# Assisted Reproductive Technology and Neonatal Outcomes

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## PURPOSE & OBJECTIVES

- Assisted reproductive technology (ART) use has increased substantially, particularly among women of advanced maternal age, raising concern about potential downstream neonatal risks.
- Prior studies suggest associations between ART and adverse neonatal outcomes, including preterm birth, low birth weight, and NICU admission, but findings are often confounded by maternal and obstetric factors.
- Uncertainty remains regarding whether ART independently contributes to adverse neonatal outcomes when controlling for these confounders.
- **Objective:** To determine whether conception via ART is independently associated with adverse neonatal outcomes using a large, contemporary cohort of singleton deliveries, while adjusting for key maternal, obstetric, and intrapartum variables.

## MATERIAL & METHODS

- **Study design:** Retrospective cohort study of singleton deliveries at Northwell Health institutions from December 2023 to December 2024.
- **Exposure:** Mode of conception categorized as ART versus spontaneous conception, identified through electronic health record documentation.
- **Primary outcomes:** Neonatal NICU admission and NICU length of stay.
- **Secondary outcomes:** Five-minute Apgar scores, neonatal birthweight, umbilical cord gas values, early-onset sepsis (EOS) risk scores, and Joint Commission (JHACO) PC-06 indicators for unexpected neonatal outcomes.
- **Statistical analysis:** Univariate comparisons performed using chi-squared testing
- **Multivariable analysis:** Logistic regression models estimated adjusted odds ratios (aORs) and 95% confidence intervals, controlling for maternal age, parity, gestational age, BMI, mode of delivery, placental abnormalities, diabetes, hypertensive disorders, abnormal fetal heart rate tracing, chorioamnionitis, and meconium-stained amniotic fluid.
- **Statistical significance:** Defined as $p < 0.05$; analyses conducted using Python v3.12.

## RESULTS

Table 1. Baseline Characteristics for Spontaneous v. ART conception pregnancies

| Characteristics | Spontaneous Conception (N=23,221) | ART conception (N=492) | Odds Ratio (95% CI) | P- value |
|---|---|---|---|---|
| Maternal Age≥35 yrs | 7,491 (32.3%) | 311 (63.2%) | 3.61 (3.00-4.34) | <0.001 |
| Parity <2 | 17,806 (76.7%) | 445 (90.5%) | 0.35 (0.26-0.47) | <0.001 |
| Cesarean Delivery | 7,602 (32.7%) | 283 (57.5%) | 2.78 (2.32-3.33) | <0.001 |
| Preterm delivery (<37wk) | 1,638 (7.1%) | 60 (12.2%) | 1.86 (1.42-2.43) | <0.001 |
| BMI ≥30 | 12,747 (54.9%) | 278 (56.5%) | 1.07 (0.89-1.28) | 0.49 |
| Placental Abnormalities | 246 (1.1%) | 17 (3.5%) | 3.34 (2.03-5.51) | <0.001 |
| Diabetes | 2,715 (11.7%) | 81 (16.5%) | 1.49 (1.17-1.90) | 0.002 |
| Hypertensive Disorders | 2,396 (10.3%) | 89 (18.1%) | 1.92 (1.52-2.42) | <0.001 |
| Abnormal FHR tracing | 6,267 (27.0%) | 117 (23.8%) | 0.84 (0.68-1.04) | 0.12 |
| Chorioamnionitis | 790 (3.4%) | 22 (4.5%) | 1.33 (0.86-2.05) | 0.21 |
| Meconium-stained fluid | 2,284 (9.8%) | 45 (9.2%) | 0.92 (0.68-1.26) | 0.07 |

## RESULTS

Table 2. Key Neonatal Outcomes by Mode of Conception (unadjusted comparison)

| Outcome | ART Conception (n=492) | Natural Conception (n=23,221) | P-value (<0.05) |
|---|---|---|---|
| NICU Admission (%) | 10.1% | 11.0% | <0.001 |
| NICU LOS (median) | ~10.1 days | ~8.6 days | 0.447 |
| 5min APGAR <7 (%) | 2.0% | 0.7% | 0.005 |
| Low Birth Weight <2500g (&) | 10.6% | 6.3% | 0.004 |
| PC-06 (overall) (%) | 5.9% | 2.9% | 0.001 |
| PC-06 (moderate) (%) | 5.5% | 2.4% | <0.001 |

Table 3. Adjusted Multivariate Models

| Outcome | Adjusted OR (95% CI) | Conclusion |
|---|---|---|
| NICU Admission | 1.23 (0.91-1.57) | Not independently associated |
| 5min APGAR <7 | 2.44 (1.20-4.96) | Independently association |
| Low Birthweight | 1.25 (0.84-1.85) | Not independently associated |
| PC-06 (overall) | 2.07 (1.41-3.04) | Independent association |
| PC-06 (moderate) | 2.42 (1.62-3.59) | Independent association |

- Many adverse neonatal outcomes seen in ART pregnancies are explained by maternal and obstetric factors
- ART remains independently associated with:
  - Lower five-minute Apgar scores, unexpected neonatal outcomes (PC-06 indicators)
  - NICU admission and low birth weight do not remain statistically significant after adjustment

## RESULTS

- NICU admission occurred more frequently among ART-conceived neonates compared with spontaneous conceptions (18.1% vs 11.0%, $p < 0.001$); however, this association was not statistically significant after adjustment for confounders (aOR 1.23, 95% CI 0.91–1.67).
- Five-minute Apgar scores <7 were significantly more common in ART-conceived neonates (2.0% vs 0.7%, $p = 0.005$) and remained independently associated with ART after adjustment (aOR 2.44, 95% CI 1.20–4.96).
- Low birth weight (<2500 g) was more frequent among ART conceptions (10.6% vs 6.3%, $p = 0.004$), though this association was no longer significant after adjustment.
- ART conception was independently associated with worsened neonatal outcomes per Joint Commission PC-06 indicators, including:
- Independent risk factors for adverse neonatal outcomes included cesarean delivery, hypertensive disorders, abnormal fetal heart rate tracing, chorioamnionitis, and meconium-stained amniotic fluid.

## CONCLUSIONS

Although ART-conceived neonates demonstrated higher rates of NICU admission and low birth weight on unadjusted analysis, these associations were largely explained by maternal and obstetric factors. However, ART conception remained independently associated with lower 5-minute APGAR scores and increased odds of unexpected neonatal outcomes, highlighting the need for individualized perinatal surveillance and targeted counseling in ART pregnancies.

## REFERENCES

## ACKNOWLEDGEMENTS & CONTACT INFORMATION

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