



# Reassessing the role of endometrial thickness in frozen embryo transfer success: A large-scale multicenter study

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Jullin Fjeldstad<sup>1</sup>, Jessica Rawlins<sup>1</sup>, Laís Vanzella<sup>1</sup>  
(1) Future Fertility, Toronto, ON, Canada

## Introduction

Endometrial receptivity is routinely assessed via ultrasound to measure endometrial thickness (EMT). While studies suggest a positive association between EMT and frozen embryo transfer (FET) outcomes, reported threshold values remain inconsistent. Using a large multicenter dataset, this study aimed to refine the EMT-FET relationship and establish evidence-based thresholds to inform clinical decision-making.

## Objective

To evaluate the predictive value of EMT on biochemical pregnancy (BP), clinical pregnancy (CP), live birth (LB), and miscarriage, and to define minimum effective and optimal thickness thresholds in FET cycles.

## Methods



Retrospective analysis: 70 US clinics, 50,090 autologous, blastocyst FET cycles from 23,232 patients (inclusive of all embryo qualities/grades).



EMT measured by transvaginal ultrasound prior to progesterone initiation or before luteal phase in natural cycles (EMT categories: <7mm, 7-11mm, >11mm)

Clinical endpoints per transfer recorded:

- **BP** (positive beta hCG test)
- **CP** (gestational sac or HB on 6-7 week ultrasound)
- **LB** (delivery with signs of life)
- **Miscarriage** (loss of pregnancy before 20 weeks)



Multivariable logistic regression (adjusted for maternal age, blastocyst quality, PGT-A status) used to predict BP, CP, LB, and miscarriage; EMT evaluated categorically and continuously (spline regression).



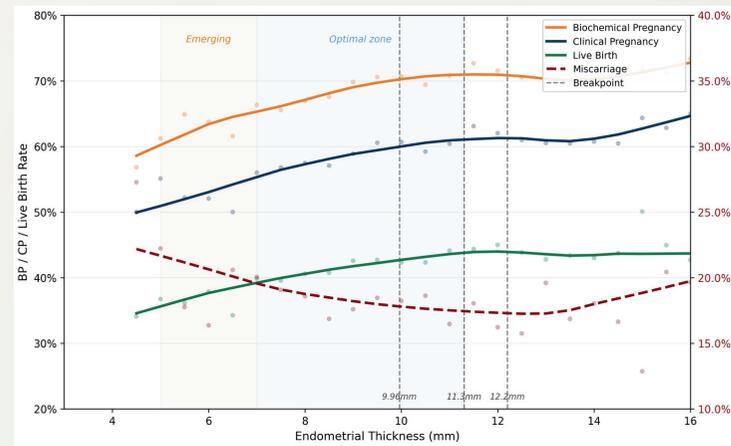
Endpoints: Breakpoints estimated by segmented regression (Davies test); minimum effective dose modeling (MED) identified improvement thresholds; interactions assessed via likelihood ratio tests; model performance assessed by AUC.

## Results

**Table 1:** Adjusted odds ratio for reproductive outcomes by endometrial thickness category in autologous frozen embryo transfer cycles

| Outcome                    | 7-11 mm vs <7 mm    | >11 mm vs <7 mm     |
|----------------------------|---------------------|---------------------|
| Biochemical Pregnancy (BP) | 1.48 (1.37-1.61)*** | 1.83 (1.68-1.99)*** |
| Clinical Pregnancy (CP)    | 1.82 (1.67-1.99)*** | 2.47 (2.26-2.70)*** |
| Miscarriage                | 0.87 (0.72-1.04)    | 0.80 (0.66-0.96)    |
| Live Birth (LB)            | 1.72 (1.56-1.90)*** | 2.22 (2.01-2.45)*** |

\*\*\*p<0.001



**Figure 1:** Adjusted spline regression curves for the relationship between endometrial thickness and clinical outcomes with vertical breakpoint markers

- Non-linear rise-plateau relationship observed between EMT and clinical outcomes
- BP/CP/LB odds increased from <7mm to 7-11mm and were highest at >11mm
- Miscarriage odds trended lower at higher EMT (significant for BP but not CP loss)
- MED analyses: benefits begin at ~5mm for BP/CP/LB and at ~6mm for lower miscarriage risk
- Segmented regression identified outcome-specific breakpoints (beyond which higher thickness does not improve outcomes):
  - 9.96mm for CP
  - 11.3mm for LB
  - 12.2mm for miscarriage
- Prior to breakpoints, each additional millimeter increased BP odds by 16.9% (p<0.001), CP odds by 21.6% (p<0.001), LB odds by 14.1% (p<0.001), and modestly reduced miscarriage odds by 3.6%, (p<0.01).
- EMT's positive effects on BP varied by maternal age (<30 to >42; p<0.001) and PGT-A screening status (p<0.05), whereas effects on CP did not; age modified the EMT-miscarriage association (p<0.05).
- Overall discrimination was low (AUC 0.56-0.57 for BP/CP/LB; 0.53 for miscarriage conditional on BP/CP), indicating EMT alone is a weak but statistically significant predictor.

## Conclusions

Clinically, EMT >7mm identifies favorable conditions for embryo transfer, with optimal live birth outcomes observed up to ~11.3mm. While informative, EMT alone provides limited predictive performance, particularly for live birth (AUC 0.57), underscoring the potential for integrative approaches, such as AI-driven models, to combine endometrial, embryonic, and patient-level data for more precise transfer guidance and potential improvement of successful live birth outcomes.

[1] Pérez-Milán, F. et al. Impact of endometrial thickness on reproductive outcome in fresh and frozen-thawed embryo transfer: systematic review and meta-analysis. *Ultrasound Obstet Gynecol.* 66, 271-281 (2025).  
[2] Wu, J., Sheng, J., Wu, X. & Wu, Q. Ultrasound-assessed endometrial receptivity measures for the prediction of in vitro fertilization-embryo transfer clinical pregnancy outcomes: A meta-analysis and systematic review. *Exp. Ther. Med.* 26, (2023).