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Assessment of Patient Cohort Matching Approaches: Statistical Application of NEQsi.

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INTRODUCTION

- **NEQsi** - Embryo quality is an established critical contributor to IVF cycle outcomes. The recently developed NEQsi system allows conversion of Gardner embryo grades to linear numeric variables for seamless integration into statistical models (1).
- **Patient Matching Approaches** - Exact matching, propensity matching, and statistical analysis of unmatched cohorts are common approaches to assessing comparator groups. Exact matches based on pre-selected criteria, while desirable, are not always plausible. Propensity score matching (2) provides a retrospective approach to balancing study arms and demographics. It is also acceptable to use an un-matched approach, as inclusion of every patient with available data is another method to prevent selection bias.

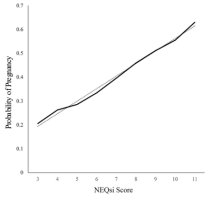


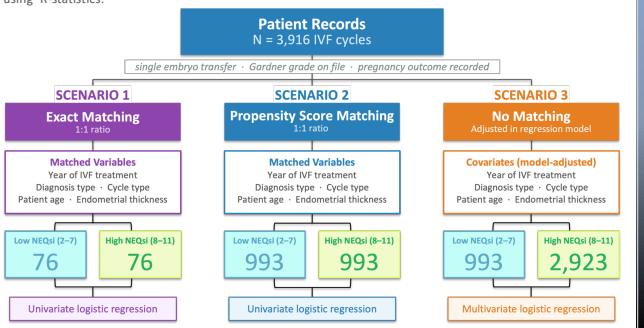
Figure 1: Modeled relationship between NEQsi and probability of pregnancy. NEQsi demonstrates a tight positive linear correlation between NEQsi score and probability of pregnancy [Figure from (1)].

AIM

Our objectives were to evaluate patient matching strategies for a retrospective approach to assessing impact of low (2 to 7) versus high (8 to 11) NEQsi scores on pregnancy outcomes using:
1) Exact matching;
2) Propensity score matching; and,
3) No matching.

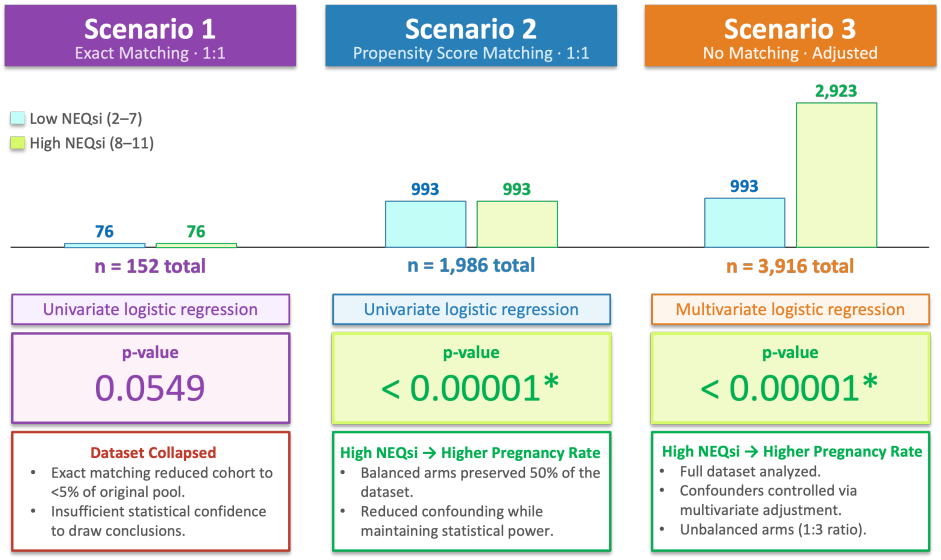
METHOD

We conducted a series of retrospective analyses using patient records from a multi-physician ART clinic. Records for patients with IVF cycles between 2014 and 2025 were accessed (n = 3916). Inclusion criteria were patients who had a single embryo transfer, Gardner grade on file, and pregnancy outcome. All embryo grades were converted to NEQsi scores and patients were allocated to either the test group (NEQsi scores between 2 and 7; low scoring embryos; n = 993) or the control group (NEQsi scores between 8 and 11; high scoring embryos; n = 2923). Three scenarios were used to prepare for comparison by logistic regression using 'R-statistics:



RESULTS

- *Scenario 1*: Exact matching resulted in 76 patients (out of 3916) in each group. Low-quality embryos were not associated with lower pregnancy rates (p=.0549)
- *Scenario 2*: Propensity score matching paired 933 test patients to 933 controls (n=1986, of the initial 3916)
- *Scenario 3*: No matching resulted in 933 test patients and 2932 controls (n=3916).
- Scenarios 2 and 3 both demonstrated that a low NEQsi score was associated with low probability of pregnancy (p< .00001)



CONCLUSIONS

- NEQsi successfully integrated morphologic embryo quality into the three most common approaches for patient matching.
- NEQs score is a significant predictor of pregnancy outcome.
- Exact matching collapsed the dataset to less than 5% of it's original size, limiting confidence in conclusions drawn from this method.
- Propensity score matching decreased the impact of the confounders, maintained large cohort sizes, and provided a method to balance study arms.
- Un-matched cohorts performed similarly in regression analysis to propensity matching when adjusted for the other factors in the model.

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FUTURE DIRECTIONS

- Ultrasound based endometrial receptivity (usER) testing has been demonstrated to improve pregnancy rates (3,4). Preliminary findings have shown that combining usER testing with NEQsi can further optimize outcomes (5). Large studies combining Endometrial receptivity, NEQsi, and propensity matching approach will be developed assess the relative contributions of both embryo quality and endometrial receptivity to cycle outcomes.

CONTACT INFORMATION

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