IVF is a numbers game. What is the evidence for the number of eggs for successful treatment

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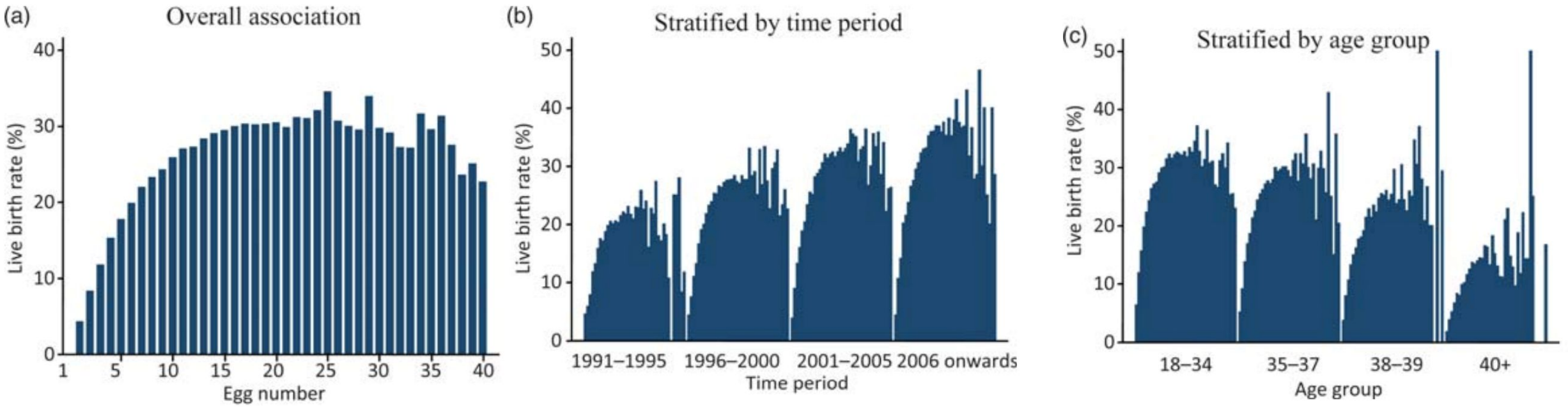
Is number of oocytes a useful indicator?

YES!

Is number of retrieved oocytes a useful indicator? YES



Human Reproduction, Vol.26, No.7 pp. 1768–1774, 2011
Advanced Access publication on May 10, 2011 doi:10.1093/humrep/der106

human reproduction ORIGINAL ARTICLE *Infertility*

Association between the number of eggs and live birth in IVF treatment: an analysis of 400 135 treatment cycles

Sesh Kamal Sunkara[1], Vivian Rittenberg[1], Nick Raine-Fenning[2], Siladitya Bhattacharya[3], Javier Zamora[4], and Arri Coomarasamy[5,*]

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Is number of retrieved oocytes a useful indicator? YES

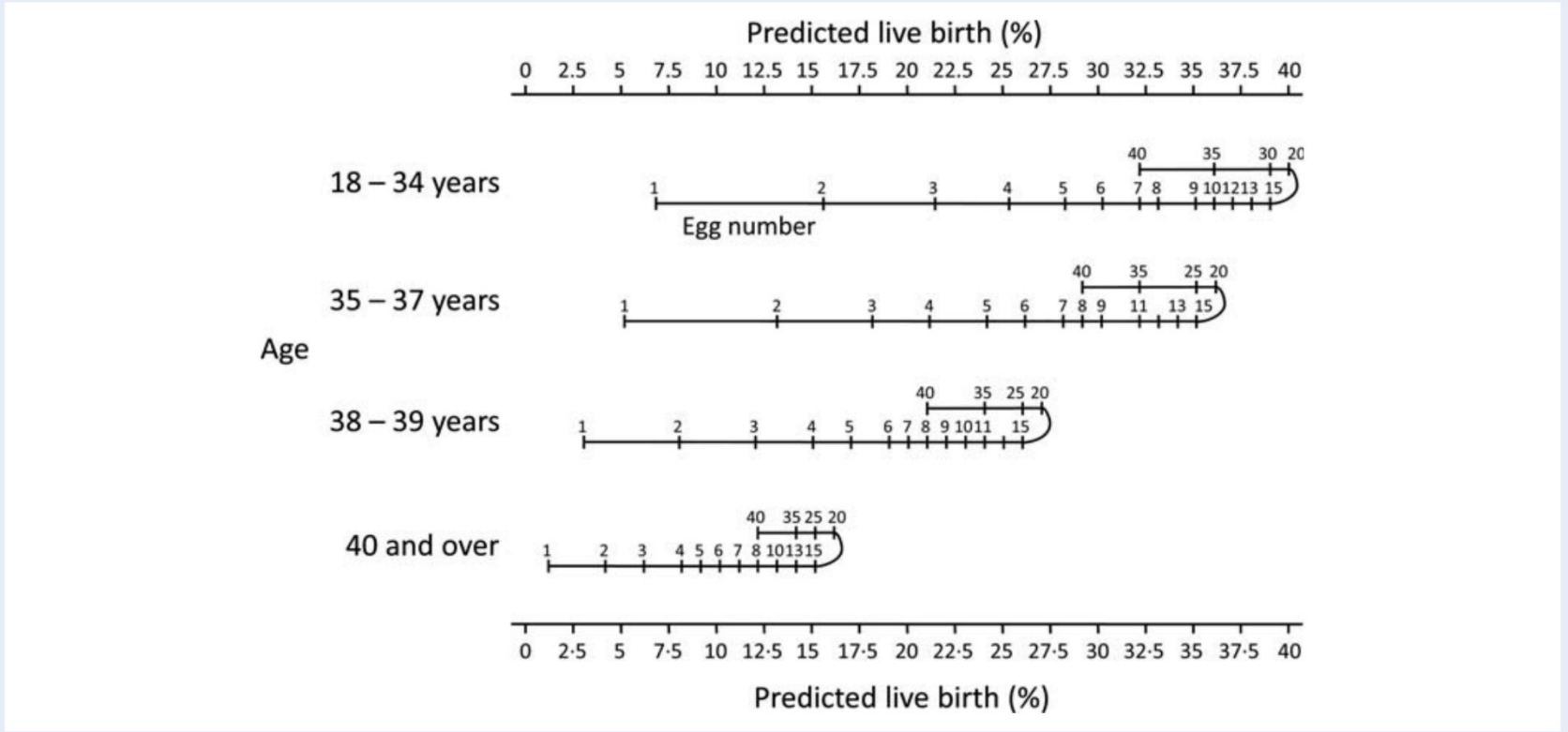

Figure 5 Nomogram to calculate predicted live birth probability given egg number and age.

Predicted live birth (%) per first fresh embryo transfer per cycle!

Only fresh transfer considered (not FET)

More oocytes = more embryos = DET

Not the cumulative live birth rate per cycle

Freeze all (OHSS) not included

Predicted live birth may be underestimated

The more the better (15 to 20) regardless of age

Low responders have lower quality oocytes

Sunkara et al. Human Reproduction 2011

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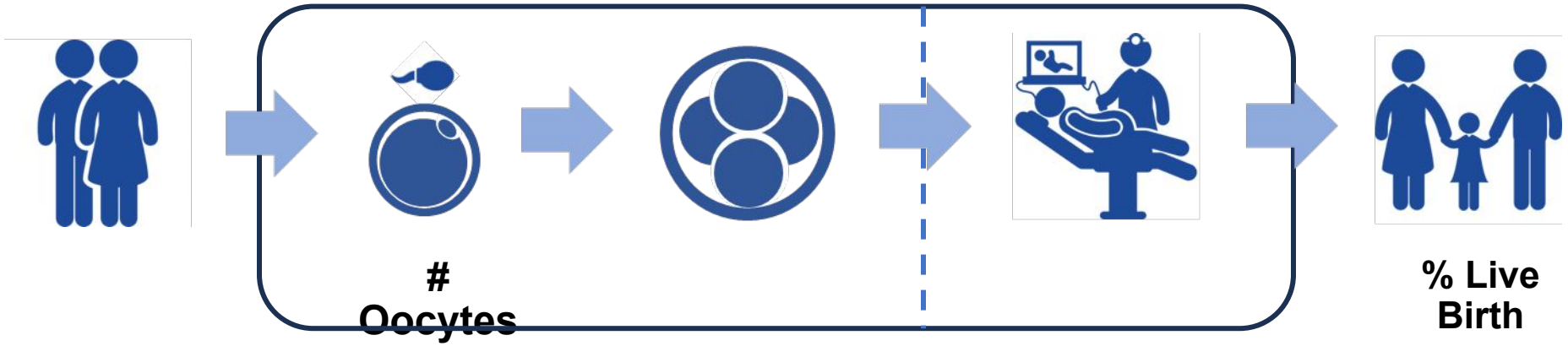
Is number of oocytes a **useful** indicator?

NO!

Is number of retrieved oocytes a useful indicator? NO



 # Oocytes is a post-treatment indicator

It is the earliest laboratory predictor of the outcome

⇧ ⇧ ⇧ # Oocytes ⇧ ⇧ ⇧ # & quality of embryos ⇧ ⇧ ⇧ % Implantation ⇧ ⇧ ⇧ % Live Birth

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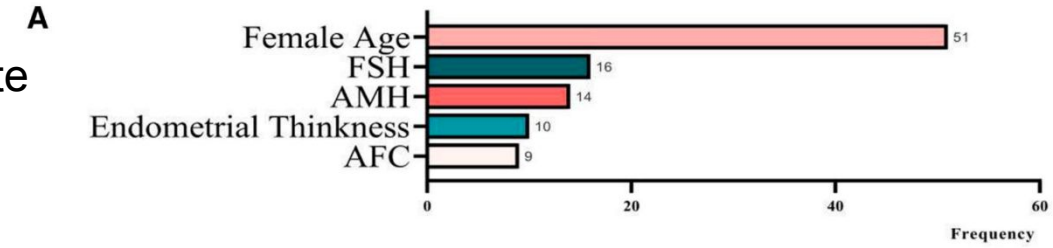
What are useful predictors?

Useful predictors

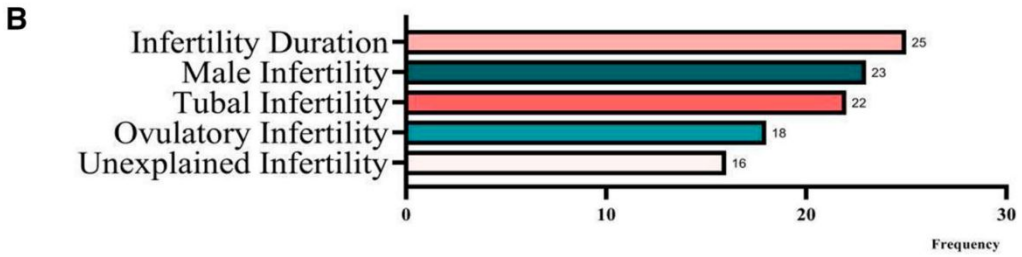
- 72 studies with 132 predictors and 82 prognostic models

Five more frequent predictors in each category

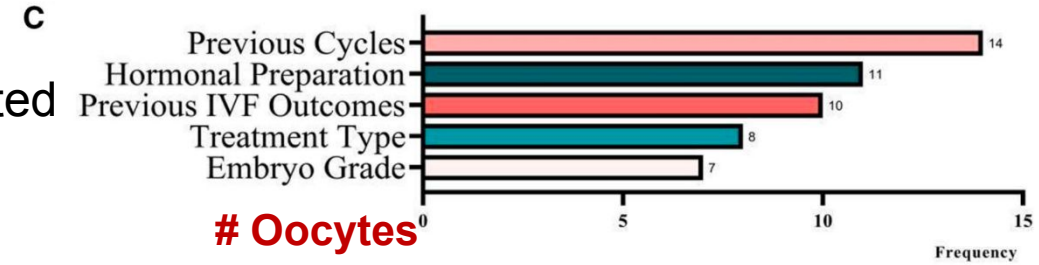
Age-related



Infertility-related



IVF-related



 # Oocytes

OXFORD human reproduction

Human Reproduction, 2025, **40(4)**, 633–646
https://doi.org/10.1093/humrep/deaf013
Advance Access Publication Date: February 21, 2025
Original Article

Infertility

Clinical prediction models for *in vitro* fertilization outcomes: a systematic review, meta-analysis, and external validation

C.H. Tian[1,†], L.Y. Liu[1,†], Y.F. Huang[1,†], H.J. Yang[2], Y.Y. Lai[1], C.L. Li[1], D. Gan[3], and J. Yang[1,*]

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Useful predictors

Top 15 keywords with the strongest predictors bursts

Keywords	Year	Strength	Begin	End	2010 - 2024
previous ivf treatment outcome	2011	2.55	**2011**	2017	
unsuccessful ivf attempts	2011	2.16	**2011**	2015	
combined causes	2011	1.42	**2011**	2015	
source of embryo	2011	1.42	**2011**	2015	
smoking habit	2012	1.12	**2012**	2013	
treatment year	2013	1.07	**2013**	2018	
embryo morphological variables	2016	1.21	**2016**	2020	
previous pregnancy	2011	1.12	**2016**	2018	
embryo grade	2010	1.88	**2017**	2021	
anti-müllerian hormone	2011	1.26	**2018**	2019	
type of infertility	2018	1.23	**2018**	2022	
antral follicle count	2013	1.1	**2018**	2019	
sperm factors	2020	1.4	**2020**	2022	
number of oocytes	2018	1.2	**2021**	2022	
embryo images	2021	1.04	**2021**	2022	

Tian et al. Human Reproduction 2025

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What can we say in 2025 about the number of oocytes as a predictor?

#oocytes as a predictor

Journal of Gynecology Obstetrics and Human Reproduction 50 (2021) 101878

Original Article

The predicted probability of live birth in *In Vitro Fertilization* varies during important stages throughout the treatment: analysis of 114,882 first cycles

Antonio La Marca[a,b,*], Martina Capuzzo[a], Valeria Donno[a], Mario Mignini Renzini[b,c], C. Del Giovane[d], Roberto D'Amico[a], Sesh Kamal Sunkara[f]

Table 2
Multivariate analysis on three different models. The odds of at least one birth rate are highlighted for Model 2 and Model 3 as a function of the number of oocytes and embryos obtained.

	MODEL 1 All women starting 1° cycle (Multivariable Odds Ratio 95% CI)	MODEL 2 Women who had at least 1 oocyte retrieved (Multivariable Odds Ratio 95% CI)	MODEL 3 Women who had at least 1 embryo created (Multivariable Odds Ratio 95% CI)
All women	**114882**	**105580**	**101434**
Age (years)			
18-34	1	1	1
35-37	0.78 (0.75 – 0.80)*	0.82 (0.80 – 0.85)*	0.82 (0.79 – 0.85)*
38-39	0.52 (0.50 – 0.55)*	0.58 (0.56 – 0.61)*	0.58 (0.55 – 0.61)*
40-42	0.26 (0.24 – 0.28)*	0.31 (0.29 – 0.34)*	0.31 (0.29 – 0.33)*
43-44	0.07 (0.06 – 0.09)*	0.10 (0.08 – 0.13)*	0.10 (0.08 – 0.13)*
45-50	0.03 (0.02 – 0.07)*	0.05 (0.03 – 0.09)*	0.05 (0.03 – 0.10)*
Time waiting (years)			
< 1	1	1	1
1-3	0.74 (0.67 – 0.82)*	0.76 (0.69 – 0.84)*	0.76 (0.68 – 0.83)*
4-6	0.63 (0.57 – 0.70)*	0.66 (0.59 – 0.73)*	0.66 (0.60 – 0.73)*
7-9	0.56 (0.50 – 0.62)*	0.59 (0.53 – 0.66)*	0.61 (0.55 – 0.68)*
10-12	0.53 (0.47 – 0.59)*	0.57 (0.51 – 0.64)*	0.59 (0.52 – 0.55)*
> 12	0.53 (0.47 – 0.59)*	0.56 (0.50 – 0.63)*	0.58 (0.52 – 0.65)*
Cause of infertility			
Unknown	1	1	1
Low sperm count only	1.00 (0.93 – 1.03)	0.99 (0.95 – 1.02)	0.99 (0.95 – 1.02)
Ovulatory only	0.78 (0.74 – 0.81)*	0.78 (0.75 – 0.81*	0.75 (0.71 – 0.78)*
Tubal disease only	0.83 (0.89 – 0.97)*	0.94 (0.90 – 0.98)*	0.93 (0.89 – 0.97)*
Others	0.92 (0.87 – 0.98)*	0.97 (0.91 – 1.02)	0.97 (0.91 – 1.02)
Female primary infertility			
Yes	0.88 (0.86 – 0.91)*	0.90 (0.87 – 0.92)*	0.91 (0.89 – 0.94)*
No	1	1	1
Number of oocytes retrieved			
≥ 20		1.88 (1.76 – 2.00)*	1.02 (0.94 – 1.11)
15-19		2.4 (2.27 – 2.55)*	1.28 (1.19 – 1.38)*
10-14		2.37 (2.25 – 2.5)*	1.39 (1.3 – 1.48)*
5-9		1.81 (1.72 – 1.9)*	1.27 (1.21 – 1.35)*
1-4		1	1
Number of embryos created			
≥ 20			1.28 (1.12 – 1.46)*
15-19			1.79 (1.65 – 1.95)*
10-14			1.81 (1.71 – 1.91)*
5-9			1.56 (1.5 – 1.63)*
1-4			1

* $p < 0.01$.

Models 2 & 3 with variables after the start of treatment statistically improve the overall prediction of live birth.

So, markers of ovarian reserve should be included in a model (AMH, AFC).

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Adjusted logistic regression models predicting cumulative live birth using predictors available before the first complete IVF cycle (pretreatment models) and before the second complete IVF cycle (posttreatment model).

	Pretreatment model		Posttreatment model
Predictors	**Adjusted model for all women OR (95% CI) N = 88,613**	**Adjusted model for women with AMH measurement OR (95% CI) N = 53,766**	**Adjusted model for all women OR (95% CI) N = 24,735**
Complete cycle no.			
1	1	1	
2	0.58 (0.56, 0.60)	0.61 (0.58, 0.63)	1
3	0.41 (0.38, 0.43)	0.45 (0.42, 0.49)	0.69 (0.65, 0.74)
Woman's age (y)[a]			
20	0.74 (0.67, 0.82)	0.69 (0.60, 0.79)	0.88 (0.72, 1.07)
Reference = 25	1	1	1
30	1.03 (0.98, 1.09)	1.09 (1.02, 1.17)	1.01 (0.89, 1.15)
35	0.69 (0.66, 0.73)	0.79 (0.74, 0.85)	0.80 (0.69, 0.92)
40	0.28 (0.26, 0.30)	0.34 (0.32, 0.37)	0.39 (0.34, 0.45)
45	0.04 (0.03, 0.04)	0.03 (0.03, 0.04)	0.09 (0.07, 0.12)
Previous full-term birth			
No	1	1	–
Yes	1.05 (1.01, 1.08)	1.05 (1.01, 1.10)	–
Type of infertility (yes vs. no)			
Male factor	1.17 (1.14, 1.20)	1.08 (1.04, 1.12)	1.18 (1.11, 1.24)
Polycystic ovary syndrome	1.15 (1.12, 1.19)	1.04 (0.99, 1.08)	1.14 (1.07, 1.22)
Uterine factor	0.82 (0.77, 0.87)	0.84 (0.78, 0.90)	0.75 (0.67, 0.85)
Diminished ovarian reserve	0.51 (0.50, 0.53)	0.84 (0.80, 0.89)	0.66 (0.61, 0.71)
Unexplained	1.10 (1.05, 1.14)	1.07 (1.01, 1.12)	–
Woman's BMI (kg/m^2)[a]			
19	1.02 (0.98, 1.06)	0.99 (0.93, 1.04)	0.91 (0.84, 0.99)
23	1.06 (1.04, 1.08)	1.05 (1.03, 1.08)	1.03 (0.99, 1.08)
Reference = 25	1.00	1.00	1.00
30	0.86 (0.84, 0.89)	0.87 (0.83, 0.90)	0.89 (0.84, 0.95)
35	0.75 (0.72, 0.78)	0.76 (0.72, 0.80)	0.80 (0.73, 0.87)
40	0.66 (0.63, 0.69)	0.68 (0.63, 0.72)	0.72 (0.65, 0.80)
AMH (ng/mL)[a]			
1		0.61 (0.58, 0.64)	
2		0.91 (0.90, 0.93)	
Reference = 2.5		1	
5		1.22 (1.18, 1.27)	
10		1.34 (1.26, 1.43)	
15		1.22 (1.11, 1.34)	
No. of eggs collected at the first complete cycle [a]			
5			0.76 (0.71, 0.81)
Reference = 9			1
15			1.10 (1.03, 1.18)
20			1.09 (1.00, 1.18)
25			1.02 (0.93, 1.12)

Predicting personalized cumulative live birth following in vitro fertilization

David J. McLernon, Ph.D.,[a] Edwin-Amalraj Raja, Ph.D.,[a] James P. Toner, Ph.D.,[b] Valerie L. Baker, M.D.,[c] Kevin J. Doody, M.D.,[d] David B. Seifer, M.D.,[e] Amy E. Sparks, Ph.D.,[f] Ethan Wantman, M.B.A.,[g] Paul C. Lin, M.D.,[h] Siladitya Bhattacharya, M.D.,[i] and Bradley J. Van Voorhis, M.D.[j]

Fertility & Sterility 2022

AMH (predicts #oocytes) increases the overall prediction of live birth.

#oocytes of the first cycle, increases the prediction of live birth of a second cycle.

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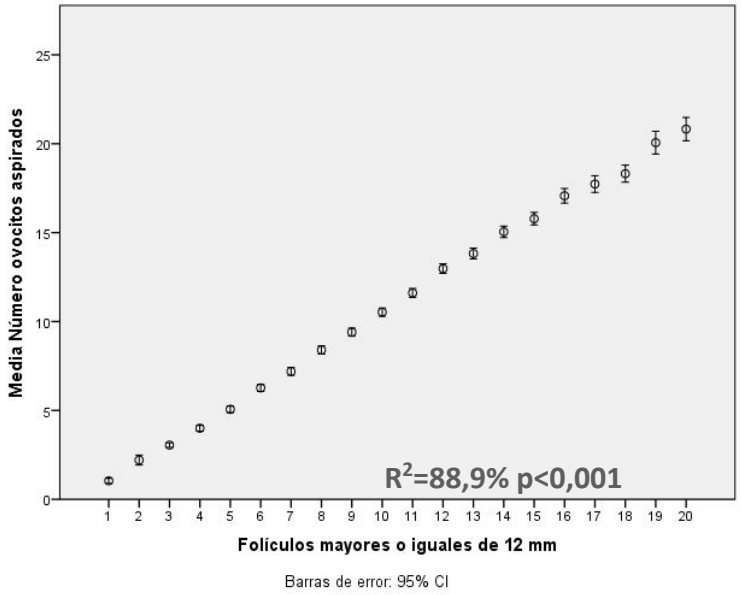
What else can be the number of oocytes useful for?

Useful predictors

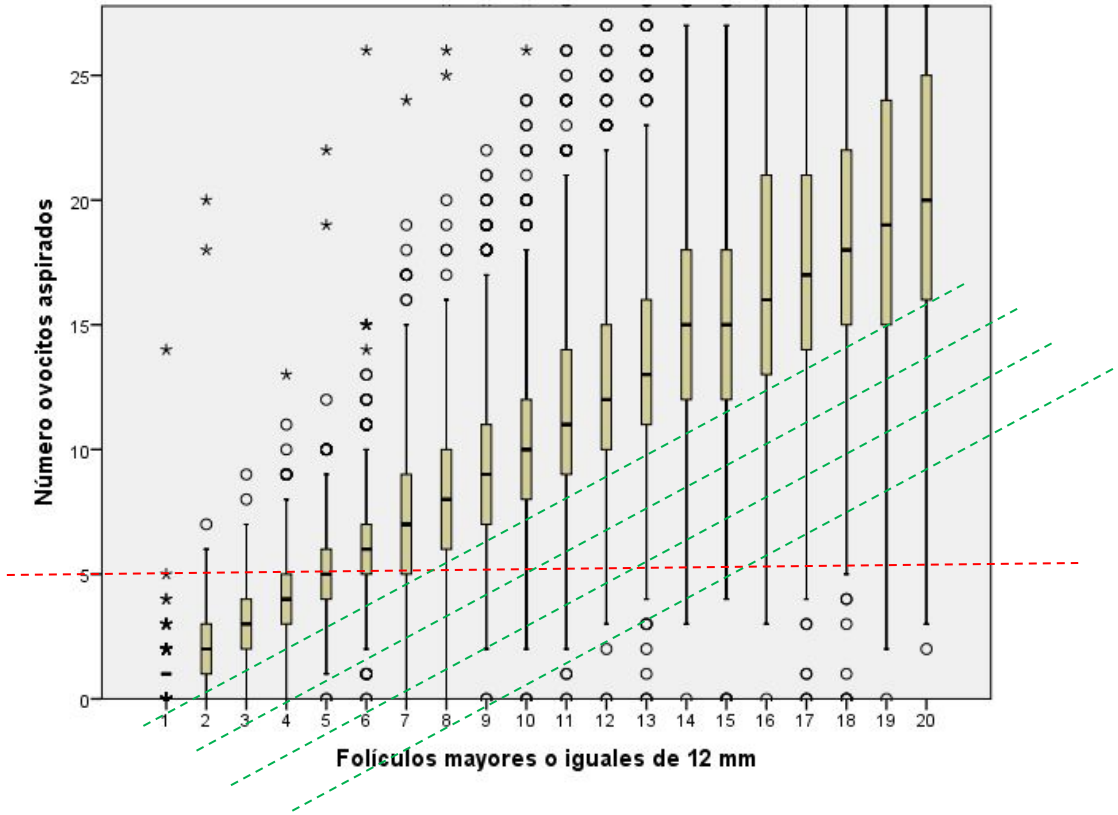
Predictive model for low yield oocyte recovery

- 3 centres
- 37783 cycles (IVF patients, oocyte freezing, donors)
- 48 variables

Best predictor is the number of follicles over 12 mm



What is a poor yield (including empty follicle syndrome?



E. Santamaría. Unpublished data

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Useful predictors

What is a poor yield (including empty follicle syndrome?

Model	Limit	% Low yield cycles
A	F_{12} - 1,00 σ	10,1%
B	F_{12} - 1,25 σ	6,2%
C	F_{12} - 1,50 σ	3,6%
D	F_{12} - 2,00 σ	1,9%

Model A	Model B	Model C	Model D
E2 on trigger day	E2 on trigger day	E2 on trigger day	E2 on trigger day
Type of trigger	Type of trigger	Type of trigger	Type of trigger
Body Mass Index	Body Mass Index	Body Mass Index	Body Mass Index
		P4 on trigger day	P4 on trigger day
Oocyte donor (Y/N)	Oocyte donor (Y/N)	Oocyte donor (Y/N)	
Oral Contraceptive Pill	Oral Contraceptive Pill	Oral Contraceptive Pill	
Days of Stimulation	Days of Stimulation	Days of Stimulation	
Clinic	Clinic	Clinic	
Year	Year	Year	

E. Santamaría. Unpublished data

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Is number of oocytes a useful indicator?

- Not a pre-treatment indicator
- It is good post-treatment indicator
  - More oocytes = more embryos = more live birth
  - AMH, AFC
  - It is very useful information for following cycles
- Expected/Recovered Oocytes can be used to define better EFS or low yield recoveries