procedures, and demographics for perioperative and long-term outcomes
- Patients undergoing free tissue transfer identified via CPT codes
- Inclusion: ≥ 30 days preoperative history and ≥ 30 days postoperative follow-up
- Sub-analysis performed for 1-year postoperative outcomes
- Cohorts stratified by age: pediatric (0–17) vs adult (18–90)
- Further subgrouping by flap type: osseous, muscle, and fasciocutaneous
- Additional stratification by age decade for descriptive analyses
- Baseline covariates: sex, race, Charlson Comorbidity Index, malignancy status, and flap



- Primary outcomes: 30-day complications, any revision procedure, and need for future microsurgical reconstruction
- Outcomes identified using standardized ICD-10 and CPT code definitions
- Cost outcomes: index hospitalization cost and total 1-year healthcare cost from claims data
- Propensity score matching (nearest neighbor, no replacement) to balance cohorts
- Matching variables: sex, race, CCI, and flap type (age excluded)
- Logistic regression used to estimate odds of complications and revisions
- Time-to-event outcomes analyzed with Kaplan–Meier and log-rank testing
- Cox proportional hazards models used to estimate hazard ratios

Results

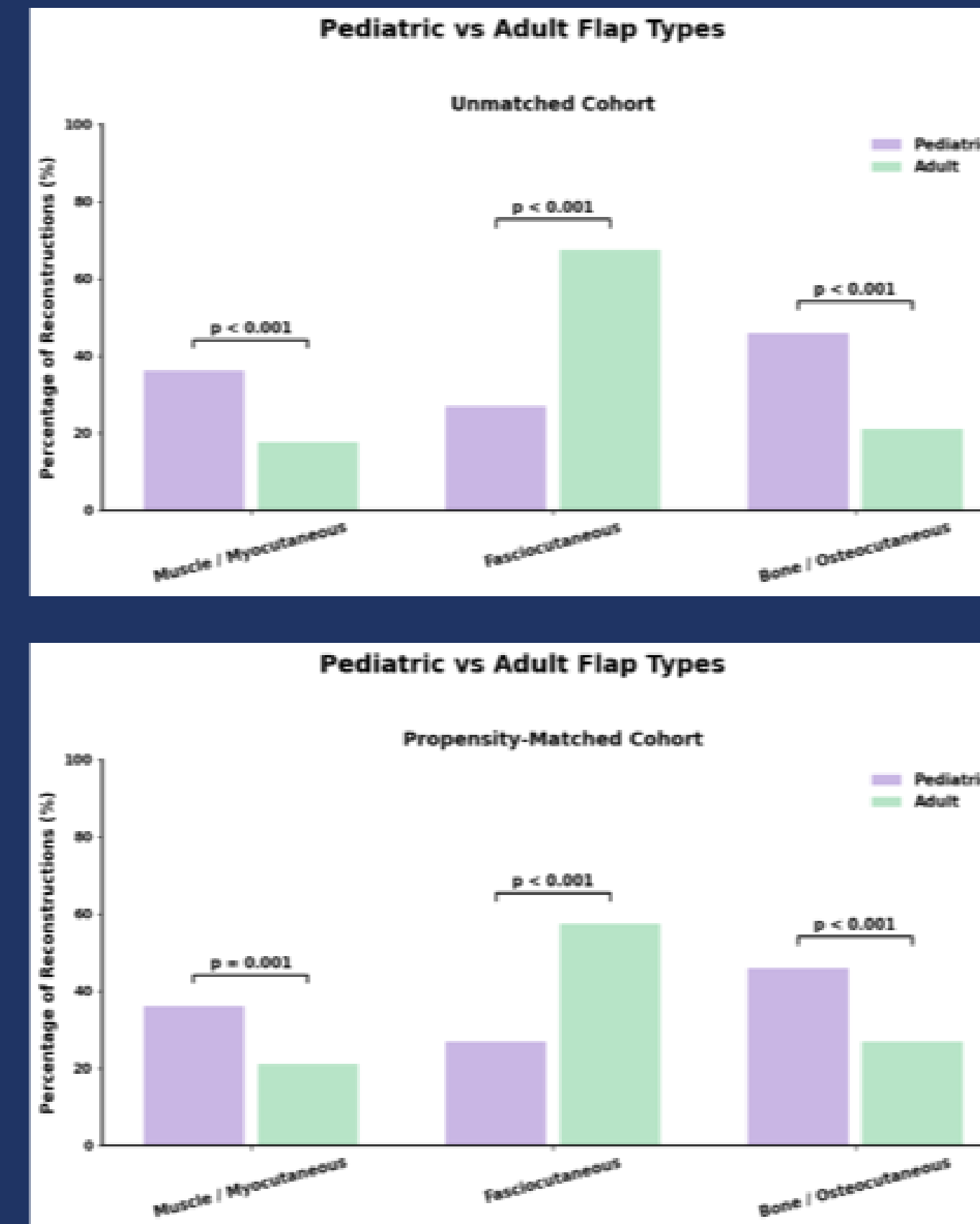


Figure 1. Distribution of Free Flap Types in Pediatric and Adult Patients Before and After Propensity Score Matching. In both the unmatched and matched cohort, pediatric patients underwent a significantly higher proportion of bone/osteocutaneous (46.0% vs 20.9%, $p < 0.001$; 57.3% vs 26.8%, $p < 0.001$) and muscle/myocutaneous flaps (36.2% vs 17.6%, $p < 0.001$; 36.2% vs 21.1%, $p = 0.001$), whereas adults more frequently received fasciocutaneous reconstruction (67.4% vs 26.8%, $p < 0.001$; 46.0% vs 26.8%, $p < 0.001$).

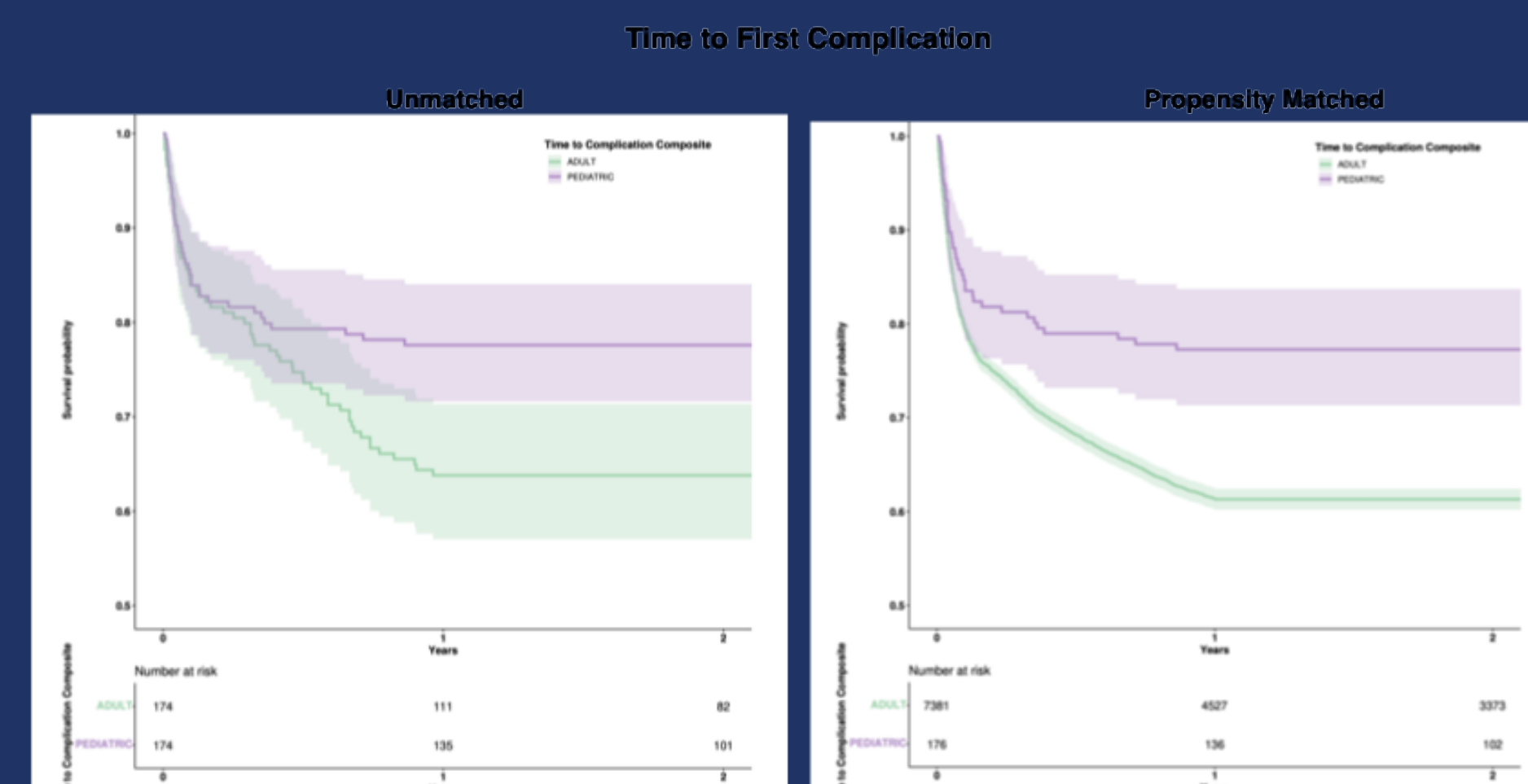


Figure 3. Time to first complication for unmatched and propensity matched cohorts. Pediatric patients in the unmatched group demonstrated a longer time to first postoperative complication compared to adults (83.0 ± 97.9 vs. 51.5 ± 73.7 days; $p = 0.011$), which was similar after propensity matching (82.6 ± 103.5 vs. 53.3 ± 75.3 days).

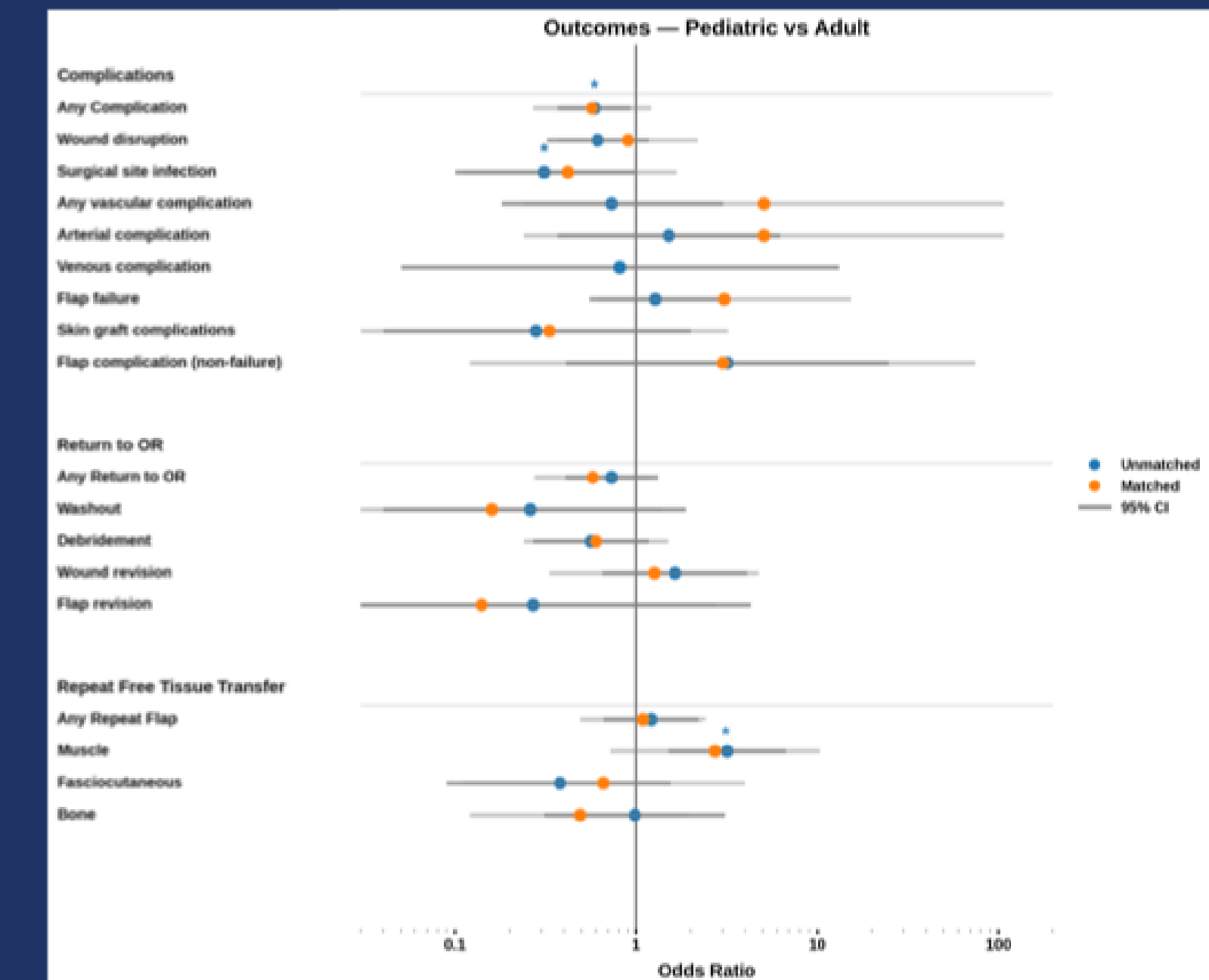


Figure 2. Postoperative outcomes in pediatric versus adult free tissue transfer patients before and after propensity score matching. Forest plot showing odds ratios (ORs) with 95% confidence intervals comparing pediatric to baseline adult patients for postoperative complications, return to the operating room, and repeat free tissue transfer. In the unmatched analysis, pediatric patients demonstrated significantly lower odds of any complication ($p=0.020$) and surgical site infection ($p=0.045$) compared with adults. After matching, these differences were attenuated. Among repeat free tissue transfers, muscle flap reconstructions were associated with higher odds of repeat flap in the matched cohort ($p=0.040$). * $p < 0.05$.

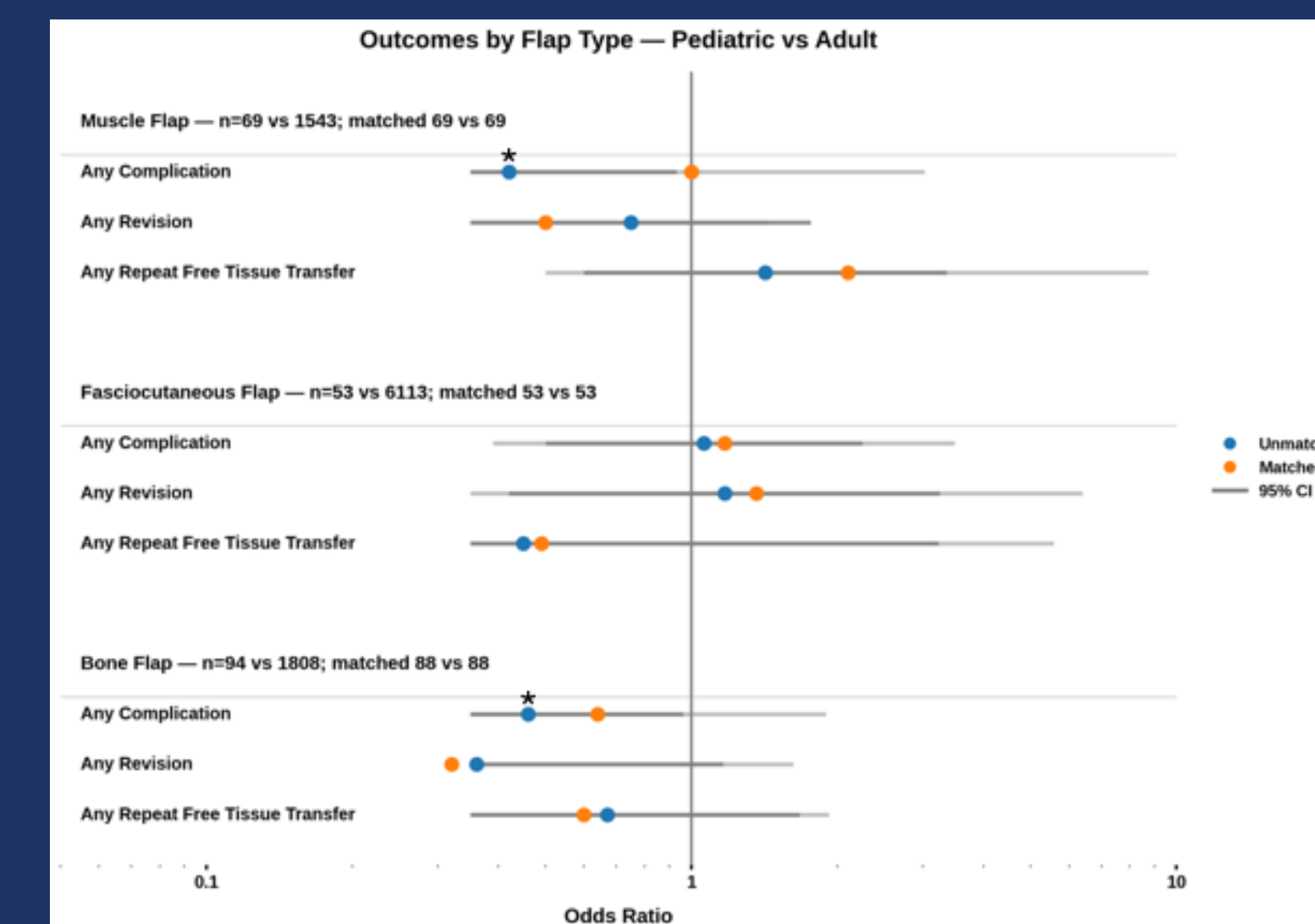


Figure 4. Outcomes by flap type in pediatric versus adult free tissue transfer before and after propensity score matching. Pediatric patients receiving muscle/musculocutaneous flaps (10.1% vs. 21.2%; OR, 0.42; 95% CI, 0.19–0.93; $p = 0.032$) and osseous/osseocutaneous flaps (8.5% vs. 16.8%; OR, 0.46; 95% CI, 0.22–0.96; $p = 0.032$) in the unmatched cohort had lower odds of postoperative complications compared with adults. These differences were not observed after matching. In the fasciocutaneous flap subgroup, complication rates were comparable between pediatric and adult patients in both unmatched and matched cohorts.

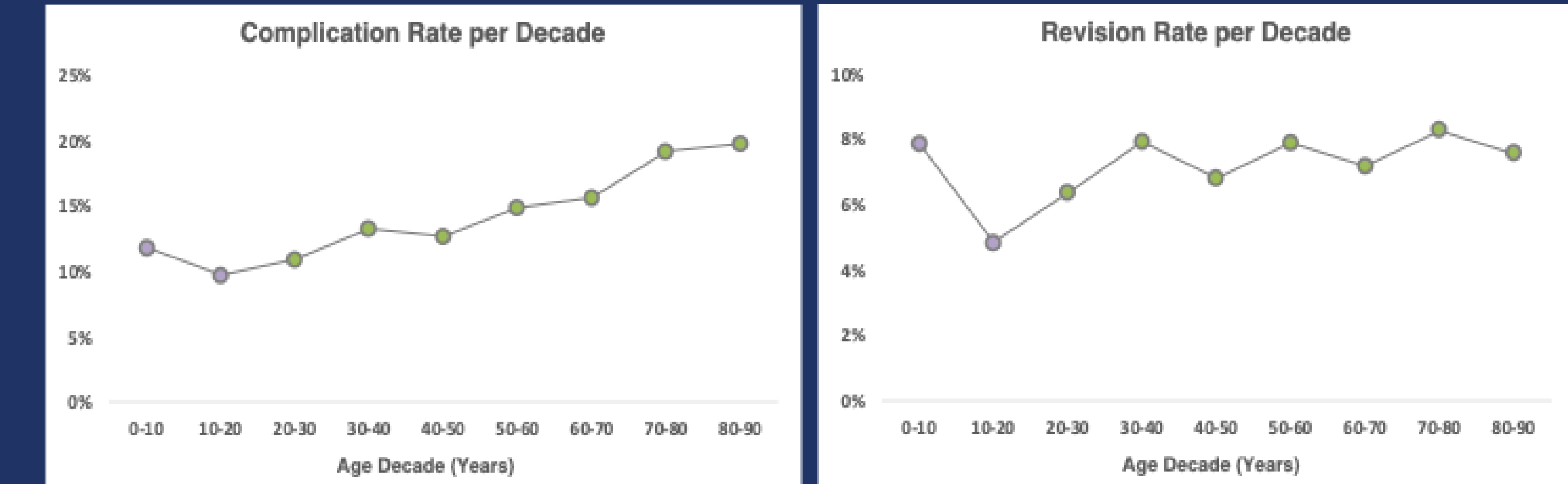


Figure 5: 1-year postoperative complication rate stratified by age decade Complication rates remained low across all decades, with gradual increase in complication profile with advanced decade age, however not statistically significant. Revision rates remained similar for all age groups.

Conclusions

Microsurgical reconstruction in pediatric patients is safe, effective, and yields outcomes comparable to adults when controlling for baseline differences. In this first direct comparative analysis, pediatric patients demonstrated lower unadjusted complication rates, with no significant differences in complications, revision procedures, flap failure, repeat free tissue transfer, or costs after propensity matching. These findings suggest that the perceived technical challenges of smaller vessel caliber in children are offset by the greater comorbidity burden in adults. Outcomes were consistent across flap types, reinforcing that age alone does not independently influence success, although flap selection may impact long-term functional outcomes. Overall, this study supports the use of free tissue transfer as a first-line reconstructive option in pediatric patients and underscores that age should not be considered a contraindication to microsurgical reconstruction.

Citations

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