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Rapid Warming of Euploid Vitri-fied Blastocysts Offers Equivalent Pregnancy Outcomes to Standard Warming Protocols in a Large Fertility Network

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PURPOSE & OBJECTIVES

- To compare pregnancy outcomes following rapid versus standard blastocyst warming protocols in frozen preimplantation genetic testing for aneuploidy (PGT-A) euploid transfers, with a focus on chemical and clinical pregnancy rates across age groups within a multi-center fertility network.

MATERIAL & METHODS

- This retrospective cohort study was conducted across a multi-center fertility network (n=17) and included 2,953 frozen, single euploid blastocyst transfer cycles performed between January 2024 and February 2025.
- Blastocyst warming was performed using either a standard or rapid protocol. The standard protocol involved three sequential media steps with pipetting at each stage, requiring 10 minutes (1 min TS, 3 min DS, 5 min WS1, 1min WS2 then culture media) to complete. The rapid protocol utilized a single thawing step lasting just single step requiring 1 minute (1 min TS media, then culture media).
- The primary outcomes were chemical pregnancy (serum β -hCG ≥ 5 mIU/mL) and clinical pregnancy (presence of an intrauterine gestational sac), each stratified by age group.
- Proportions were compared using chi-square tests (Python 3.8).

RESULTS

Comparison of Chemical and Clinical Pregnancy Rate by Age Group Following Rapid vs. Standard Embryo Warming

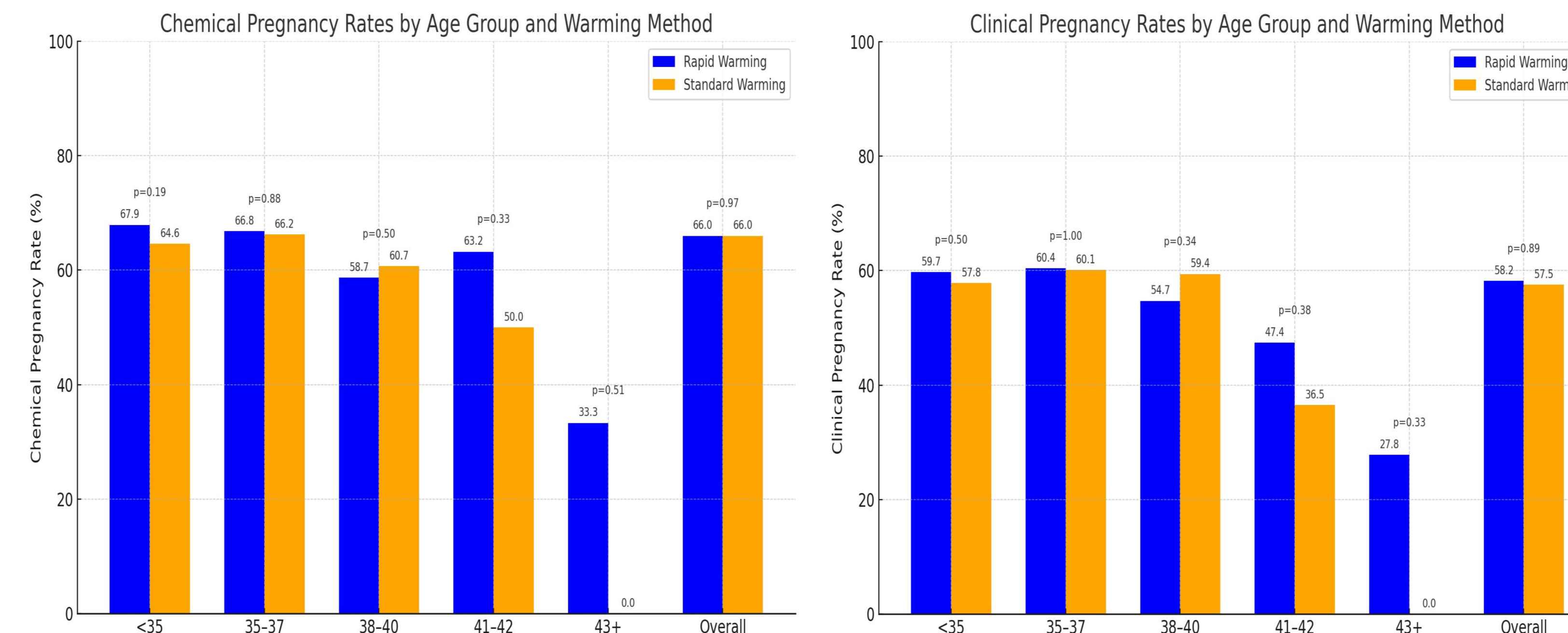


Figure 1. Chemical Pregnancy and Clinical Rate by Age Group

Chemical pregnancy is defined as a positive serum Beta-hCG result, typically measured 10–14 days after embryo transfer, indicating early implantation. Clinical pregnancy is defined as the presence of an intrauterine gestational sac confirmed by transvaginal ultrasound, typically performed 4–5 weeks after embryo transfer. Blue bars represent Rapid Warming; Orange bars represent Standard Warming.

Sample sizes per group:

- <35: Rapid Warming n = 913, Standard Warming n = 643
- 35–37: Rapid Warming n = 472, Standard Warming n = 278
- 38–40: Rapid Warming n = 327, Standard Warming n = 187
- 41–42: Rapid Warming n = 57, Standard Warming n = 52
- 43+: Rapid Warming n = 18, Standard Warming n = 6
- Overall: Rapid Warming n = 1,787, Standard Warming n = 1,166

CONCLUSION

- Rapid embryo warming yields equivalent clinical outcomes to standard warming protocols across age groups in frozen euploid blastocyst transfers.
- This network-wide analysis of nearly 3,000 frozen embryo transfers demonstrates that uniform protocol changes can be implemented with confidence in non-inferiority, which is an assessment on a scale not typically achievable in single-clinic studies.

RESULTS

Forest Plot of Pregnancy Outcomes by Warming Method and Age Group

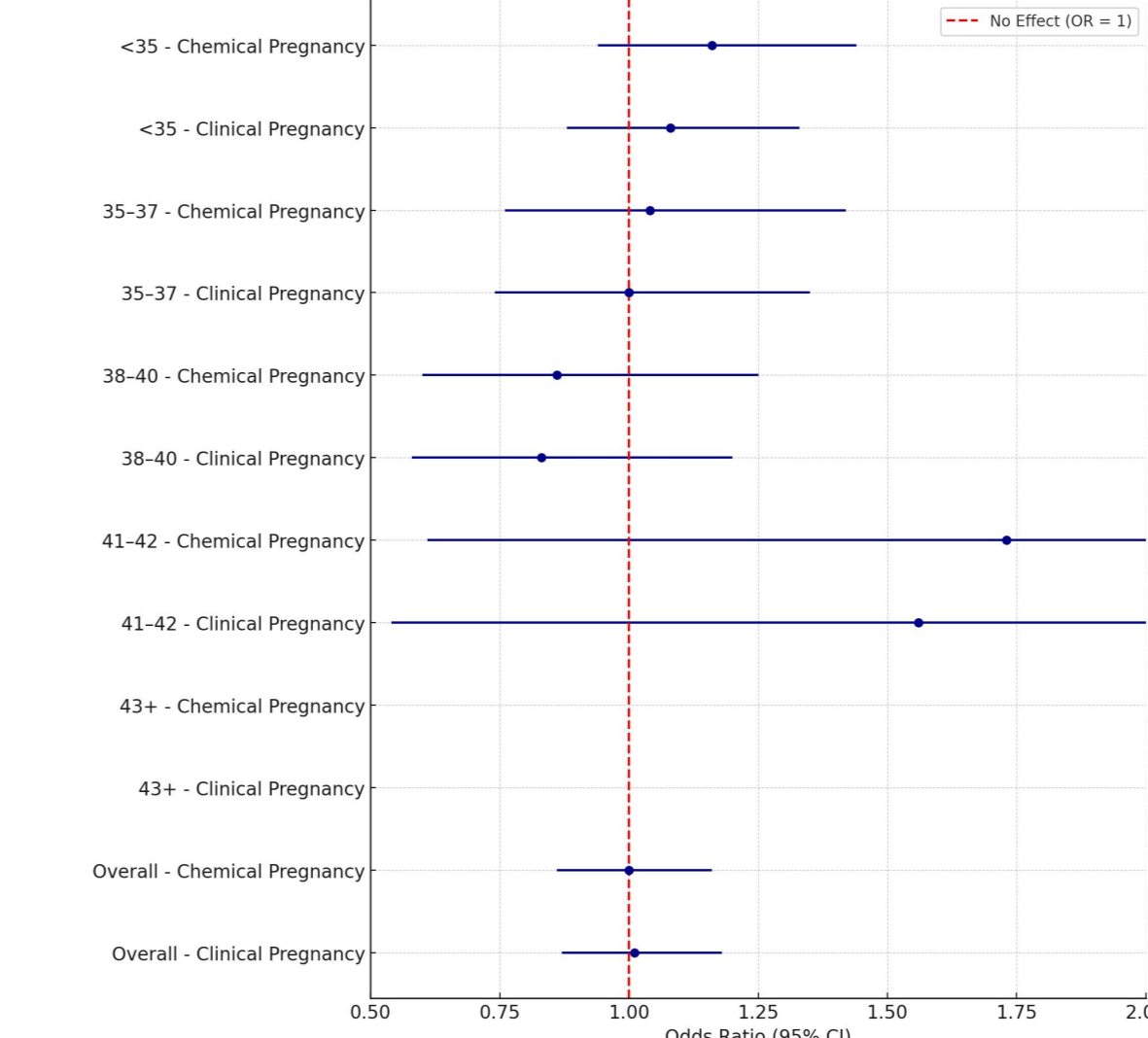


Figure 2. Forest Plot of Odds Ratios Comparing Rapid vs. Standard Warming by Age Group

This forest plot illustrates the odds ratios (OR) and 95% confidence intervals (CI) for chemical pregnancy and clinical pregnancy outcomes comparing Rapid Warming to Standard Warming across different age groups. An odds ratio >1 indicates higher odds with Rapid Warming, whereas an odds ratio <1 indicates higher odds with Standard Warming. The red dashed line represents the null value (OR = 1), suggesting no difference between the two methods. None of the comparisons reached statistical significance. In the 43+ age group, both chemical and clinical pregnancy outcomes favored Rapid Warming (OR > 1), but confidence intervals were wide due to small sample size.

Pregnancy Outcomes in Age 41+ Group Rapid vs. Standard Warming

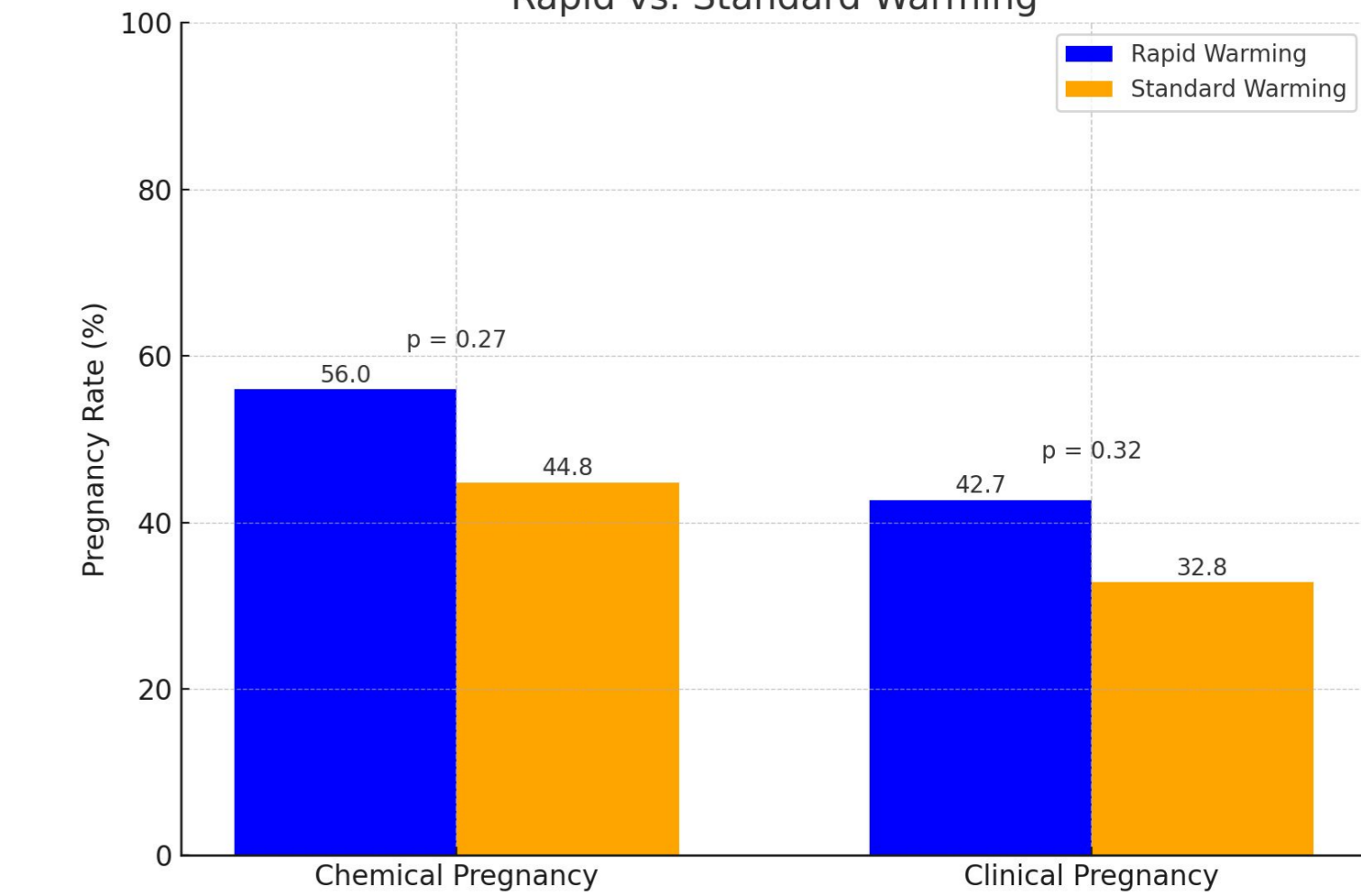


Figure 3. Chemical and Clinical Pregnancy Rates by Embryo Warming Method in Patients Aged 41 and older.

Pregnancy outcomes were compared between Rapid (n = 75) and Standard (n = 58) Warming protocols, combining age groups 41–42 and 43+. Chemical pregnancy rates were 56.0% (Rapid) vs. 44.8% (Standard), p = 0.27. Clinical pregnancy rates were 42.7% (Rapid) vs. 32.8% (Standard), p = 0.32. Differences were not statistically significant due to sample size.

IMPACT STATEMENT

This study provides robust, real-world evidence that rapid embryo warming is a safe and efficient alternative to conventional methods.

ACKNOWLEDGEMENTS

We would like to thank the entire Kindbody Laboratory staff for working so hard to continue to transition new technologies for continued improvement and patient success.

CONTACT INFORMATION

