VI ENCONTRO ANUAL ALMER

XVI CONGRESSO PAULISTA DE MEDICINA REPRODUTIVA

MEDICINA REPRODUTIVA DE PRECISÃO

Time-lase:
Estudo de viabilidade econômica

Edson Borges Jr.
Fertility Medical Group
FERTGROUP
Instituto Sapientiae

FERTGROUP | FERTILITY

FERTGROUP
MEDICINA REPRODUTIVA

Associação Instituto Sapientiae

Declaração:

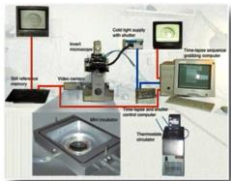
Atividade conjunta de cursos e aulas juntamente com a Igenomix – Vitrolife

Sem relação comercial com o tema relacionado a apresentação

Resolução do Conselho Federal de Medicina
nº 1.595/2.000

FERTGROUP | FERTILITY

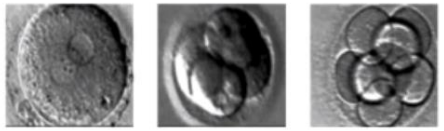
History of « modern » TLT



Single-point morphological assessment

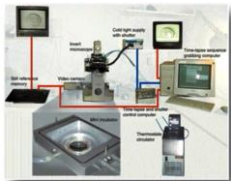
1997[1] **2011[2]** **2020**

D3 culture **Blastocyst culture**



[1]Payne et al. *Hum Reprod*. 1997;**12**:532–541.
[2]Meseguer et al. *Hum Reprod.* 2011;**26**:2658–2671.

History of « modern » TLT

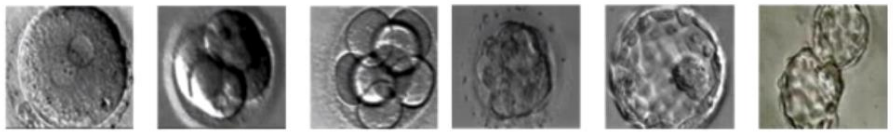


Single-point morphological assessment

Continuous embryo monitoring

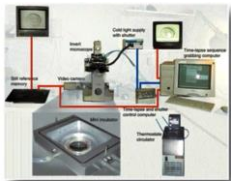
1997[1] **2011[2]** **2020**

D3 culture **Blastocyst culture**



[1]Payne et al. *Hum Reprod*. 1997;**12**:532–541.
[2]Meseguer et al. *Hum Reprod.* 2011;**26**:2658–2671.

History of « modern » TLT



Single-point morphological assessment

Continuous embryo monitoring

Manual algorithms

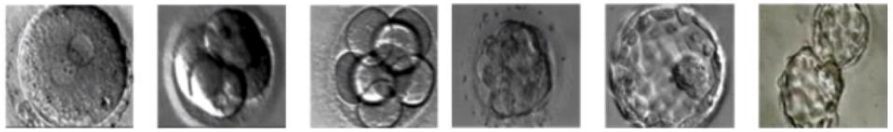
1997[1]

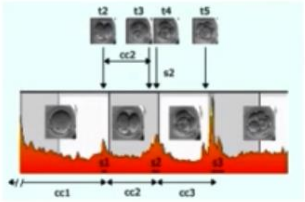
2011[2]

2020

D3 culture

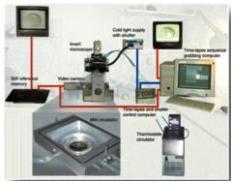
Blastocyst culture

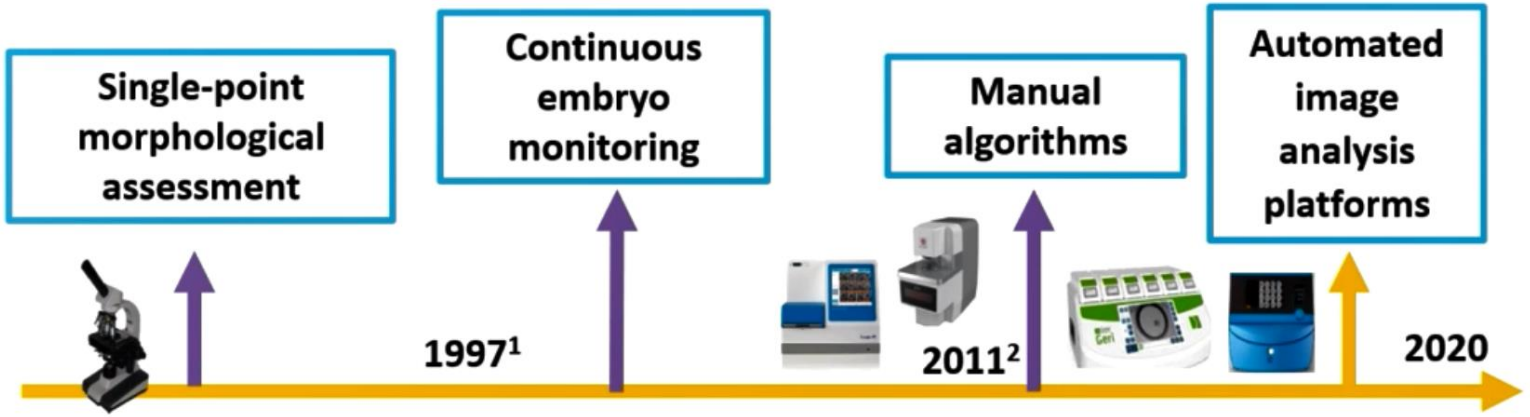


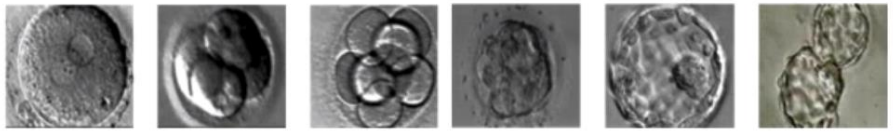


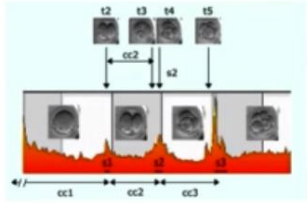
[1]Payne et al. *Hum Reprod*. 1997;**12**:532–541.
[2]Meseguer et al. *Hum Reprod.* 2011;**26**:2658–2671.

History of « modern » TLT









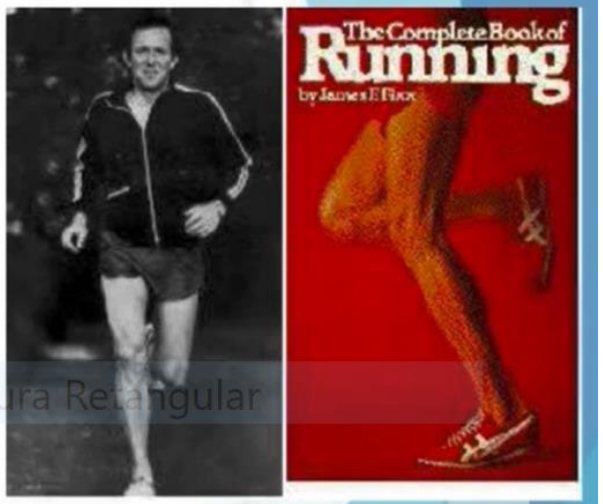
[1]Payne et al. *Hum Reprod*. 1997;**12**:532–541.
[2]Meseguer et al. *Hum Reprod.* 2011;**26**:2658–2671.

Morphokinetics and what we do not see!

- Winston Churchill
- Drank
- Smoked Cigars
- Overweight

- Roger Bannister
- The first man to run the 4 minute mile
- Exercised frequently

- Jimmy Fixx
- Started America's fitness revolution, popularizing running

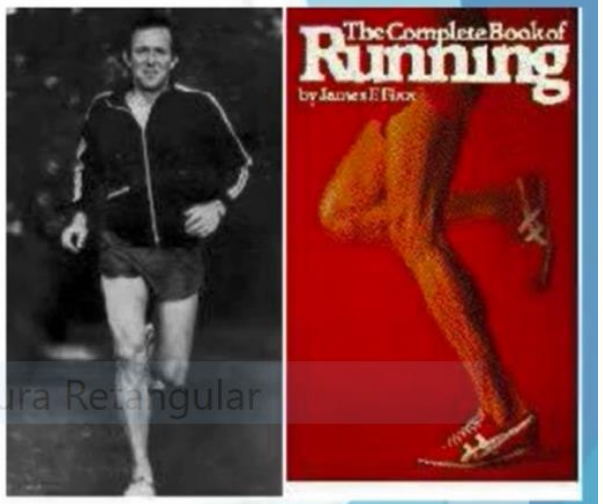


Morphokinetics and what we do not see!

- Winston Churchill
- Drank
- Smoked Cigars
- Overweight

- Roger Bannister
- The first man to run the 4 minute mile
- Exercised frequently

- Jimmy Fixx
- Started America's fitness revolution, popularizing running



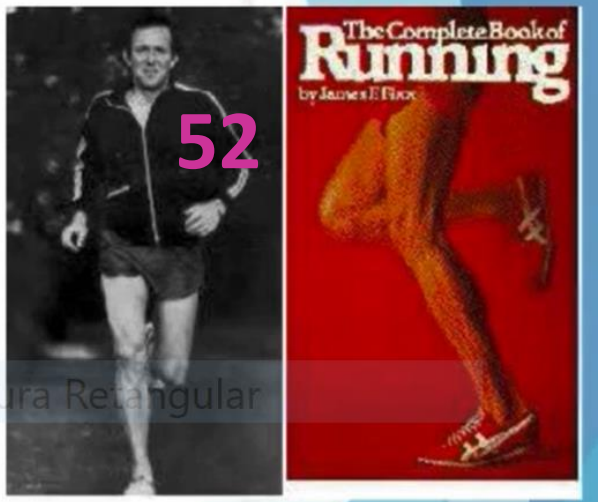
Who lived the longest?

Morphokinetics and what we do not see!

- Winston Churchill
- Drank
- Smoked Cigars
- Overweight

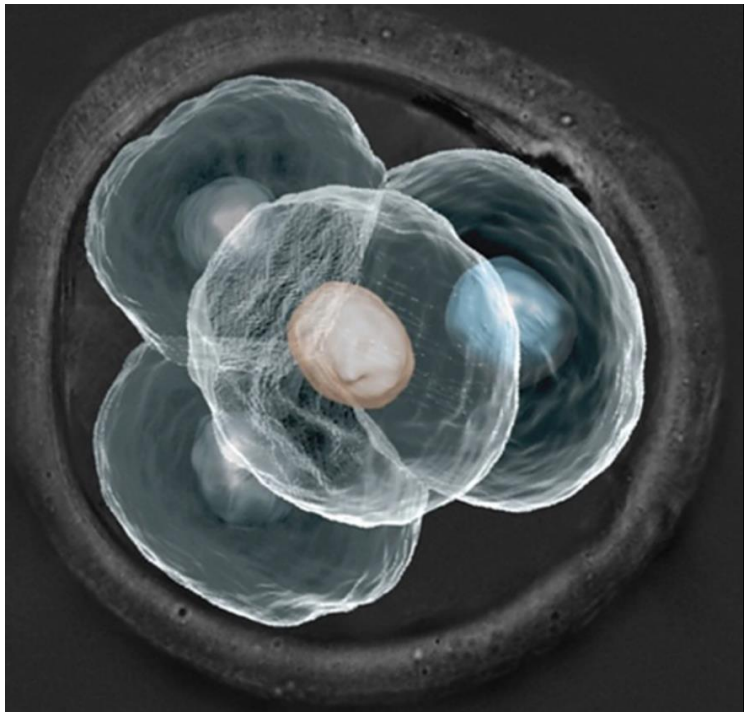
- Roger Bannister
- The first man to run the 4 minute mile
- Exercised frequently

- Jimmy Fixx
- Started America's fitness revolution, popularizing running



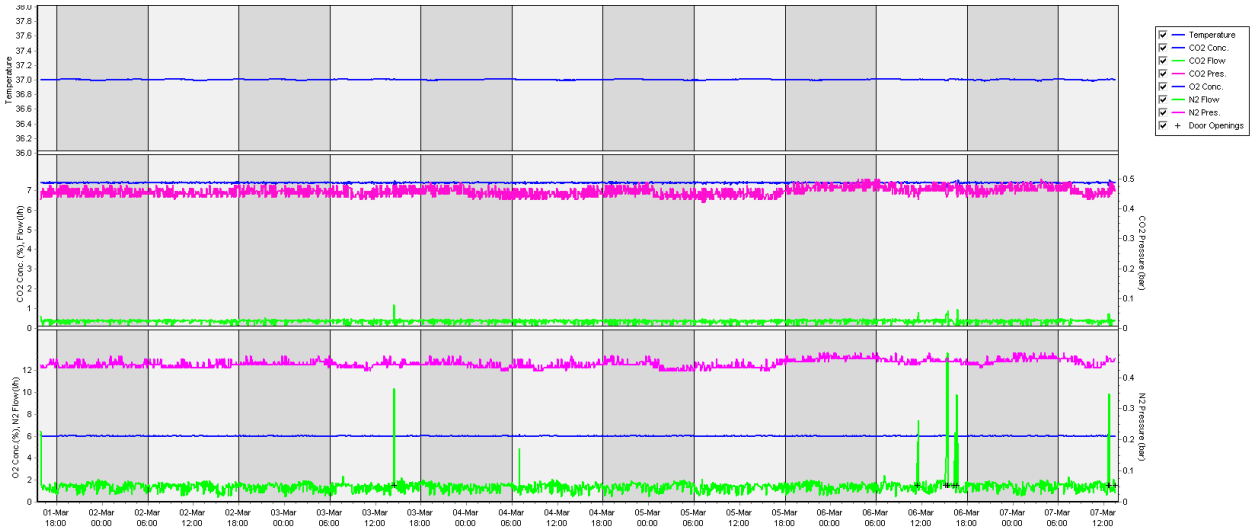
Who lived the longest?

IA and deep learning – embryo evaluation



TIME-LAPSE EMBRYOSCOPE

AMBIENTE DE CULTIVO SEGURO PARA OS EMBRIÕES



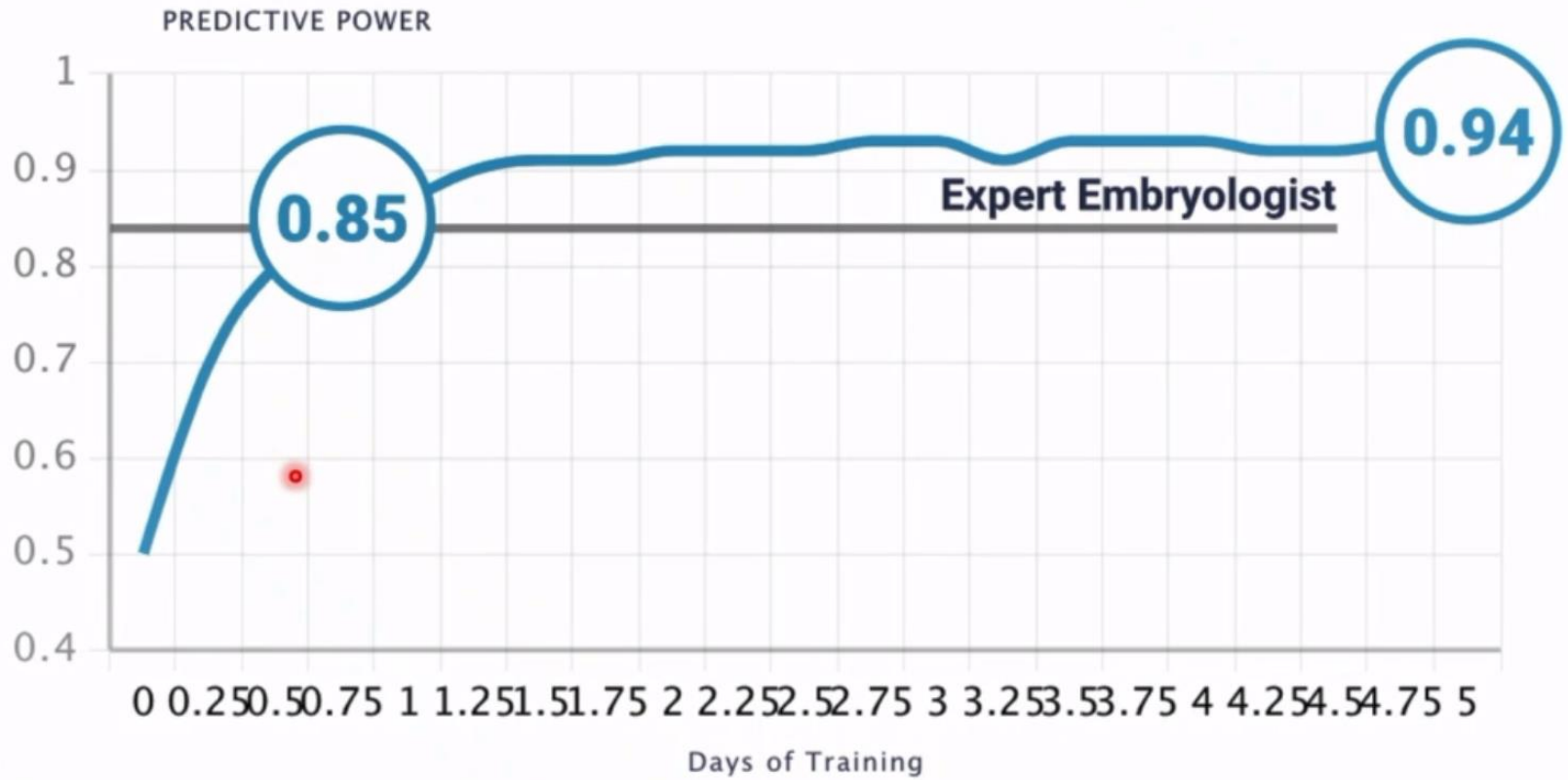
- Temperatura
- CO_2 / O_2
- pH
- VOC
- Coleção de imagens
- Alarme

Summary | Alarms | Warnings | Log | Other

Variable	Unit	Average	Min	Max	StdDev	Set-Point
Temperature	C	37.00	36.98	37.02	0.007	37.0
CO2 Concentration	%	7.38	7.25	7.46	0.032	7.4
CO2 Flow	l/h	0.36	0.01	0.60	0.096	0.0
CO2 Pressure	bar	0.46	0.42	0.50	0.016	0.0
O2 Concentration	%	6.01	5.97	6.15	0.011	6.0
N2 Flow	l/h	1.38	0.45	6.45	0.361	0.0
N2 Pressure	bar	0.44	0.42	0.48	0.013	0.0

FERTGROUP | FERTILITY

AI technology **exceeded expert human embryologists after only one day** of training

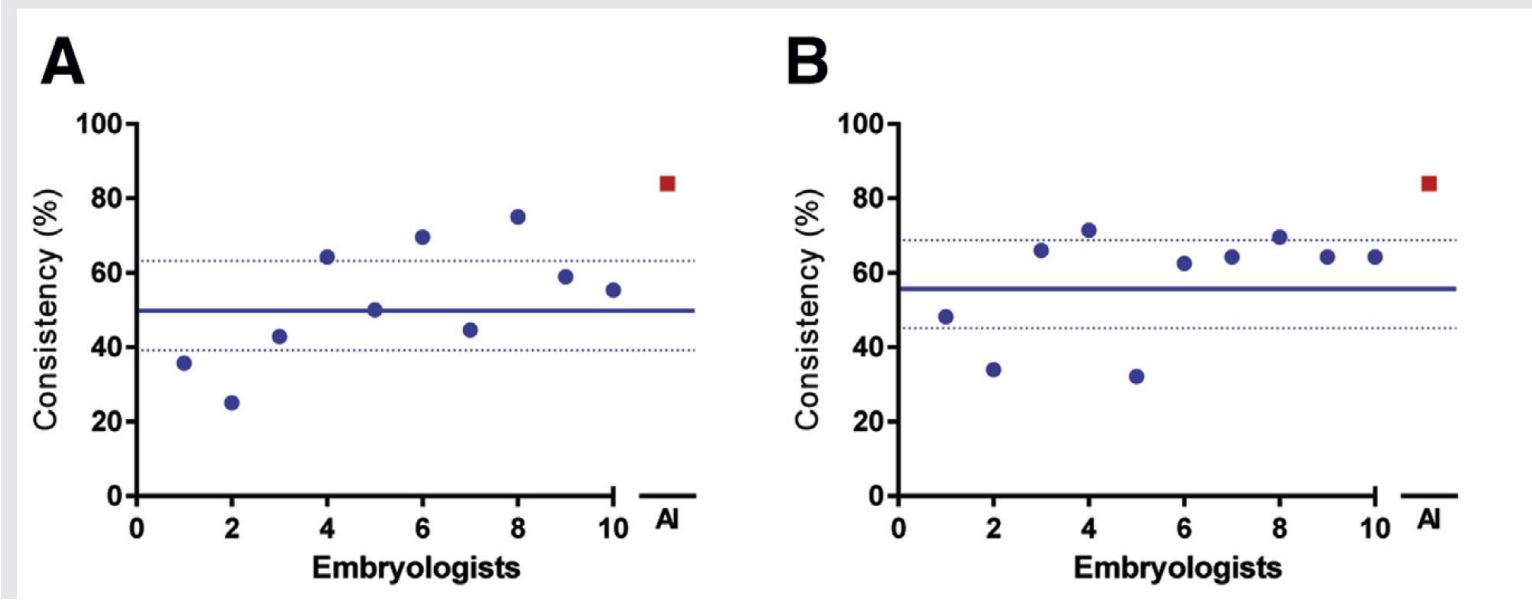


Consistency and objectivity of automated embryo assessments using deep neural networks

Charles L. Bormann, Ph.D.,[a,b] Prudhvi Thirumalaraju, B. Tech,[c] Manoj Kumar Kanakasabapathy, M. Tech,[c] Hemanth Kandula, B. Tech,[c] Irene Souter, M.D.,[a] Irene Dimitriadis, M.D., Ph.D.,[a,b] Raghav Gupta, B. Tech,[c] Rohan Pooniwala, B. Tech,[c] and Hadi Shafiee, Ph.D.[a,b]

Fertility and Sterility® Vol. 113, No. 4, April 2020

Either discarding or selecting embryos for biopsy for cryo-preservation



Variability ***(%CV averages)*****:**

- Embryologist: *82.84% for 70 hpi and 44.98% for 113 hpi*
- Neural Network: 16,08%

FERTGROUP | FERTILITY

Human Fertilisation & Embryology Authority

Category	Add-on	HFEA traffic light scoring
Gamete, endometrial and embryological	Time-lapse imaging of embryos*	🟠
	Assisted hatching*	🔴
	EmbryoGlue*	🟠
	Sperm DNA testing*	Not considered by HFEA
	Egg activation with calcium ionophore*	🟠
	Physiological intracytoplasmic sperm injection (PICSI)*	🔴
	Intracytoplasmic morphologic sperm injection (IMSI)*	🔴
	Preimplantation genetic screening (PGS) (on subset of chromosomes) §	🔴
	Endometrial receptivity array†	🟠
Surgical procedures	Endometrial scratching†	🟠
Drug therapies	Reproductive immunology‡	🔴

Key
- 🟢 Evidence of clinical effectiveness and safety
- 🟠 Conflicting clinical effectiveness
- 🔴 Evidence of clinical ineffectiveness

FERTGROUP | FERTILITY

https://www.hfea.gov.uk/treatments/treatment-add-ons/

JBRA Assisted Reproduction 2023;**27**(4):727-738
doi: 10.5935/1518-0557.20230047

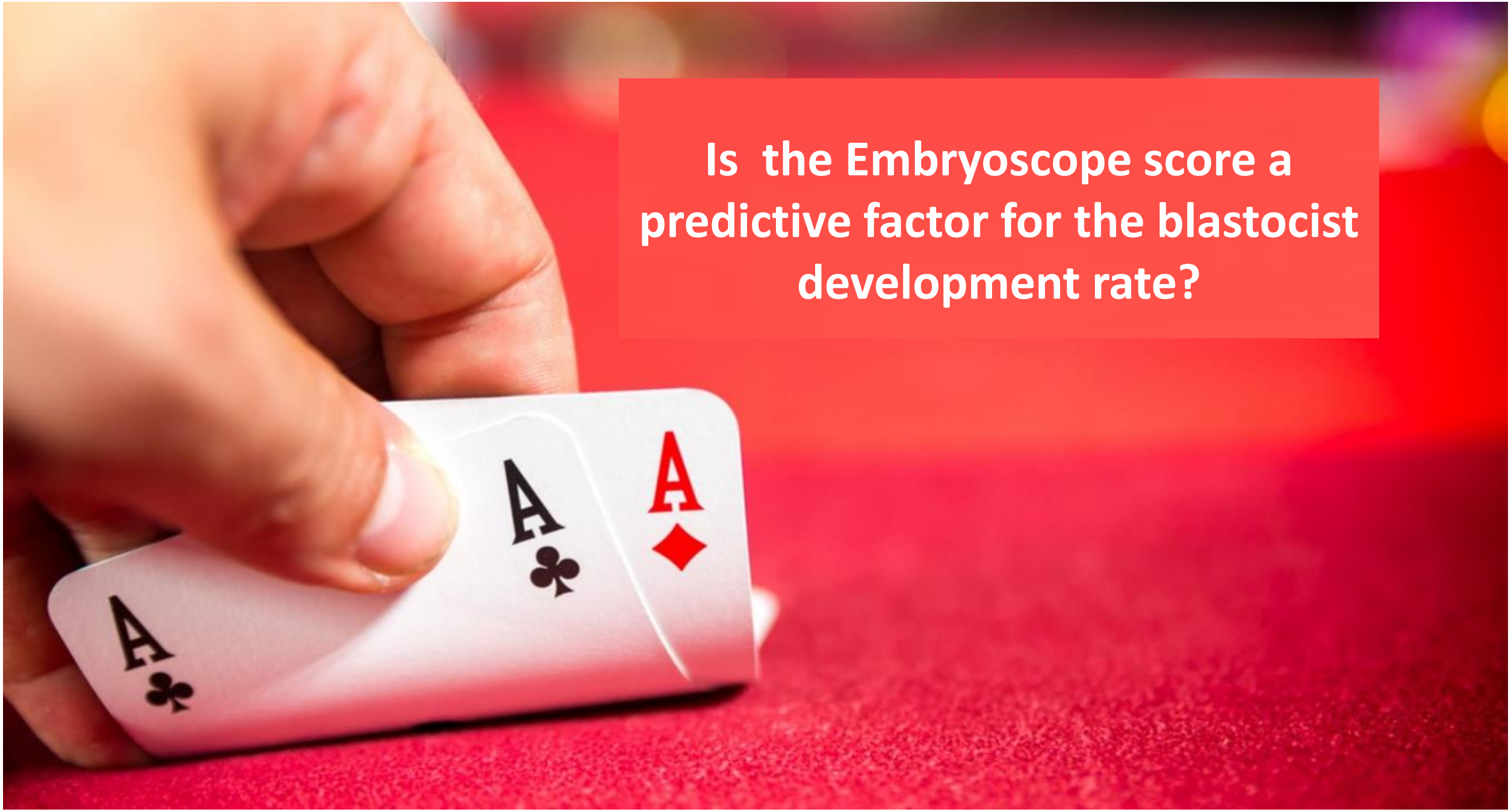
SBRA Pages

Delphi consensus on add-ons and social midia in Assisted Reproductive Technology

Alvaro Ceschin[1], Álvaro Petracco[2], Edson Borges Jr[3,4], Emerson Barchi Cordts[5], Hitomi Miura Nakagawa[6], Maria do Carmo Borges de Souza[7], Maria Madalena Pessoa Caldas[8], Newton Eduardo Busso[9], Paulo Gallo de Sá[10], Pedro Augusto Araújo Monteleone[11], Rui Alberto Ferriani[12]

[1]Feliccità – Instituto de fertilidade, Curitiba, PR, Brazil
[2]Fertilitat – Porto Alegre, RS, Brazil
[3]Fertility Medical Group, São Paulo, SP, Brazil
[4]Associação Instituto Sapientiae, São Paulo, SP, Brazil
[5]Instituto Ideia Fértil, São Paulo, SP, Brazil
[6]GENESIS - Centro de Assistência em Reprodução Humana, Brasília, DF, Brazil
[7]Fertipraxis Centro de Reprodução, Rio de Janeiro, RJ, Brazil
[8]Clínica de Fertilidade GEARE, Recife, PE, Brazil
[9]Projeto ALFA, São Paulo, SP, Brazil
[10]Centro de Fertilidade Vida, Rio de Janeiro, RJ, Brazil
[11]Monteleone – Centro de Fertilização Humana, São Paulo, SP, Brazil
[12]Setor de Reprodução Humana FMRP/USP, Ribeirão Preto, SP, Brazil

Traffic light scoring	Add-on
	Ativação artificial de ovócitos com ionóforo de cálcio
	Ciclos eletivos de congelamento de embriões
	Meio enriquecido com ac. hialurônico (EmbryoGlue)
	DuoStim
	Injeção intracitoplasmática de esperma morfologicamente selecionado (IMSI)
	Injeção Intracitoplasmática de Espermatozoide Fisiológica (PICSI)
	Teste de fragmentação de DNA espermático
	Teste genético pré-implantacional para aneuploidia
	Tecnologia de imagem *time-lapse*
	Hormônios do crescimento
	Antioxidantes masculinos

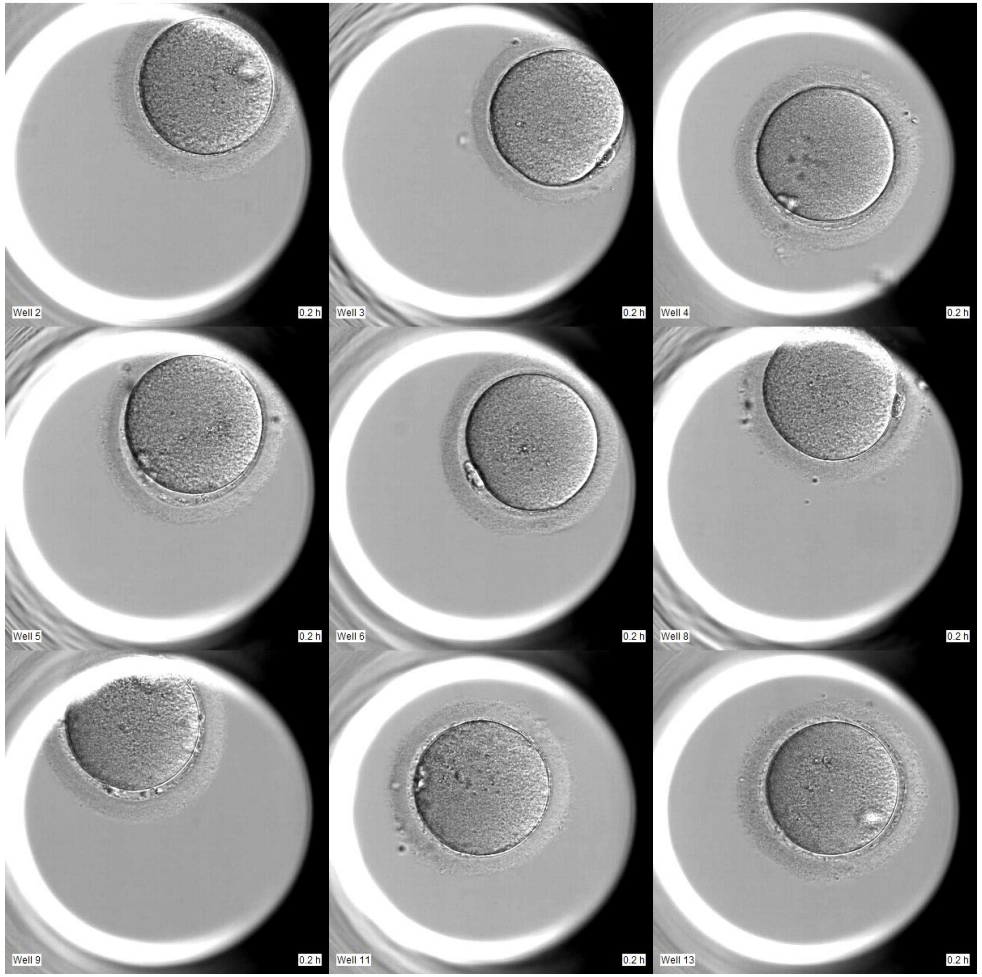

Is the Embryoscope score a predictive factor for the blastocist development rate?

Embryoscope FERTILITY

- 427 ciclos
- 372 pacientes

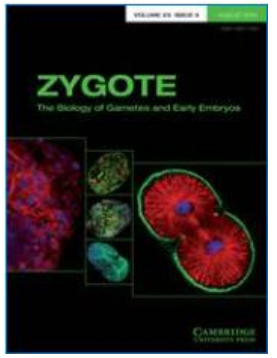
✓3.020 ovócitos cultivados
✓2.398 2PN (79,4%)
✓1.488 blastocistos: *62,1% 2PN*

❑ 2018: *49,9% 2PN*



FERTGROUP | FERTILITY

Improved embryonic development and utilization rates with EmbryoScope: a within-subject comparison versus a benchtop incubator



Edson Borges Jr. *et al,* 2022
doi:10.1017/S0967199422000077

Table 2. Comparison of embryonic development between Control and TLI groups using GzLM followed by Bonferroni post hoc test

Variables	Control group ($n = 71$)	TLI group ($n = 71$)	*P*-value
Normal fertilization (%)	74.8 ± 2.7 (69.6–80.1)	77.4 ± 2.7 (72.2–82.6)	0.499
Abnormal fertilization (%)	6.2 ± 1.5 (3.1–9.2)	6.8 ± 1.5 (3.8–9.8)	0.767
Non-fertilization (%)	16.8 ± 2.1 (12.7–20.8)	11.9 ± 2.1 (7.8–15.9)	0.098
Oocyte degeneration post injection (%)	2.2 ± 1.3 (0.22–4.7)	3.9 ± 1.3 (1.4–6.3)	0.352
Day-2 non-cleavage (%)	3.8 ± 0.2 (3.3–4.3)	1.1 ± 0.1 (0.9–1.3)	<0.001
Cleavage (%)	85.3 ± 1.2 (83.0–87.7)	84.2 ± 1.3 (81.7–86.8)	0.521
Day-5 embryos (%)	62.4 ± 1.0 (60.5–64.3)	86.4 ± 1.1 (84.2–88.6)	<0.001
Blastocyst development (%)	40.9 ± 1.1 (38.8–43.1)	55.6 ± 1.3 (53.1–58.1)	<0.001
Frozen blastocyst (%)	31.8 ± 0.8 (30.3–33.3)	37.0 ± 0.9 (35.2–38.9)	<0.001
OUR	40.7 ± 1.0 (38.8–42.7)	50.2 ± 1.1 (48.0–52.4)	<0.001
EUR	52.4 ± 1.1 (50.3–54.7)	66.6 ± 1.2 (64.3–68.9)	<0.001

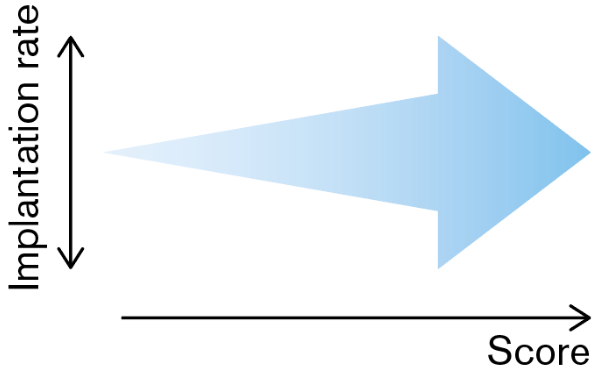
Note: Values are means ± standard error (95% confidence interval). EUR: embryo utilization rate; GzLM: generalized linear models; OUR: oocyte utilization rate; TLI: time-lapse imaging.

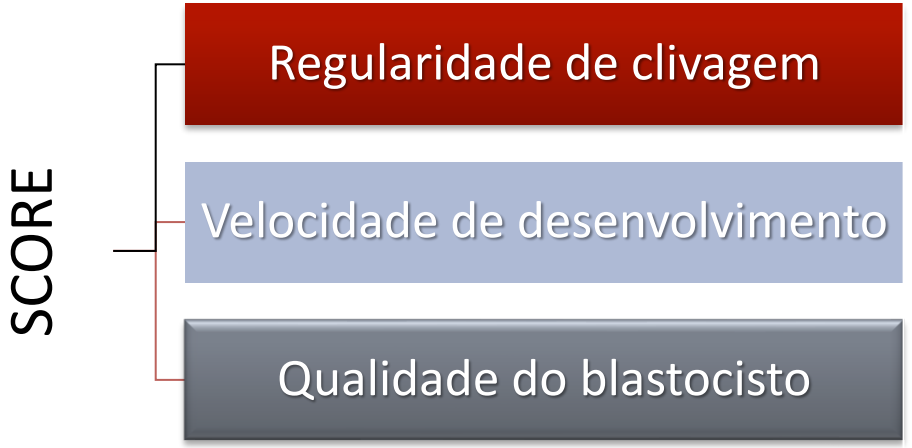

Is the Embryoscope score correlated with pregnacy rate?

EMBRYOSCOPE – KIDScore D5

O KIDScore D5 é baseado nas informações do desenvolvimento embrionário até o dia 5, de aproximadamente 1100 embriões com status de implantação conhecido.

Score: 1 a 9,9 (de acordo com a chance de implantação)





EMBRYOSCOPE - KIDSCORE

KIDSCORE D3

Well	Dec.	Current score	NOT2PN	tPNf	t2	t3	t4	t5	t8	cells66	Last stage	Morph. grade	Last image
AA-1	❄	3	●	23.1	26.3	40.0	40.8	40.8	60.3	8.0	B	4CC D6	
AA-2	❄	4	●	24.9	27.6	39.0	39.2	57.3	69.5	7.0	B	5BA D6	
AA-3	❄	4	●	23.7	26.3	40.2	40.5	56.4	68.8	7.0	B	4CC D6	
AA-4	✗	5	○	22.2	24.9	36.5	37.2	51.1	56.6	9.0	B	4CC D6	
AA-5	✓	5	●	24.9	27.6	40.5	41.2	56.1	58.8	8.0	B	3BA D5	
AA-6	❄	5	●	21.1	24.1	35.6	36.3	49.6	52.4	8.0	B	4BB D5	
AA-7	❄	1	●	26.1	28.8	31.0	41.0	41.0	55.8	8.0	B	4AA D5	
AA-8	❄	1	●	31.5	33.6	36.5	47.4	48.1	65.3	8.0	B	3BB D5	
AA-9	✓	5	●	22.7	25.3	37.0	37.0	49.4	52.6	8.0	B	4AA D5	
AA-10	❄	1	●	21.4	23.7	24.8	33.6	33.8	46.4	8.0	B	5AA D5	

SCORE

KIDSCORE D5

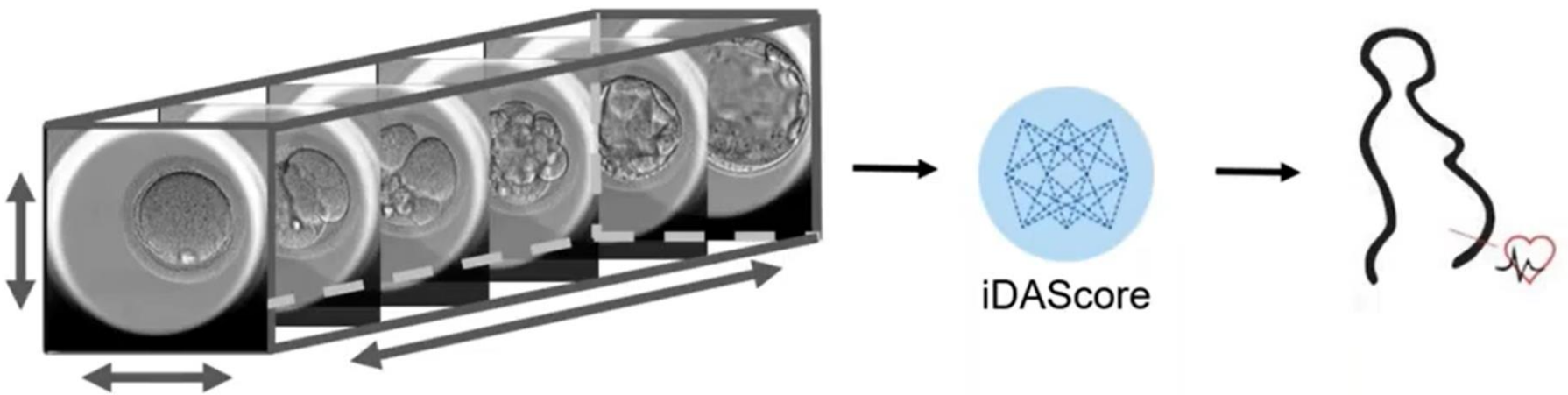
Well	Dec.	Current score	NOT2PN	t2	t3	t4	t5	tB	TE	Last stage	Morph. grade	Last image
AA-1	❄	2.3	●	26.3	40.0	40.8	40.8	136.7	C	B	4CC D6	
AA-2	❄	4.9	●	27.6	39.0	39.2	57.3	118.5	A	B	5BA D6	
AA-3	❄	4	●	26.3	40.2	40.5	56.4	113.4	C	B	4CC D6	
AA-4	✗	2.9	○	24.9	36.5	37.2	51.1	127.3	C	B	4CC D6	
AA-5	✓	6.5	●	27.6	40.5	41.2	56.1	112.2	A	B	3BA D5	
AA-6	❄	6.5	●	24.1	35.6	36.3	49.6	111.7	B	B	4BB D5	
AA-7	❄	3.6	●	28.8	31.0	41.0	41.0	107.5	A	B	4AA D5	
AA-8	❄	3.3	●	33.6	36.5	47.4	48.1	114.9	B	B	3BB D5	
AA-9	✓	7.8	●	25.3	37.0	37.0	49.4	104.7	A	B	4AA D5	
AA-10	❄	3.9	●	23.7	24.8	33.6	33.8	94.8	A	B	5AA D5	

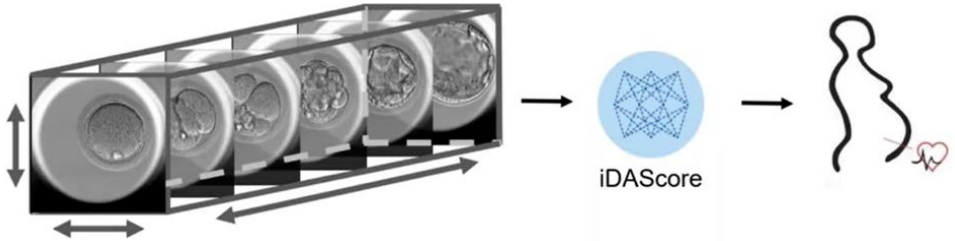
FERTGROUP | FERTILITY

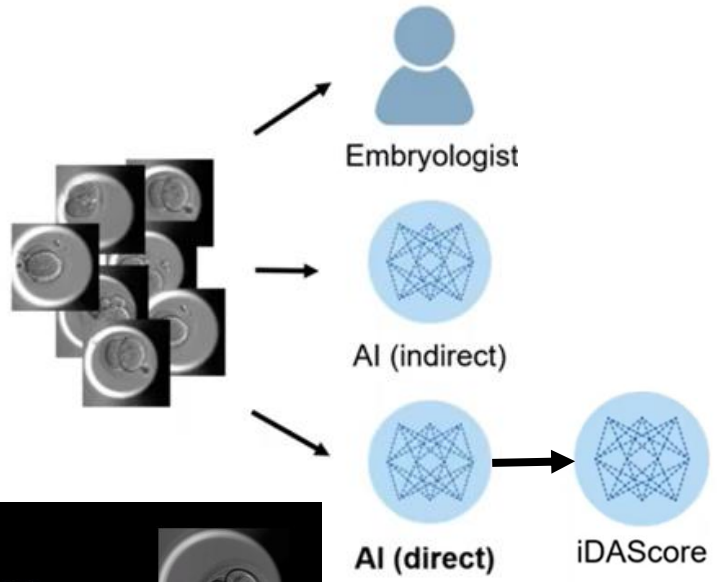
IDASCORE

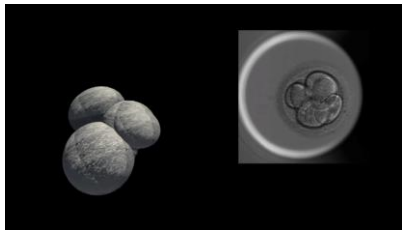
- Full time-lapse sequences
- 18 clinics
- Linked to fetal heartbeat (FH)

	IVY	iDAScore
FH+	694	4,337
FH-	1,079	10,307
Discards	7,063	101,188
Total	**8,836**	**115,832**









Make a Decision

Embryos

Finalise

Embryo	Score	Fresh ○ All ◉	Pronuclei	Decision
AA-1	9.0			
AA-2	8.9			
AA-4	8.9			
AA-6	8.2			
AA-7	6.7			
AA-8	8.9			
AA-9	9.5			✓
AA-10	8.9			

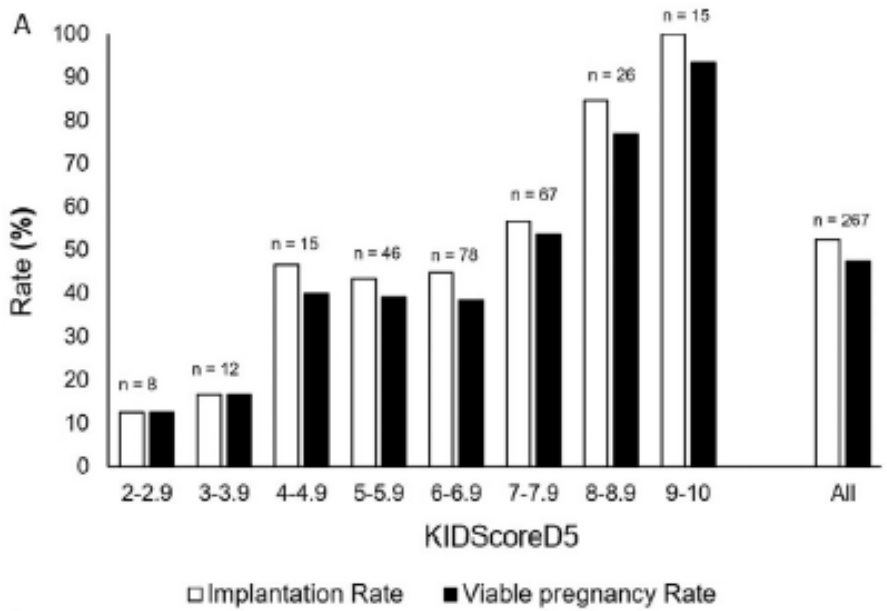
FERTGROUP | FERTILITY

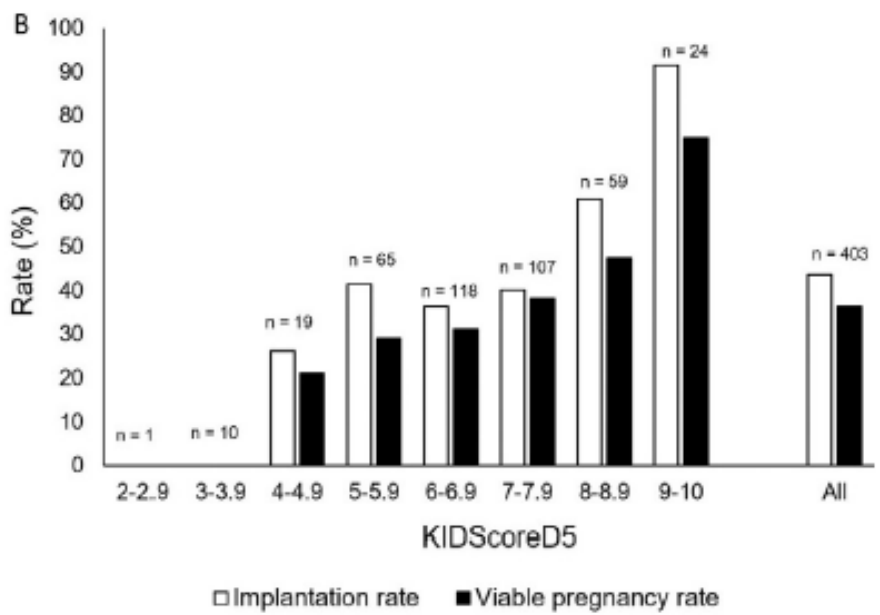
RBMO

ELSEVIER

ARTICLE

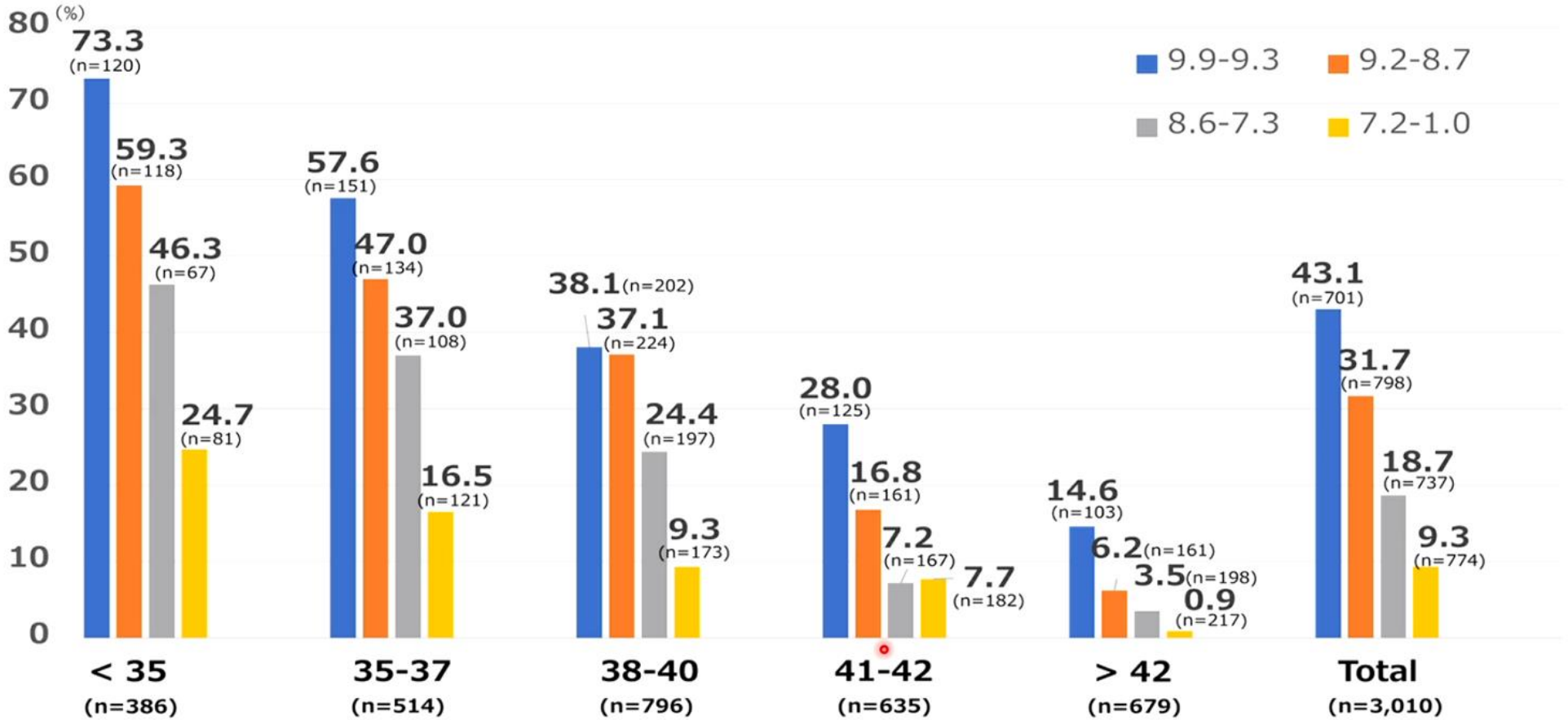
Time-lapse KIDScoreD5 for prediction of embryo pregnancy potential in fresh and vitrified-warmed single-embryo transfers





European Society of Human Reproduction and Embryology

The correlation between LB rates and each iDAScore group stratified by SART maternal age groups.



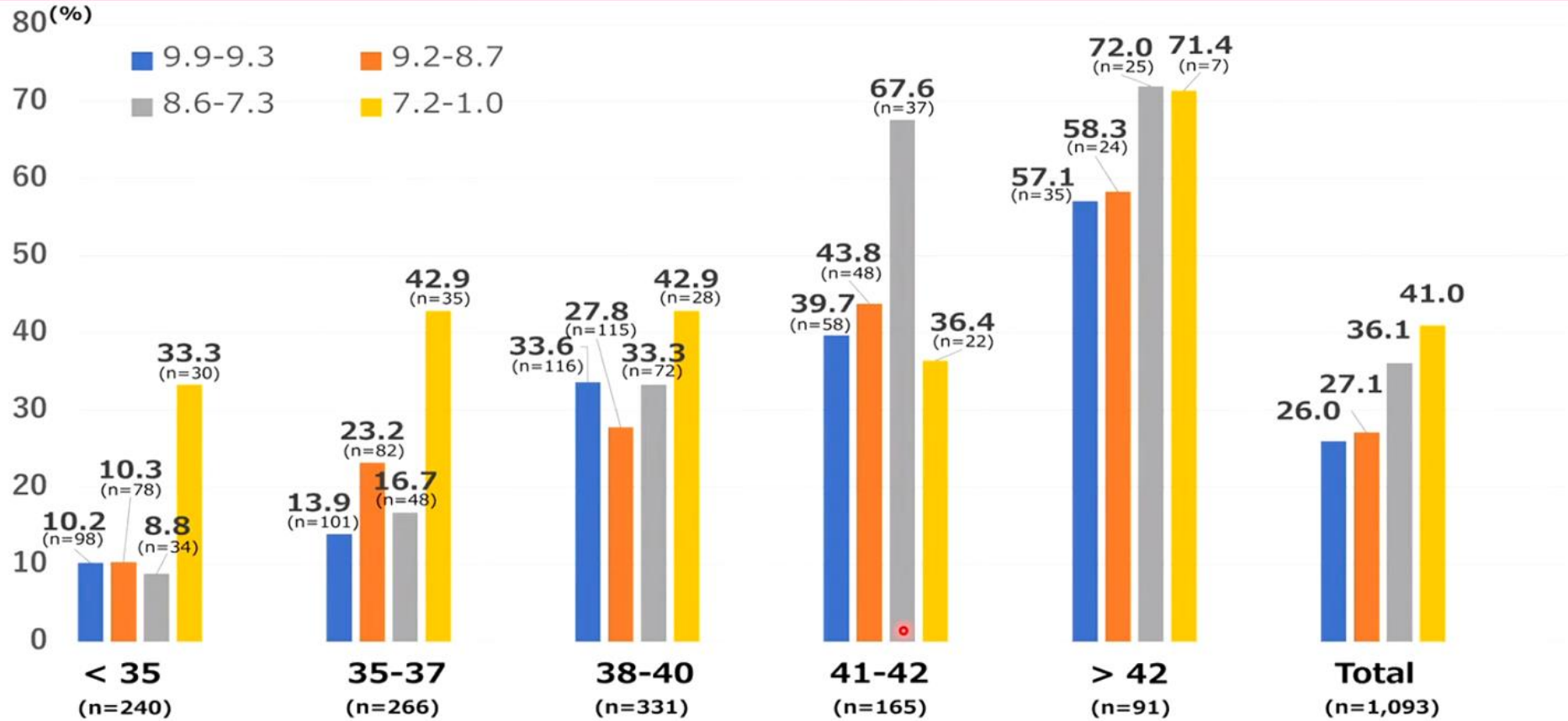
In each maternal age group, LB rates significantly decreased when the iDAScore group decreased ($P<0.05$)

Kato Ladies Clinic

Journal of Assisted Reproduction and Genetics (2022) 39:2089–2099
https://doi.org/10.1007/s10815-022-02562-5

European Society of Human Reproduction and Embryology

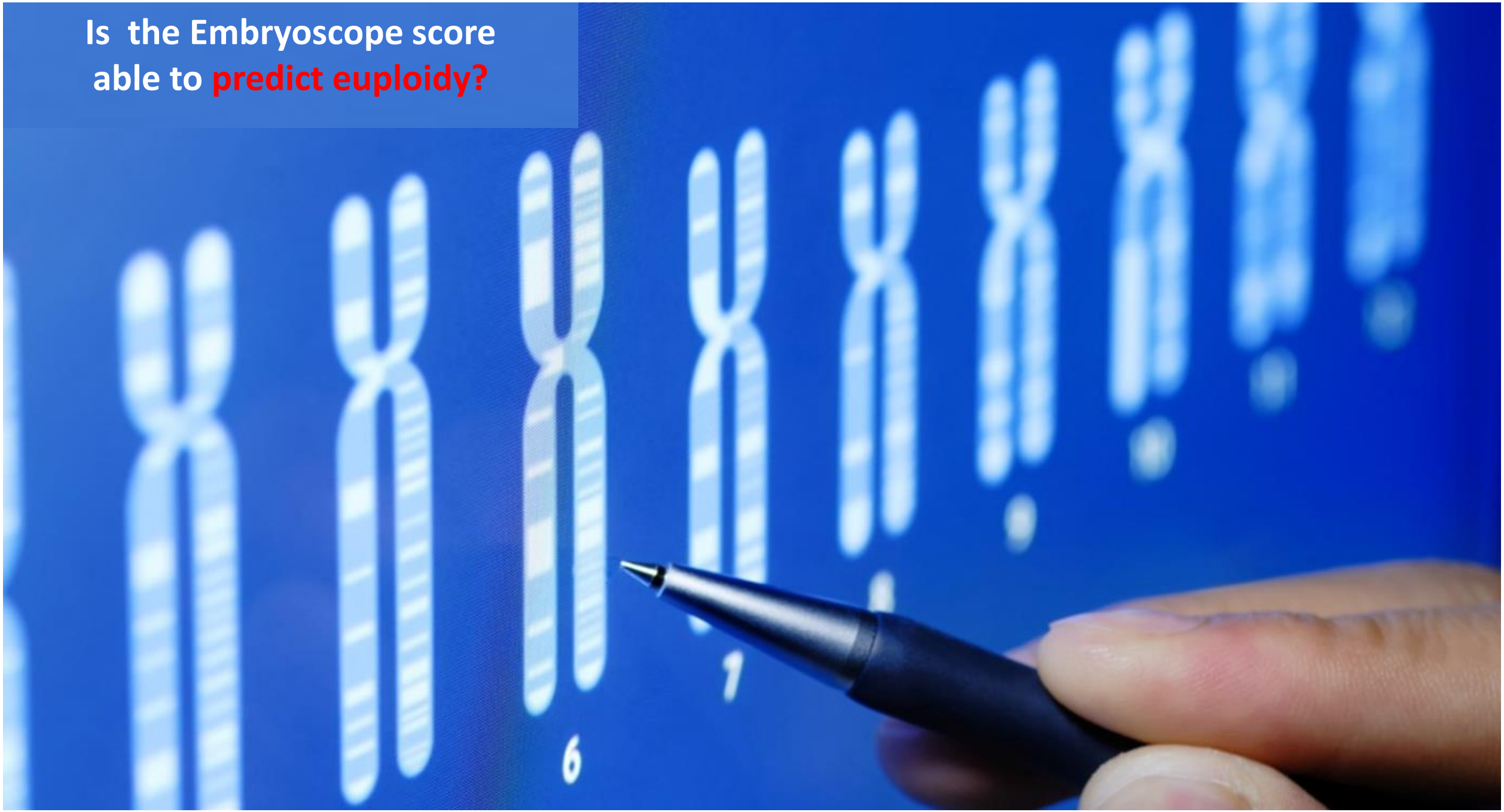
The correlation between miscarriage rates and each iDAScore group stratified by maternal age



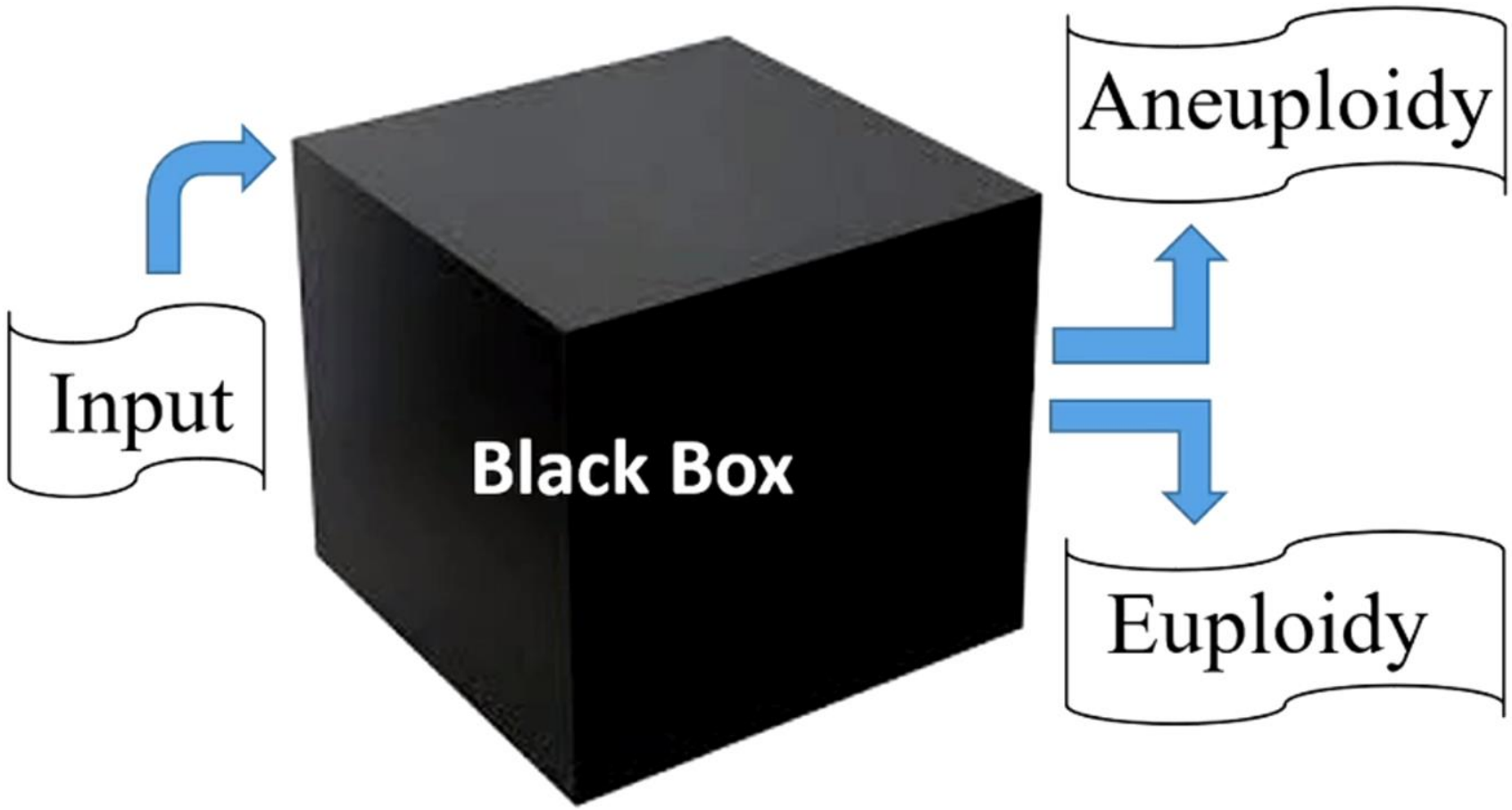
TM rates significantly increased progressively with decreasing iDAScores, except in the 38–40 year-old group and >42 years-old group (P<0.05).

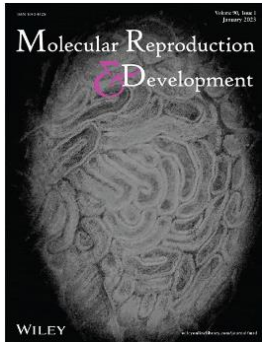
Journal of Assisted Reproduction and Genetics (2022) 39:2089–2099
https://doi.org/10.1007/s10815-022-02562-5

Is the Embryoscope score able to predict euploidy?



- Noninvasive PGT: Current Status





Time-lapse monitoring: An adjunct tool to select embryos for preimplantation genetic testing

Daniela P. de Almeida Ferreira Braga[1,2] | Amanda S. Setti[1,2] | Patricia Guilherme[1] | Christina Morishima[2] | Assumpto Iaconelli Jr.[1,2] | Edson Borges Jr.[1,2]

Table 1: General characteristics of patients and laboratory ICSI cycle outcomes (n=316)

		Mean	Std. Deviation
Female age (years)		38.3	3.4
Male age (years)		40.2	5.5
Total dose of FSH	Follitropin alfa (IU)	2615.7	799.2
	Follitropin delta (µg)	152.8	34.7
Oestradiol level on hCG trigger (pg/mL)		2127.9	2104.2
Follicles (n)		13.1	8.6
Retrieved oocytes (n)		10.0	7.1
Oocyte yield (%)		76.8	17.0
Mature oocytes (n)		7.7	5.9
Mature oocyte rate (%)		77.4	19.2
Fertilization rate (%)		77.7	19.0
Blastocyst development (%)		53.6	31.4

Note: ICSI – intracytoplasmic sperm injection; FSH– follicle stimulating hormone; hCG – human chorionic gonadotropin

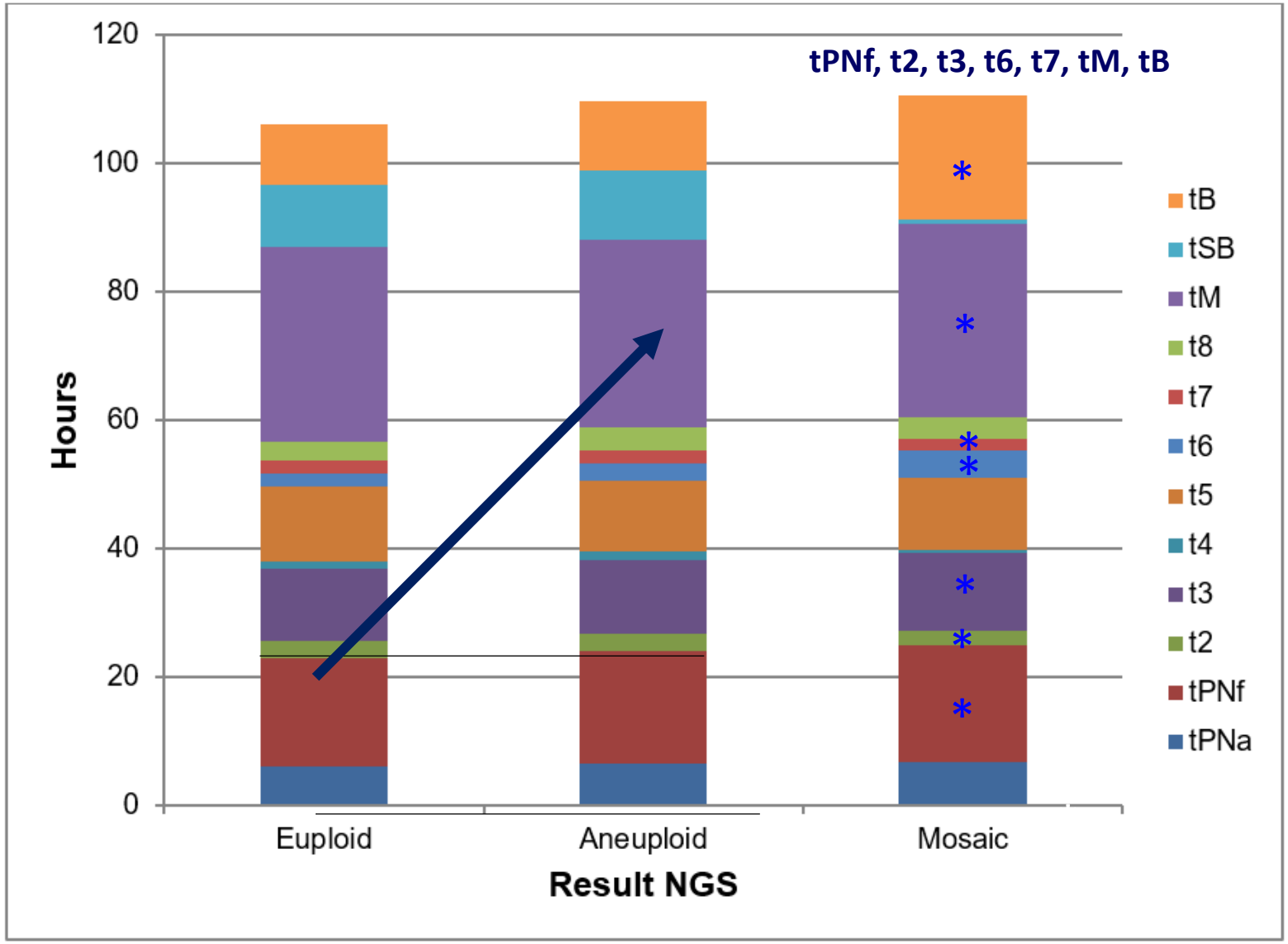


Figure 1: A comparison of the cumulative morphokinetic development of euploid, aneuploidy and mosaic embryos.

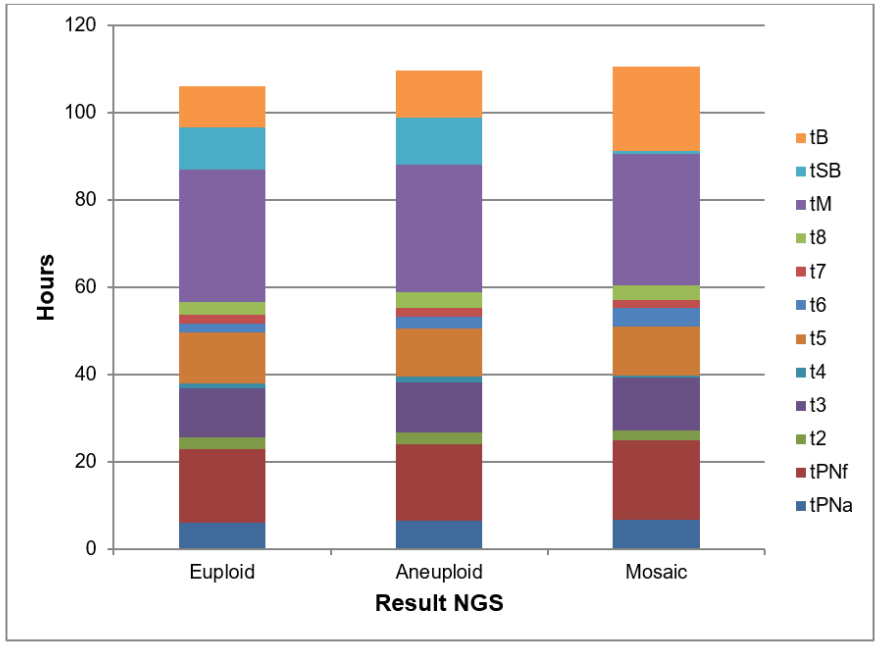


Figure 1: A comparison of the cumulative morphokinetic development of euploid, aneuploidy and mosaic embryos.

Morphokinetic data	Euploid embryos (n=352)	Aneuploid embryos (n=593)			Mosaic embryos (n=22)			p-value
KIDScore day 5	6.52±0.13[a]	5.54±0.10 [b]	-0.97	-1.30 - -0.64	4.62±0.49 [a.b]	-1.89	-2.89 - -0.88	< 0.001

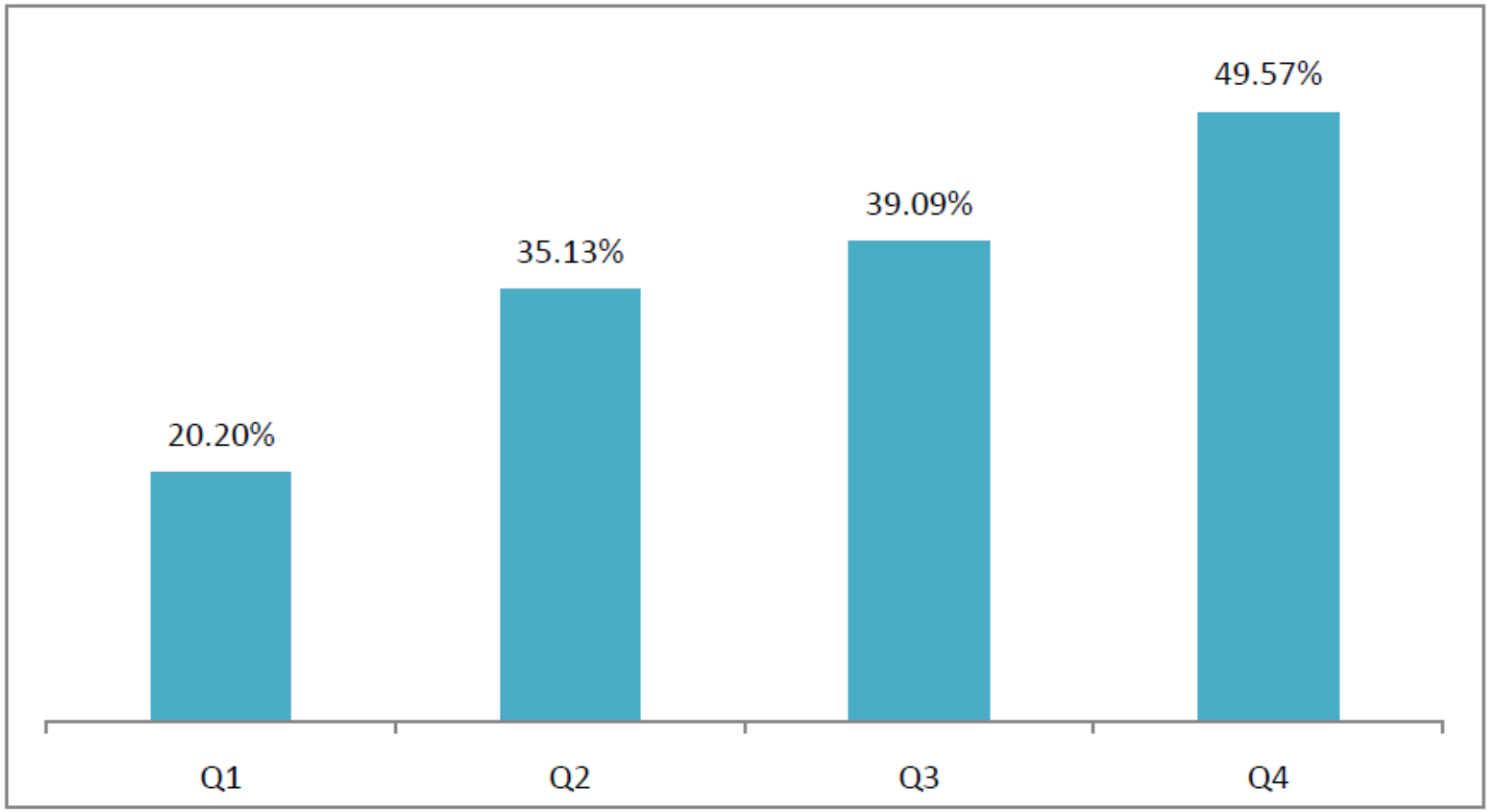


Figure 2: Distribution of the percentage of euploid embryos into the KIDScore D 5 categories, Q1 ≤3.9, Q2, between 4 and 5.6, Q3 between 5.7 and 7.5, and Q4 ≥7.6

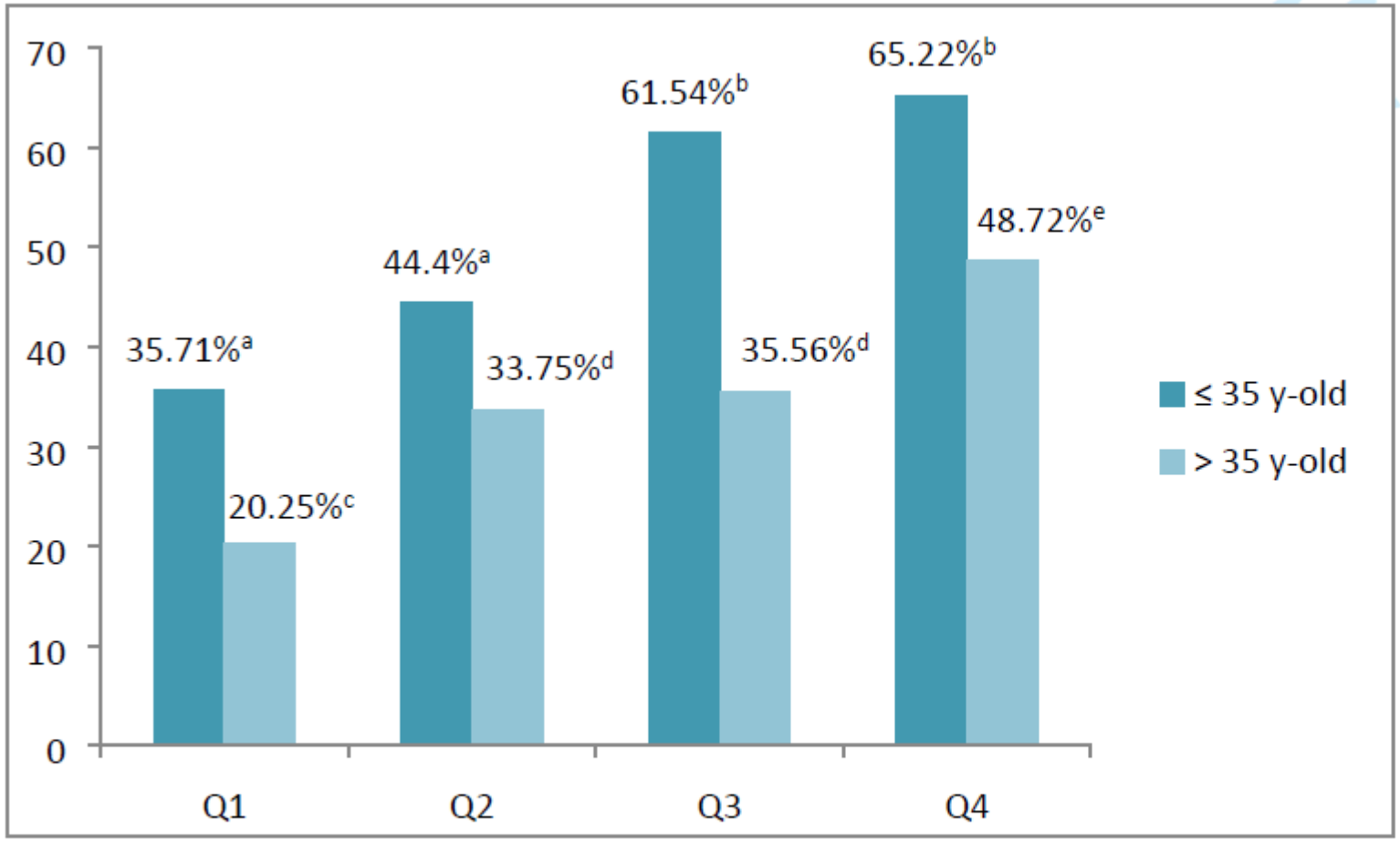


Figure 3: The distribution of the chance of being euploid according with the KIDScore D 5 category: Q1 ≤3.9, Q2 between 4 and 5.6, Q3 between 5.7 and 7.5, and Q4 ≥7.6. a≠b≠c≠d≠e.

Time-lapse imaging: Morphokinetic analysis of in vitro fertilization outcomes

Carla Giménez, M.Sc.,[a,b] Laura Conversa, M.Sc.,[a,b] Lucía Murria, M.Sc.,[a,b] and Marcos Meseguer, Ph.D.[a,b]

[a]IVIRMA Global Research Alliance, IVI Foundation, Instituto de Investigación Sanitaria La Fe (IIS La Fe), Valencia, Spain; [b]IVIRMA Global Research Alliance, IVIRMA Valencia, Valencia, Spain

Fertility and Sterility® Vol. 120, No. 2, August 2023 0015-0282/$36.00

https://doi.org/10.1016/j.fertnstert.2023.06.015

FERTGROUP | FERTILITY

Published morphokinetic studies using time-lapse imaging.

Author	Study design	Sample size (embryos)	Selection parameter	Predictive outcome
Wong et al. (39), 2010	Retrospective study	100	P1, P2, and P3	Blastocyst formation
Hashimoto et al. (40), 2012	Experimental study	80	t3, t4	Blastocyst formation
Coticchio et al. (20), 2018	Retrospective cohort study	500	tPB2, tPNa, tPNf, VP, t2-tPNf, tPNa- tPNf…	Blastocyst formation
Motato et al. (41), 2016	Retrospective study	7,483	tM, t8–t5	Blastocyst formation
Goodman et al. (31), 2016	Randomized controlled study	1,012	t5, tSB, cc2, s2, and s3	Blastocyst formation
Cruz et al. (42), 2012	Retrospective cohort study	834	t4, t5, tM, and s2	Blastocyst formation
Chamayou et al. (43), 2013	Retrospective study	244	t1,t2, t4, t7, t8, and s3	Blastocyst formation
Kahraman et al. (44), 2012	Randomized controlled study	406	t2, t8, tM, tB, s2, and cc2	Blastocyst formation
Cetinkaya et al. (45), 2015	Retrospective study	3,354	t8–t5, sychrony of cell division	Blastocyst formation
Milewski et al. (46), 2015	Retrospective observational study	432	t2, t5, and cc2	Blastocyst formation
Fishel et al. (47), 2018	Retrospective cohort study	843	tSB and dB	Blastocyst formation
Mizobe et al. (48), 2016	Experimental cohort study	791	Cell Fragmentation	Blastocyst formation
Mizobe et al. (49), 2018	Experimental cohort study	948	ECC1 and sychrony of cell division	Blastocyst formation
Pennetta et al. (50), 2021	Retrospective cohort study	780	s2	Blastocyst formation
Meseguer et al. (12), 2011	Retrospective study	247	t5, cc2, and s2	Implantation potential
Goodman et al. (31), 2016	Randomized controlled study	94	t5, tSB, cc2, s2, and s3	Implantation potential
Petersen et al. (51), 2016	Retrospective study	3275	t3, t3–tPNf, and (cc3)/(t5–t2)	Implantation potential
Basile et al. (52), 2015	Retrospective Study	754	t3, t5, and cc2	Implantation potential
VerMilyea et al. (53), 2014	Retrospective multicentric study	331	P2 and P3	Implantation potential
Liu et al. (54), 2020	Retrospective cohort study	270	cc2 and t5–tPNf	Implantation potential
Azzarello et al. (55), 2012	Experimental study	159	tPNf	Live birth outcome
Sayed et al. (56), 2020	Retrospective study	2827	t2, cc2	Live birth outcome
Bori et al. (57), 2022	Retrospective cohort study	12,468	t2, t3, t4, t5, and tB	Implantation potential Live birth outcome
Chavez et al. (26), 2012	Prospective observational study	75	P1, P2, P3, and cell fragmentation	Aneuploidy risk
Basile et al. (58), 2014	Retrospective cohort study	504	cc3 and t5–t2	Aneuploidy risk
Bamford et al. (59), 2022	Systematic review	Approximately 40,000	T8, t9, tB, and tEB	Aneuploidy risk
McCoy et al. (27), 2018	Systematic review	Approximately 41,000	Direct cleavage	Aneuploidy risk
Del Carmen Nogales et al. (60), 2017	Retrospective cohort study	485	t3, t5–t2	Aneuploidy risk
Campbell et al. (61), 2013	Retrospective cohort study	98	tB, tSB	Aneuploidy risk
Desai et al. (62), 2018	Retrospective study	767	tEB, tSB, tSB–tEB, and individual dysmorphism	Aneuploidy risk

Giménez. What can TLI do for ART? Fertil Steril 2023.

1 RBMO VOLUME 48 ISSUE 1 2024 103570

RBMO

REVIEW

Considerations for future modification of The Association for the Study of Reproductive Biology embryo grading system incorporating time-lapse observations

The Association for the Study of Reproductive Biology (ASEBIR) Interest Group in Embryology

TABLE 1 MAIN MORPHOKINETIC EVENTS IN TIME-LAPSE TECHNOLOGY ASSESSMENT

Timing	Event
t0	Time of standard IVF or mid-time intracytoplasmic sperm injection.
tPNf	Complete disappearance of pronuclei.
tn	First time frame at which embryo reaches *n* number of cells.
tTM	Trichotomous mitosis.
s2	Synchronicity for second cell cycle, time between division to three cells and subsequent division to four cells.
s3	Synchronicity for third cell cycle, time between division to five cells and subsequent division to eight cells.
ECC2	Embryo cell cycle: t4–t2.
tSC	First evidence of compaction.
tSB	Initiation of blastulation (first frame in which the blastocoel is visible).
tB	Full blastocyst (last frame before zona pellucida starts to thin.)
tEB	Initiation of expansion: first frame of zona pellucida thinning.
tHN	Initiation of hatching process.
tHD	Fully hatched blastocyst.

Adapted from The European Society of Human Reproduction and Embryology guidelines (*Apter* et al., *2020*).

FERTGROUP | FERTILITY

Viabilidade Econômica

- É a capacidade de um projeto, empreendimento ou investimento gerar lucro e retornos financeiros positivos.

- Em outras palavras, é a análise de verificação se uma ação é economicamente justificável e se vale a pena do ponto de vista financeiro.

Em um estudo de viabilidade econômica, busca-se avaliar a aplicabilidade do negócio para obter a partir daí uma projeção do seu comportamento frente ao mercado, dando uma maior segurança a investimentos, seja em novos empreendimentos ou mesmo em empresas já consolidadas.

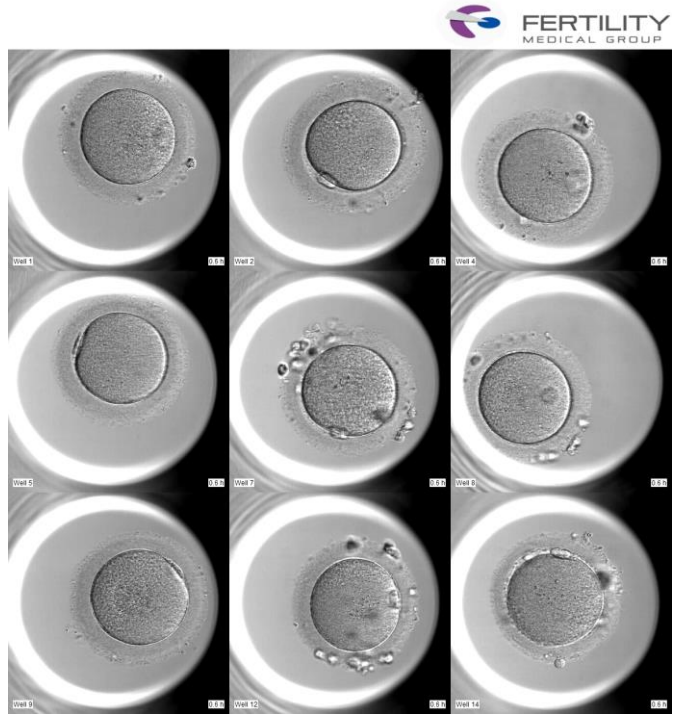
Análise de mercado;

Projeção de receitas, despesas, custos e investimentos (projeção de fluxo de caixa);

Análise de indicadores calculados em cima dos dados projetados de receitas, despesas, custos e investimentos.

Viabilidade Econômica

- **Embryoscope plus:** R$ 2.000.000,00
- **Manutenção anual:** R$ 60.000,00
- **Cobrança/caso (- impostos):** R$ 1.656,00
- **Diferença custo/caso:** R$ 178,49



- Payback

É o período de retorno de um negócio, ou seja, em quanto tempo a empresa irá reaver seu investimento inicial;

- Valor Presente Líquido (VPL)

Demonstra os fluxos de caixa esperados do negócio avaliado. A taxa de desconto aplicada para se obter o valor presente reflete a Taxa Mínima de Atratividade (TMA) requerida pelo investidor. Essa taxa fornece o valor mínimo que o investidor busca ganhar em determinado investimento, refletindo o valor do dinheiro no tempo, e os riscos de um determinado mercado, de acordo com o setor.

VPL = Valor presente das entradas de caixa – investimento inicial.

Assim, se o VPL for maior que zero, a empresa estará com um retorno maior do que seu custo de capital, ou seja, seu negócio é rentável.

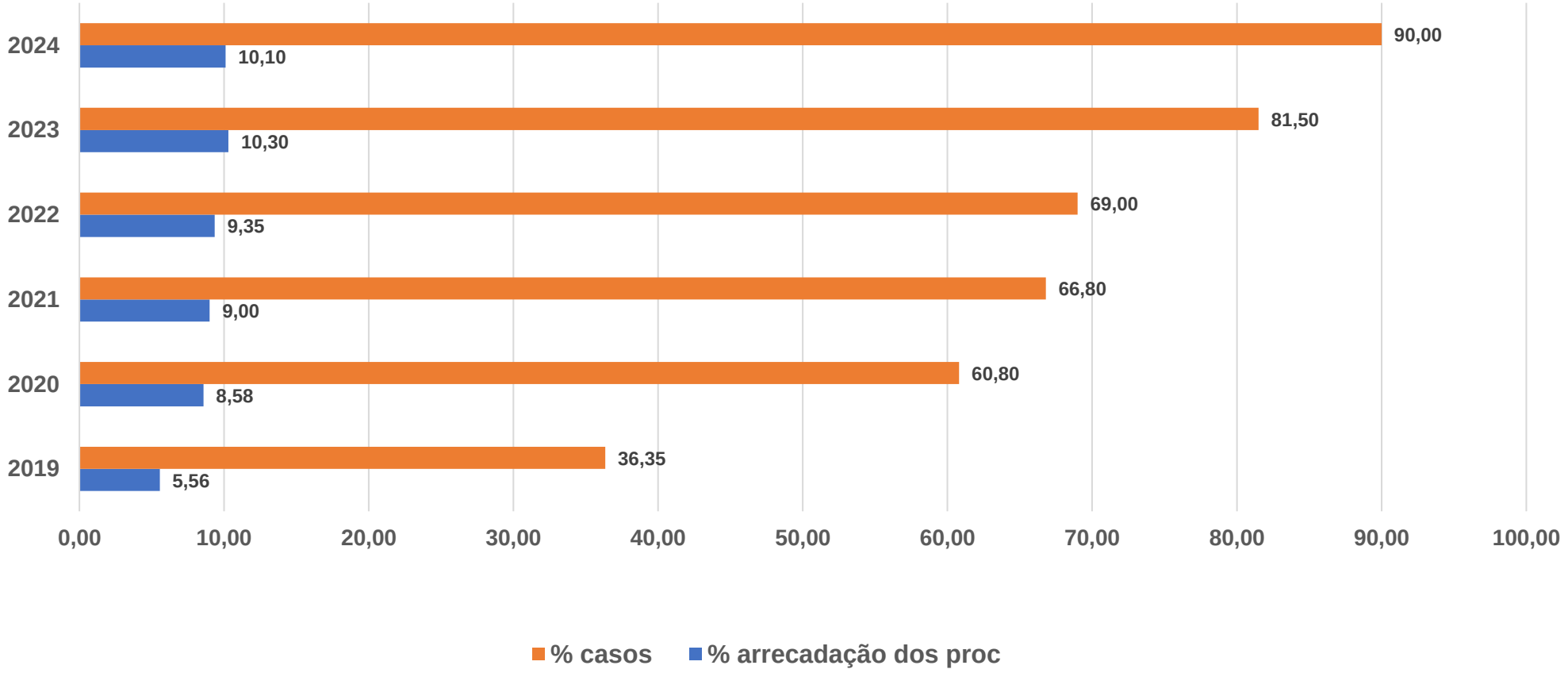
- **Payback: 3 anos**

- **Valor presente líquido: R$ 2.374.400,00**
  (Incluindo: oportunidade do dinheiro, manutenção, diferença gasto/caso)

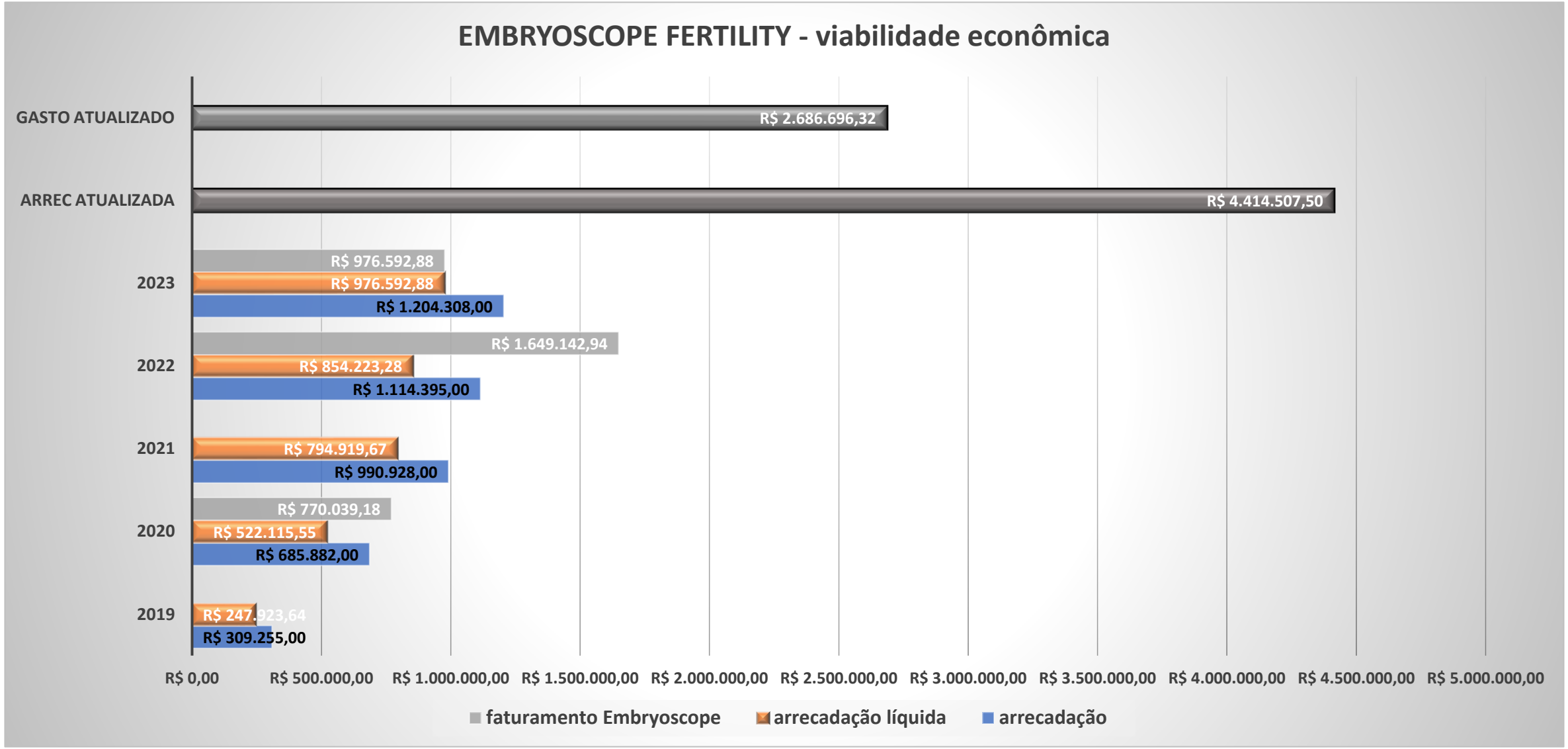
Recebimento/caso	R$ 1.477,51
no. casos	650
no. casos embryoscope (70%)	455
Arrecadação 3 anos	**R$ 2.258.817,29**

Aumento no faturamento bruto: R$ 2.5000.000,00 (EBITDA)

Embryoscope FERTILITY



FERTGROUP | FERTILITY



FERTGROUP | FERTILITY

EMBRYOSCOPE

- Desde 2018
- 22 incubadoras em 20 laboratórios

PRIMO VISION EVO+	EMBRYOSCOPE D	EEVA	GERI	MIRI TL

Rank	Facility	City	State
1	Weill Cornell Medicine - Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine	New York	New York
2	Columbia University Fertility Center	New York	New York
3	Duke Fertility Center	Morrisville	North Carolina
4	Cleveland Clinic Fertility Center	Beachwood	Ohio
5	NYU Langone Fertility Center	New York	New York
6	Brigham and Women's Hospital Center for Infertility and Reproductive Surgery	Boston	Massachusetts
7	Advanced Fertility Center of Texas	Houston	Texas
8	Mayo Clinic Assisted Reproductive Technologies	Rochester	Minnesota
9	Carolinas Fertility Institute	Winston-Salem	North Carolina
10	Massachusetts General Hospital Fertility Center	Boston	Massachusetts

RBMO

ELSEVIER

ARTICLE

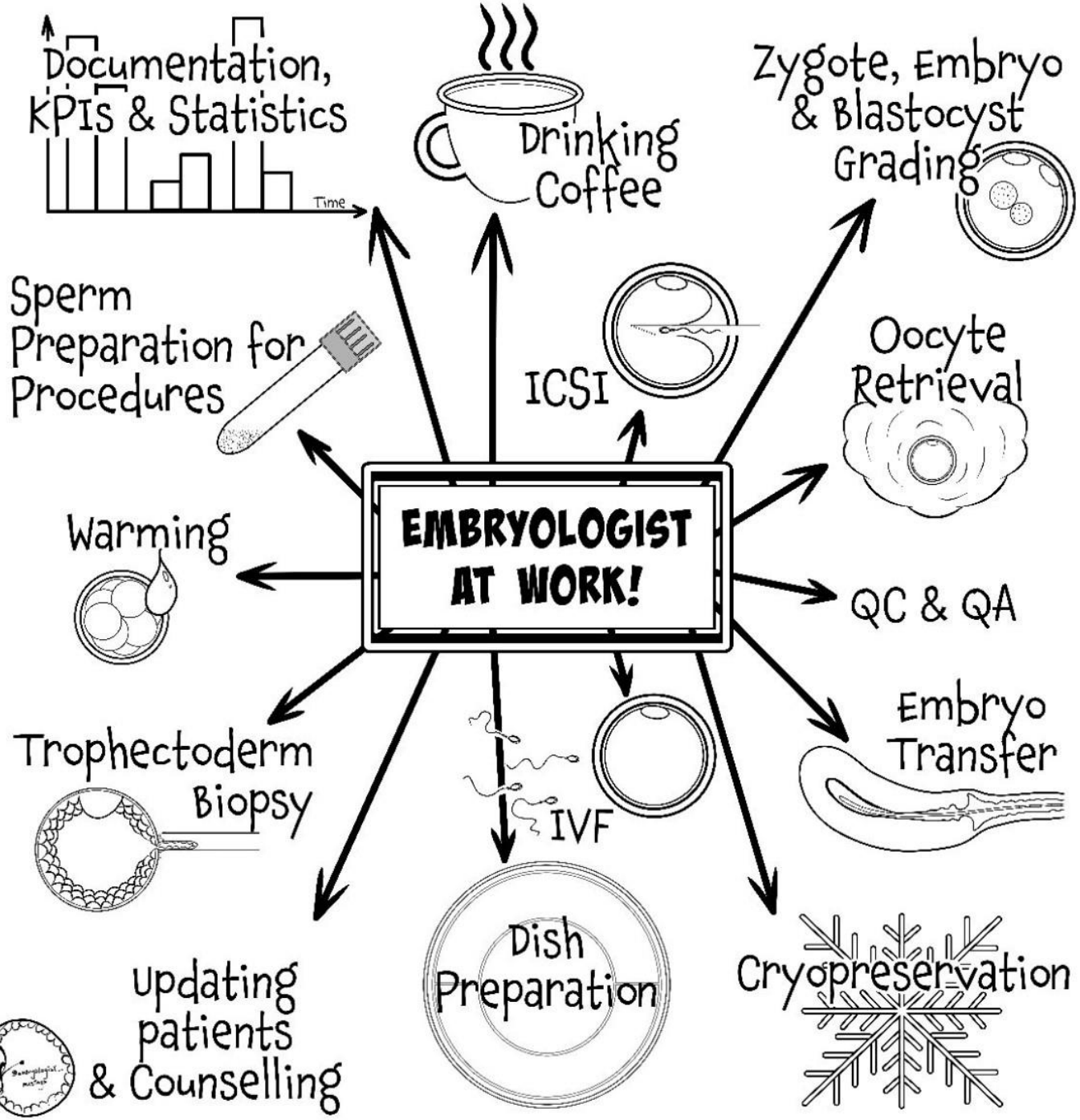
The prevalence, promotion and pricing of three IVF add-ons on fertility clinic websites

TABLE 1 ADVERTISEMENT AND PRICING OF ADD-ONS ON CLINIC WEBSITES

Add-on	Number (%) advertising	Price (£) Median, interquartile range, range
Assisted hatching	24 (28)	450, 288–481, 130–600[a]
PGT-A	41 (47)	
Stand-alone	36 (41)	2695, 2500–2850, 2100–3295[b]
As part of package	5 (6)	9500, 6460–9500, 4230–9500
Time-lapse embryo imaging	58 (67)	
Stand-alone	47 (54)	478, 300–699, 0–795[c]
As part of package	11 (13)	4020, 3608–4638, 2950–6975
Number of add-ons advertised		
0	20 (23)	
1	25 (29)	
2	28 (32)	
3	14 (16)	
Median (IQR)	1 (1–2)	

Time-lapse embryo imaging	
Improves IVF success rates	11
Improves clinical outcomes	3
Improves implantation chances/rates	12
Improves/increases ongoing pregnancy chances/rates	21
Evidence-based studies/research/RCT	22
Reference of studies	3
Insufficient/no evidence	4
Improves embryo selection – selection of 'highest potential' embryo	30
Improves embryo culture and manipulation conditions	8
Significant reduction of miscarriage/early pregnancy loss rates	10
Higher percentage of genetically normal blastocysts – improves embryo potential	8
Increases live birth rate	3
Reduces preterm birth and very low birth weight	1
Improves birth rates	1
Supports better embryo development	11
Reference to possible negative impact (e.g. on live birth)	0

FERTGROUP | FERTILITY


Documentation, KPIs & Statistics
Time
Drinking Coffee
Zygote, Embryo & Blastocyst Grading
Sperm Preparation for Procedures
ICSI
Oocyte Retrieval
EMBRYOLOGIST AT WORK!
Warming
QC & QA
Trophectoderm Biopsy
IVF
Embryo Transfer
Updating patients & Counselling
Dish Preparation
Cryopreservation

Standard culture			Time lapse			Time saved
ICSI after 12:30 p.m.			**Day 0**			Flexible timing of ICSI	60 min**

Notes:
Assumes single-step culture system for both
*per case
**estimated per first case
^Introduction of risk

Standard culture					Time lapse			Time saved
	ICSI after 12:30 p.m.			**Day 0**			Flexible timing of ICSI	60 min**
Move 2PNs to culture dish*^	Remove dish assess at scope*^	16-20 hrs post-ICSI (fixed)		**Day 1**		Assessment in TL culture	Flex timing	10 min*

FERTGROUP | FERTILITY

Standard culture				Time lapse			Time saved
	ICSI after 12:30 p.m.			**Day 0**			Flexible timing of ICSI	60 min**
Move 2PNs to culture dish*^	Remove dish assess at scope*^	16-20 hrs post-ICSI (fixed)		**Day 1**		Assessment in TL culture	Flex timing	10 min*
	Remove dish assess at scope*^			**D3 OBS/AH**		Assessment in TL culture	Flex timing	5 min*

FERTGROUP | FERTILITY

Standard culture				Time lapse		Time saved
	ICSI after 12:30 p.m.			**Day 0**	 	Flexible timing of ICSI	60 min**
Move 2PNs to culture dish*^	Remove dish assess at scope*^	16-20 hrs post-ICSI (fixed)		**Day 1**		Assessment in TL culture	Flex timing	10 min*
	Remove dish assess at scope*^			**D3 OBS/AH**		Assessment in TL culture	Flex timing	5 min
Move embryos for ET	Remove dish/ assess at scope*^	Take photo*		**D5/6 OBS/ET**		Photo in TL saved to EMR	Flex timing	10 min

FERTGROUP | FERTILITY

Standard culture				Time lapse			Time saved
	ICSI after 12:30 p.m.			**Day 0**			Flexible timing of ICSI	60 min**
Move 2PNs to culture dish*^	Remove dish assess at scope*^	16-20 hrs post-ICSI (fixed)		**Day 1**		Assessment in TL culture	Flex timing	10 min*
	Remove dish assess at scope*^			**D3 OBS/AH**		Assessment in TL culture	Flex timing	5 min
Move embryos for ET	Remove dish/ assess at scope*^	Take photo*		**D5/6 OBS/ET**		Photo in TL saved to EMR	Flex timing	10 min
Separate embryos for cryo^				**Biopsy/Cryo**		Scroll-ability = better embryo selection	Remove dish for cryo^	5 min

FERTGROUP | FERTILITY

- Estar *up-to-date* em tecnologia
- Associar tecnologia com melhores resultados
- Benefício em dispender mais R$ visando maiores chances de sucesso
- A frente da concorrência
- Respaldo na ciência

Investimento / retorno em SAÚDE:
Não é medido somente em ganho financeiro:

Imagem, Reputação, Credibilidade!!

RBMO

REVIEW

Artificial intelligence in the embryology laboratory: a review

TABLE 2 LIST OF KEY ADVANCEMENTS IN THE AUTOMATION OF IVF LABORATORY PROCEDURES WITH THE AID OF AI

Cell type	ART procedure	Summary of advancement	References
Spermatozoa	Sperm count	Automated calculation of sperm concentration on a handheld device.	*Kanakasabapathy et al. (2017)*
	Sperm motility assessment	Automated calculation of sperm motility on a handheld device.	*Kanakasabapathy et al. (2017)*
	Forward progression score	Automated measurement of sperm velocity and classification of individual sperm forward progression score.	*Goodsen et al. (2017); Kanakasabapathy et al. (2017)*
	DNA fragmentation assay	Automated measurement of sperm DNA fragmentation on a handheld device.	*Dimitriadis et al. (2019a)*
	Sperm viability assessment	Automated differential count of live–dead sperm staining.	*Dimitriadis et al. (2019a)*
	Sperm morphology measurement	Automated classification and measurement of normal and abnormal sperm morphology forms.	*Mirsky et al. (2017); Thirumalaraju et al. (2019a)*
Oocyte	Oocyte morphology classification	Identification and classification of oocyte morphological features.	*Dickinson et al. (2020); Manna et al. (2013); Targosz et al. (2021)*
	Oocyte quality assessment	Association of oocyte morphology with pronuclear development and subsequent embryo development.	*Kanakasabapathy et al. (2020a); Manna et al. (2013); Sacha et al. (2021)*
	Oocyte maturation assessment	Automated identification of extruded polar body in metaphase II oocytes.	*Dickinson et al. (2020)*
	Alignment of oocyte for ICSI	Identification of proper location to inject spermatozoa into oocytes during ICSI.	*Dickinson et al. (2020)*
Pronuclear stage	Fertilization assessment	Automated fertilization assessment 14-18 h post-insemination.	*Dimitriadis et al. (2019b); Kanakasabapathy et al. (2020b)*
	Pronuclear stage morphology classification	Segmentation and classification of pronuclear stage morphologic features.	*Zhao et al. (2021)*
	Pronuclear stage quality assessment	Prediction of embryo development at the pronuclear stage based on cytoplasmic movement.	*Coticchio et al. (2021)*
	Assessment of ICSI performance	Automated monitoring of individual embryologists performing ICSI using deep-learning enabled fertilization assessment.	*Thirumalaraju et al. (2019b)*
Cleavage stage	Predict day 5 embryo development	Prediction of blastocyst-stage development on Day 3 of development using extracted features, static images and time-lapse imaging data from cleavage-stage embryos.	*Bortoletto et al. (2019); d'Estaing et al. (2021); Kanakasabapathy et al. (2020a); Liao et al. (2021); Wang et al. (2018)*
	Predict implantation potential	Cleavage-stage prediction of embryo implantation using extracted features in a decision tree model and from direct learning using static images.	*Bormann et al. (2021a); Carrasco et al. (2017)*
	Monitor embryo culture environment	Development of a KPI that associates the development prediction of cleavage-stage embryos with implantation outcomes.	*Bormann et al. (2021a)*
	Predict ploidy status of embryo	Non-invasive embryo ploidy prediction using static cleavage-stage embryo images.	*Meyer et al. (2020)*
	Identify correct location to perform assisted hatching	Identification of proper location to perform laser-assisted hatching based on cleavage-stage embryo morphology.	*Kelly et al. (2020)*
	Embryo identification and witnessing	Utilization of a CNN to assess cleavage-stage embryo quality and develop a unique key specific to each embryo for purposes of tracking and witnessing them throughout culture.	*Bormann et al. (2021b)*
Blastocyst stage	Blastocyst-stage classification	Classification and grading of blastocyst-stage embryos based on morphology and implantation outcome.	*Bormann et al. (2020b); Khosravi et al. (2019); Malmsten et al. (2020); Leahy et al. (2020); Thirumalaraju et al. (2021); VerMilyea et al. (2020)*
	Vitrification and embryo biopsy decision-making	Use of static images to determine whether a blastocyst meets developmental criteria for vitrification and/or trophectoderm biopsy.	*Bormann et al. (2020b); Souter et al. (2020)*
	Select embryo(s) for transfer	Prediction and selection of blastocyst-stage embryos for transfer based on static images, developmental size, trophectoderm expansion and proteomics.	*Bori et al. (2020a, 2020b); Bormann et al. (2020a); Fitz et al. (2021); Huang et al. (2021); Louis et al. (2021); Tran et al. (2019)*
	Predict ploidy status of embryo	Non-invasive embryo ploidy prediction using static blastocyst-stage embryo images and patient characteristics.	*Chavez-Badiola et al. (2020a); Jiang et al. (2021); Meyer et al. (2020); Pennetta et al. (2018)*
	Quality assurance monitoring of laboratory procedures	Use of implantation prediction models to assess embryo selection, vitrification, warming and transfer competencies of embryologists and physicians.	*Dimitriadis et al. (2021)*
	Embryo identification and witnessing	Utilization of a CNN to assess blastocyst-stage embryo quality and develop a unique key specific to each embryo for purposes of tracking and witnessing them throughout culture.	*Kanakasabapathy et al. (2020c)*

AI – artificial intelligence; ART – assisted reproductive technology; CNN – convolutional neural network; ICSI – intracytoplasmic sperm injection; KPI – key performance indicator.


Are we ready to publish?
PEAR REVIEW

Received: 29 November 2022 | Accer
DOI: 10.1002/mrd.23692

RESEARCH ARTICLE

Time-lapse r
preim-lantation

Danie
Patr
Ed

Zygote

cambridge.org/zyg

Research Article

Cite this article: Setti AS et al. (2022) Improved embryonic development and utilization rates with EmbryoScope: a within-subject comparison versus a benchtop incubator. Zygote. 30: 633–637. doi: 10.1017/S0967199422000077

Zygote

cambridge.org/zyg

Research Article

Cite this article: Setti AS et al. (2
anti-Müllerian hormone concentrations
related to embryo development: lessons from
time-lapse imaging. Zygote. 31: 570–576.
doi: 10.1017/S0967199423000370

ira Braga[1,2] |
Morishima

ORIGINAL ARTICLES: EMBRYOLOGY

Progesterone-p
slower embryos
compromising
and with the
dminist
t reu

Improved embryonic development and utilization rates with EmbryoScope: a within-subject comparison versus a benchtop incubator

Amanda Souza Setti[1,2], Daniela Paes de Almeida Ferreira Braga[1,2], Livia Vingris
Assumpto Iaconelli Jr[1,2] and Edson Borges Jr[1,2]

[1]Fertility Medical Group, Av. Brigadeiro Luís Antonio, 4545, São Paulo, SP, Brazil. Zip: 01401–002 and [2]Sapientia Institute, Centro de Estudos e Pesquisa em Reprodução Humana Assistida, Rua Vieira Maciel, 62, São Paulo, SP, Brazil. Zip: 04503-040

Check for updates

t in

High oocyt
morphoki
imaging

RBMO

652 RBMO VOLUME 45 ISSUE 4 2022

ARTICLE

Braga D, Setti A, Morishima C, Iaconelli A, Borges E. Understanding the implications of follicular output rate (FORT) and follicle to oocyte index (FOI) on human embryo morphokinetics. *Journal of IVF-Worldwide*. 2024;2(1). doi:10.46989/001c.91041

plications of follicular output rate (FORT) and (FOI) on human embryo morphokinetics

stina Morishima[1,2], Assumpto Iaconelli[1,2], Edson Borges[1,2]
Antonio, 4545 São Paulo – SP, Brazil. Zip: 01401-002, [2] Instituto Sapientiae – Centro de Estudos e Pesquisa
ieira Maciel, 62 São Paulo – SP, Brazil. Zip: 04503-040
orphokinetic assessment, Follicular Output Rate (FORT), Follicle-to-Oocyte index (FOI), ICSI

CrossMark

maro, went onto
egree in 2015. She
oup and Associação

Original Research Articles

Descriptive analysis of velle®

Edson Borges Jr.[1,2], Daniela Braga[1,2], Patricia Guilherme[1], As
[1] Fertility Medical Group, São Paulo – SP, Brazil, [2] Sapientiae Institute – Cen
SP, Brazil
Keywords: Controlled ovarian stimulation, descriptive analysis, follitropin

Journal of IVF-Worldwide
Vol. 1, Issue 1-3, 2023

Morphokinetic parameter comparison between embryos from couples with high or low sperm DNA fragmentation index

Amanda Souza Setti, M.Sc., [a,b] Daniela Paes de Almeida Ferreira Braga, Ph.D., [a,b] Patricia Guilherme, M.Sc.
Rodrigo Provenza, B.Sc., [a] Assumpto Iaconelli Jr., M.D., [a,b] and Edson Borges Jr., Ph.D. [a,b]
[a] Fertility Medical Group, Av. Brigadeiro Luís Antonio, São Paulo, Brazil; and [b] Sapientiae Institute – Cen
Pesquisa em Reprodução Humana Assistida, Rua Vieira Maciel, São Paulo, Brazil

Received: 31 March 2
DOI: 10.1111/and.14211

ORIGINAL ARTICL

Early and late pat
in a time-lapse imag

Amanda Souza Setti[1,2] | Danie
Iaconelli Jr.[2,4] | Edson Bor

Received: 11 July 2022 | Accepted: 20 November 2022
DOI: 10.1002/mrd.23658

RESEARCH ARTICLE

Previous infection with SARS-CoV-2 impacts embryo morphokinetics but not clinical outcomes in a time-lapse imaging system

Daniela P. A. F. Braga[1,2] | Amanda S. Setti[1,2] | Assumpto Iaconelli Jr.[1,2]
Edson Borges Jr.[1,2]

FER

Molecular Reproduction & Development

ga[1,2],
Jr[1,2]
002 and [2]Sapientiae
62, São Paulo – SP,

WILEY

nbryos

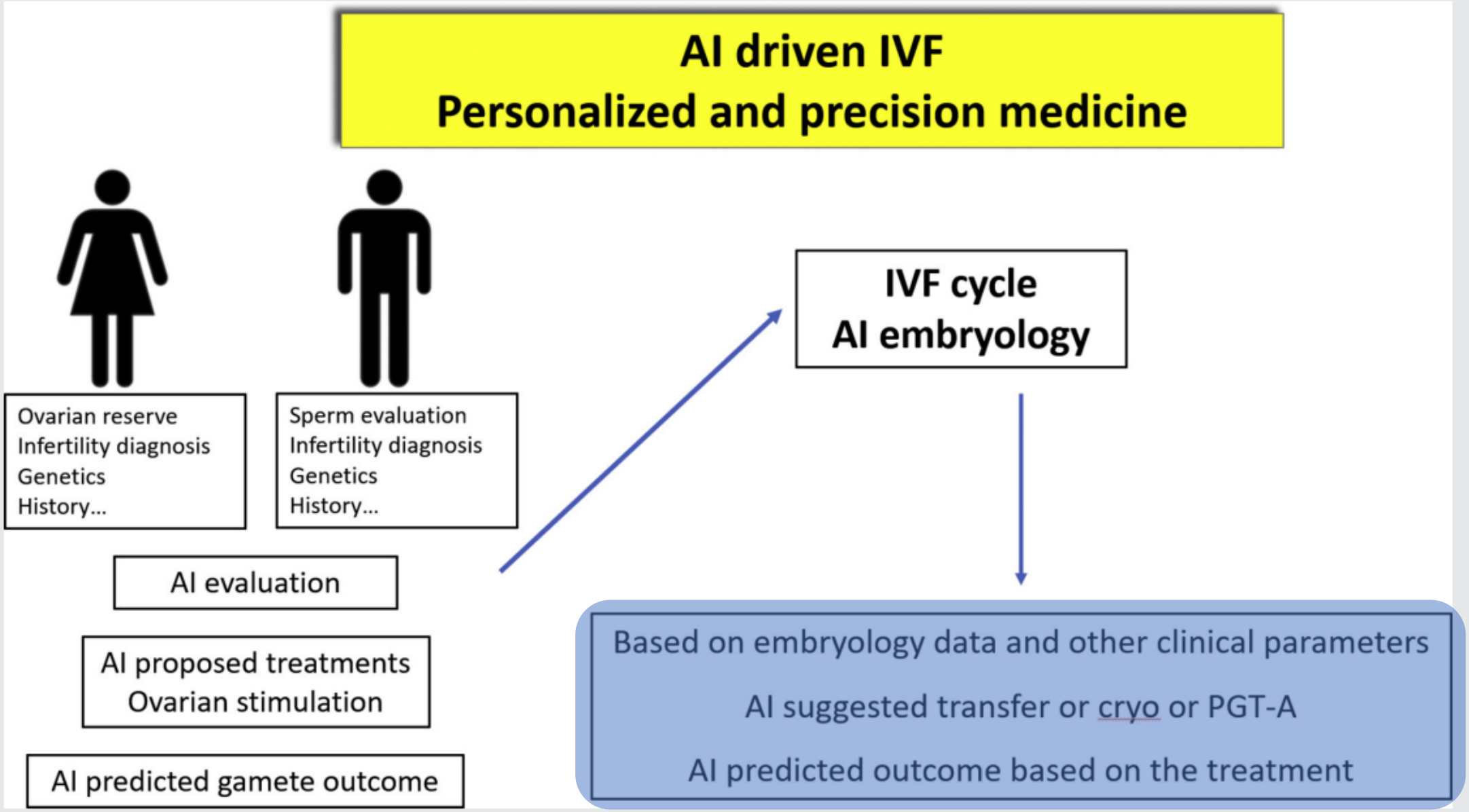
Predictive modeling in reproductive medicine: Where will the future of artificial intelligence research take us?

Carol Lynn Curchoe, Ph.D.,[a] Jonas Malmsten, M.S., D.P.S.,[b] Charles Bormann, Ph.D.,[c] Hadi Shafiee, Ph.D.,[d] Adolfo Flores-Saiffe Farias, M.Sc., Ph.D.,[e] Gerardo Mendizabal, Ph.D.,[e,f] Alejandro Chavez-Badiola, M.D.,[e,g] Alexandros Sigaras, M.S.,[h] Hoor Alshubbar, M.Sc.,[i,j] Jerome Chambost, M.Sc.,[i] Celine Jacques, Ph.D.,[i] Chris-Alexandre Pena, M.Sc.,[i] Andrew Drakeley, M.B.Ch.B., M.D.,[k] Thomas Freour, Pharm.D., Ph.D.,[l,m] Iman Hajirasouliha, Ph.D.,[h,n] Cristina Fontes Lindemann Hickman, Ph.D.,[i,j,o] Olivier Elemento, Ph.D.,[h,n] Nikica Zaninovic, Ph.D.,[b] and Zev Rosenwaks, M.D.[b]

[a] Colorado Center for Reproductive Medicine, Newport Beach, California; [b] The Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, [h] Institute for Computational Biomedicine and [n] Caryl and Israel Englander Institute for Precision Medicine, Weill Cornell Medicine; and [o] TMRW Life Sciences, New York, New York; [c] Massachusetts General Hospital and [d] Brigham and Women's Hospital, Harvard Medical School, Boston, Massahusetts; [e] IVF 2.0 LTD, Merseyside; [j] Institute of Reproduction and Developmental Biology, Imperial College London, London; and [k] Hewitt Fertility Centre, Liverpool Women's Hospital, Liverpool, United Kingdom; [f] Departamento de Ciencias Computacionales, Universidad de Guadalajara, Guadalajara and [g] New Hope Fertility Center, Mexico City, Mexico; and [i] Apricity, Paris; and [l] Service de médecine et biologie de la reproduction, CHU de Nantes and [m] Centre de Recherche en Transplantation et Immunologie, Inserm, Université de Nantes, Nantes, France

Fertility and Sterility® Vol. 114, No. 5, November 2020 0015-0282/$36.00

https://doi.org/10.1016/j.fertnstert.2020.10.040



The future of in vitro fertilization (IVF): personalized and precision evidence-based medicine. AI = artificial intelligence; PGT-A = preimplantation genetic testing for aneuploidy.

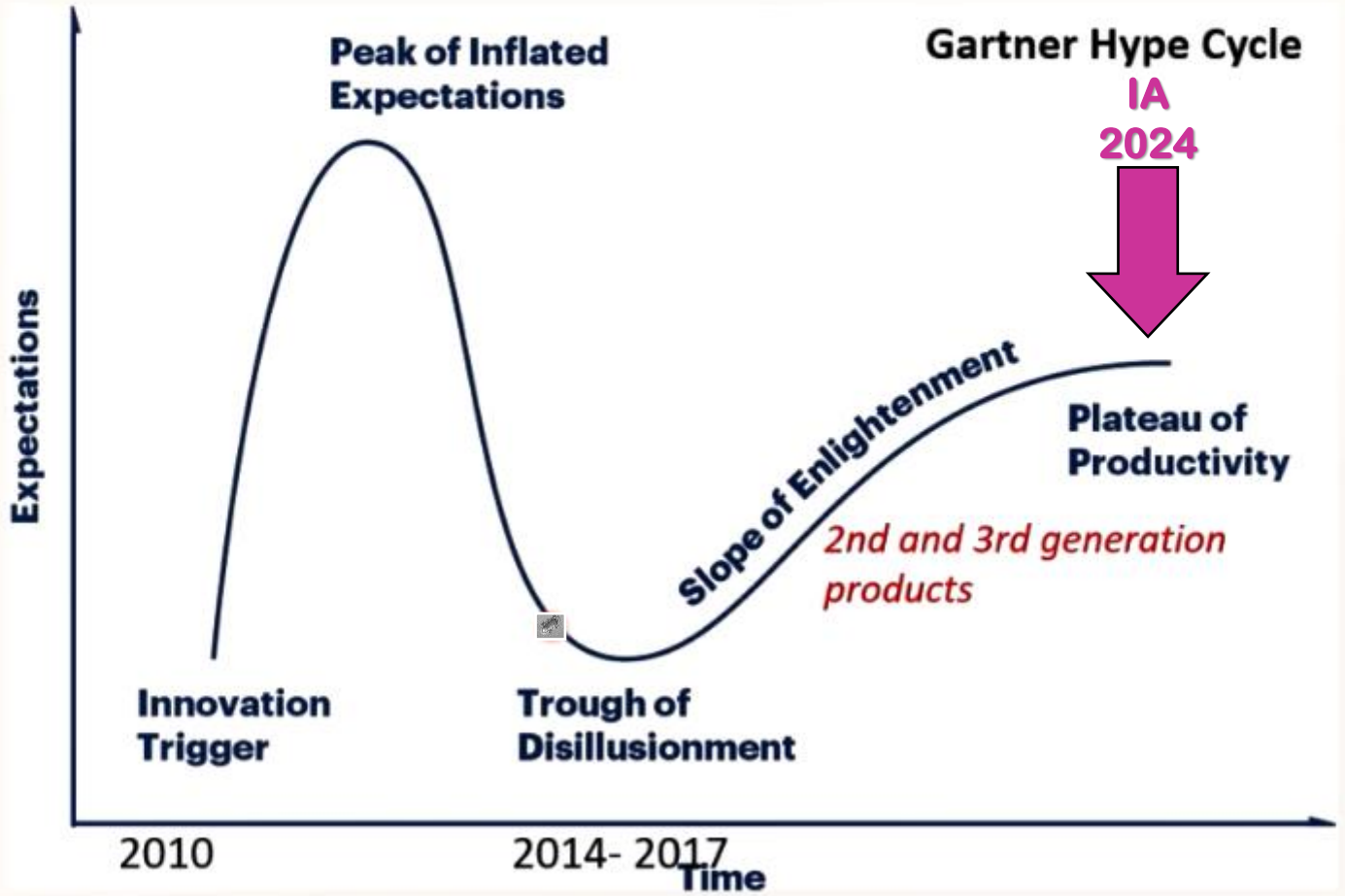
Curchoe. The future of AI in reproductive medicine. Fertil Steril 2020.

Time lapse technology (TLT) – Ideal automation partner

From past to future...

Gartner Hype cycle

Five key phases of a technology's life cycle



FERTGR

Embryo through the lens: from time-lapse cinematography to artificial intelligence

Elnur Babayev, M.D. and Eve C. Feinberg, M.D.

Northwestern University Feinberg School of Medicine, Chicago, Illinois

https://doi.org/10.1016/j.fertnstert.2019.12.001

Brackett BG. In vitro fertilization of rabbit ova: time sequence of events. Fertil Steril 1970;21:169–76.

"Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road."

—Stewart Brand

"Quando uma nova tecnologia passa por você, se você não faz parte do rolo compressor, você faz parte da estrada."


Você NÃO VIRA UM DINOSSAURO
PELA SUA IDADE,
MAS SIM POR PARAR DE APRENDER
@sakamoto.marcia

Direção
Assumpto Iaconelli Jr.
Edson Borges Jr.

Laboratório de FIV
Beatriz Muller
Livia Silvia Vingris
Lyvia E. Busso
Patrícia Guilherme
Rodrigo Rosa Provenza
Tatiana Nunes de Melo

Laboratório de Andrologia
Rodrigo Rosa Provenza
Debora Hernandez

Pesquisa e Educação
Instituto Sapientiae
Amanda Setti
Christina Morishima
Daniela Braga
Raphaela Medeiros

Corpo Clínico
Carla Iaconelli
Carolina Rossoni
Edward Carrilho
Fernanda Montenegro
Fábio Biaggioni Lopes
Mário Firmino
Mauro Bibancos
Natalia G. Tannous
Natália Martelli

Pisicologia
Rose M. Melamed

Anestesiologia
Marcelo Torres
e Equipe

Nutrição
Gabriela Halpern

FERTGROUP | FERTILITY

Enfermagem
Alcione Bispo
Gabriela Lima Almeida
Larissa Rodrigues Gonçalves
Letícia Firmino
Maria Regina S. da Silva
Patrícia Castro
Vera Lucia Alves

Informática
Anderson Veloso
Marcelo Alexandre Baptista

Farmácia
Maria das N. Fernandes

Suporte
Genilson Souza
Hugo Oliveira dos Reis
Janaína Gomes Pinho da Silva
Jicélia Santos
João Lucas Ramos
Joice Procópio
José Roberto Duarte
Leidivânia Cerqueira Alves
Marcela Rosa Anjos
Sérgio Luis da Silva
Simone de S. Carvalho
Zenilda da Conceição Souza

Comunicação e Marketing
Larissa Nishiwaki

Administração
Ana Carolina Santos
Josué B. Santos
Katia Rodrigues
Lucácio de S. Anjos
Margaret Meira

FERTGROUP | FERTILITY

Obrigado!

Edson Borges Jr.
www.fertility.com.br
E-mail: edson@fertility.com.br

FERTILITY
MEDICAL GROUP