# Evaluating the Role of rIVM and rICSI in Assisted Reproductive Technology: A Systematic Review and Meta-analysis of Outcomes in Low/Failed Maturation and Fertilisation Cases

**Authors:** *Teodora Popa,[1,2] Andrew Thompson,[1,2] Halil Ruso,[1] Daria Iliev,[1] Chloe He,[1] Zofia Rzeznik,[1,3] Brinkley Gantt Mickel,[1,2] Hannah Coffey,[1] Rufus Morgan,[1] Oana Paun,[1] Madison Bailey,[1] Muhammad Fatum,[1] Jyoti Taneja,[1] Ali Al Chami,[1] Cristina Hickman[1,4]

1. Avenues Life, London, UK
2. UCL Institute for Women's Health, London, UK
3. Imperial College London, UK
4. Department of Metabolism, Digestion, and Reproduction, King's College London, UK

*Correspondence to teodora@avenues.life

**Disclosure:** Popa has received support for attending conferences from Merck, the British Fertility Society, IBSA, and Cooper Surgical; travel grants from Merck, the British Fertility Society, IBSA, and Cooper Surgical; and payment or honoraria for speakers' events from Merck and Cooper Surgical, with personal fees of less than 1,000 GBP. Ruso has received support for attending conferences from Merck, the British Fertility Society, IBSA, and Cooper Surgical; travel grants from Merck, the British Fertility Society, IBSA, and Cooper Surgical; and payment or honoraria for speakers' events from Merck and Cooper Surgical, with personal fees of less than 1,000 GBP. Taneja has received support for attending conferences from Merck, the British Fertility Society, IBSA, and Cooper Surgical; research and travel grants from Merck, the British Fertility Society, IBSA, and Cooper Surgical; and payment or honoraria for speakers' events from Merck, with personal fees of less than 1,000 GBP. Al Chami has received support for attending the conference from Merck, the British Fertility Society, IBSA, and Cooper Surgical; research and travel grants from Merck, the British Fertility Society, IBSA, and Cooper Surgical; and payment or honoraria for speakers' events from Merck, with personal fees of less than 1,000 GBP. Hickman has received payment or honoraria for lectures, presentations, speakers' bureaus, manuscript writing, or educational events from Vitrolife, Cooper Surgical, Planer, Hamilton Thorne, Merck Serono, and Ferring, with personal fees of less than 1,000 GBP. The other authors have declared no conflicts of interest.

**Keywords:** Fertilisation, rescue intracytoplasmic sperm injection (rICSI), rescue *in vitro* maturation (rIVM).

**Citation:** EMJ Repro Health. 2025;11[1]:43-44. https://doi.org/10.33590/emjreprohealth/XUKO2817

## INTRODUCTION

Approximately 80% of retrieved oocytes in IVF cycles reach maturity, with 60–80% undergoing successful fertilisation. However, 5–15% of cycles experience poor oocyte maturation or failed fertilisation, limiting treatment success. Rescue intracytoplasmic sperm injection (rICSI) and rescue *in vitro* maturation (rIVM) have been proposed as salvage strategies in these cases. Historically, concerns over embryo quality, aneuploidy risk, and low developmental potential have limited their routine use. Yet, the Human Fertilisation and Embryology Authority (HFEA)'s 9th Code of Practice (October 2023) formally permitted rICSI.

## METHODS

To evaluate the feasibility, safety, and effectiveness of Day 0 rICSI and rIVM, the authors conducted a systematic review and meta-analysis of 38 studies published between 1992–2023, following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines.[1] Studies examining Day 1 rICSI were excluded. The analysis included 24 studies on rIVM (7,183 cycles) and 14 on rICSI (2,475 cycles; 1,377 transfers), focusing on clinical pregnancy as the primary outcome, and secondary outcomes such as fertilisation rates, polyploidy risk, blastulation, miscarriage, and live birth rates.

## RESULTS

rIVM showed oocyte maturation rates of 57% (metaphase [M] stage: MI–MII) and 68% (germinal vesicle [GV] stage: GV–MII), with blastulation rates of 21% (MI–MII) and 16% (GV–MII). Clinical pregnancy rates reached 19% for MI–MII mature oocytes, but GV–MII rIVM cycles had a high miscarriage rate (67%). Pre-vitrification maturation was 63% (24/38), which was slightly higher than 59% (19/32) post-vitrification, with higher survival rates pre-vitrification (95% versus 82%). For cycles with fewer than nine mature oocytes, rIVM significantly improved clinical pregnancy (56% versus 47%; $p<0.001$) and live birth rates (65% versus 48%; $p<0.001$).

For rICSI, pooled fertilisation rates were 68.0% (11,022/16,101), with polyploidy rates at 6.0% and malformation rates at 0.3% (2/711 embryos). The clinical pregnancy rate was 45%, the implantation rate was 30% (647/2,124), and live births reached 709 cases, with no increased risk of malformations. The estimated impact of routine rIVM and rICSI could result in an additional 1,714 live births annually in the UK.

## CONCLUSION

These findings indicate that rICSI and rIVM significantly improve pregnancy and live birth outcomes in cycles with low fertilisation or oocyte maturity, without major safety concerns. Nonetheless, study heterogeneity and the suboptimal outcomes associated with GV-stage oocytes, particularly the high miscarriage rate, warrant caution. Further prospective studies are needed to assess the long-term health of resulting offspring. Overall, these interventions offer promising strategies to optimise assisted reproductive technology outcomes, minimise cycle cancellations, and improve conception chances through evidence-based and safety-conscious approaches.

### Reference

1. Coffey H et al. O-183 evaluating the role of rescue IVM and rescue ICSI in ART: a systematic review and meta-analysis of outcomes in low/failed maturation and fertilisation cases. Hum Reprod. 2025;40(Suppl_1):deaf097.183.