AN UPDATE ON TIMED-AI (TAI) PROGRAMS FOR DAIRY CATTLE

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Alberta Agriculture and Rural Development

Outline of Webinar

- Review the physiology and endocrinology of the estrous cycle
- How estrous cycle and ovarian follicular dynamic can be manipulated
- Discuss a few controlled timed-AI (TAI) programs for dairy cattle
- Show reproductive performance data from a commercial Dairy herd

Estrous cycle in cattle

- Average 21 days long (18 to 24)
- Two phases luteal (14-18 days) and follicular (4-6 days)
- Four stages
  - Proestrus (Day 18-20)
  - Estrus (Day 0)
  - Metestrus (Day 1 - 3)
  - Diestrus (Day 4 - 17)

Hormones of the Estrous Cycle

Hormone	Produced	Action
GnRH	Hypothalamus	LH & FSH release
FSH	Hypophysis	Follicle growth
LH	Hypophysis	Regulates ovulation and CL formation
Estrogen	Ovarian follicle	Estrus behavior & GnRH surge
Progesterone	CL & Placenta	Maintenance of pregnancy
Prostaglandin 2α	Uterus	CL regression

Estrous cycle cont'd

- Follicular phase
  - Low P4, high E2
  - GnRH surge → LH&FSH surge → Ovulation

- Luteal phase
  - CL development
  - High P4, low LH
  - Follicular waves

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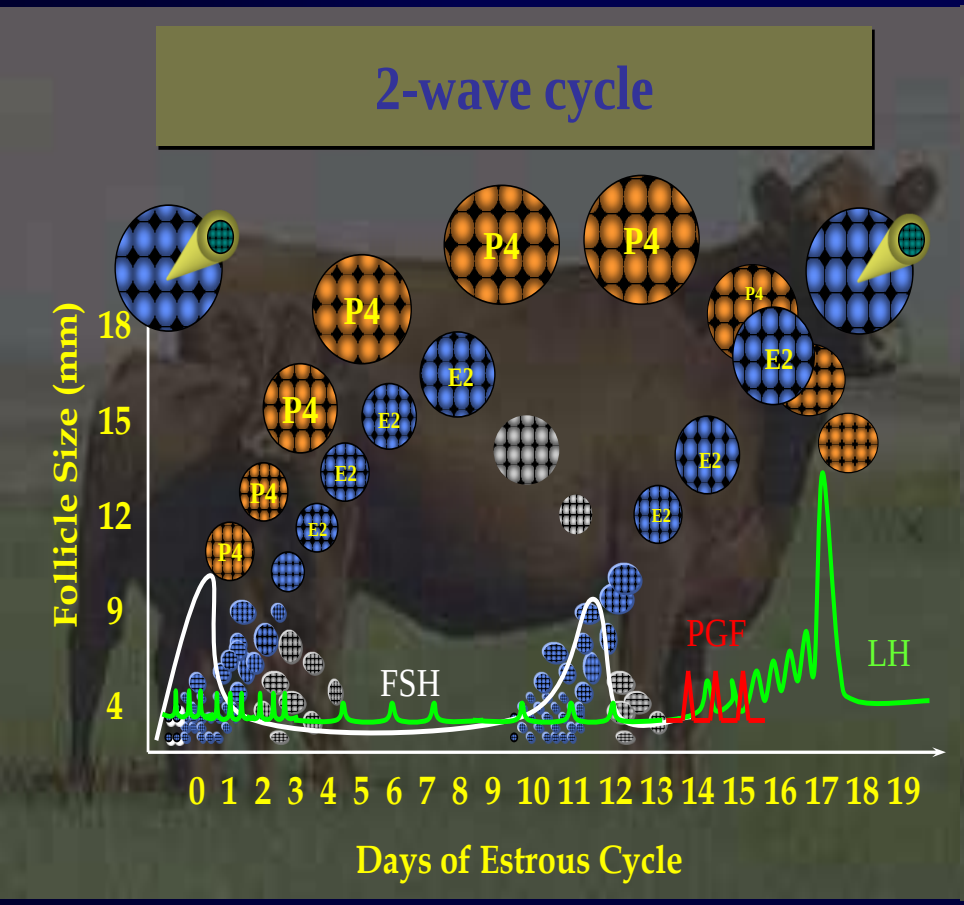
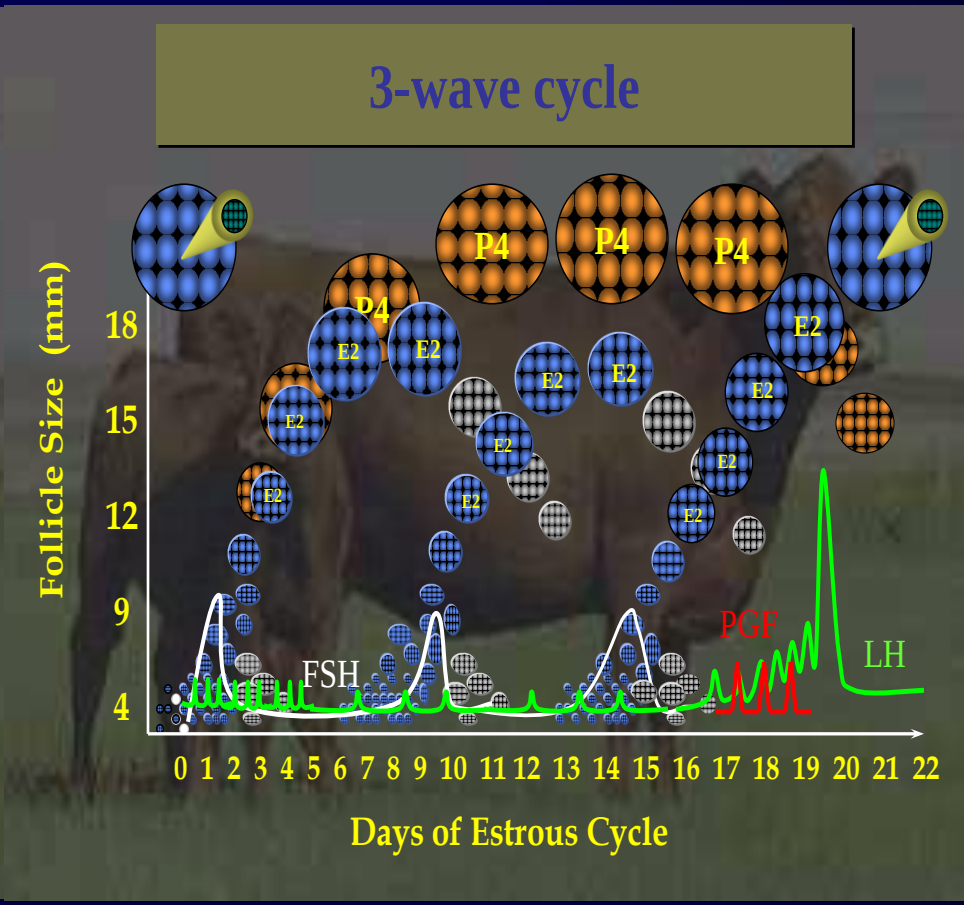
FOLLICULAR WAVES

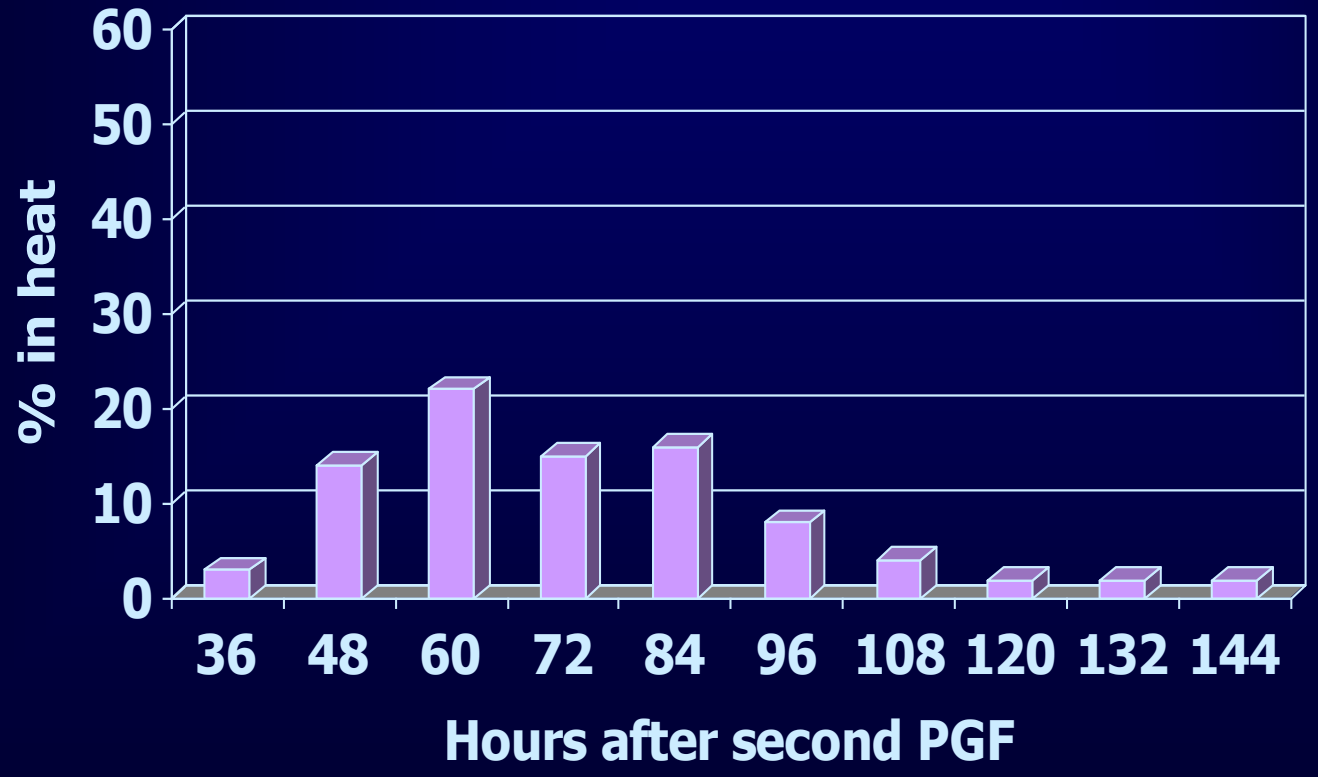




Controlling the estrous cycle

- By shortening the luteal phase (Prostaglandin 2α)
- By lengthening the luteal phase (Progestins)

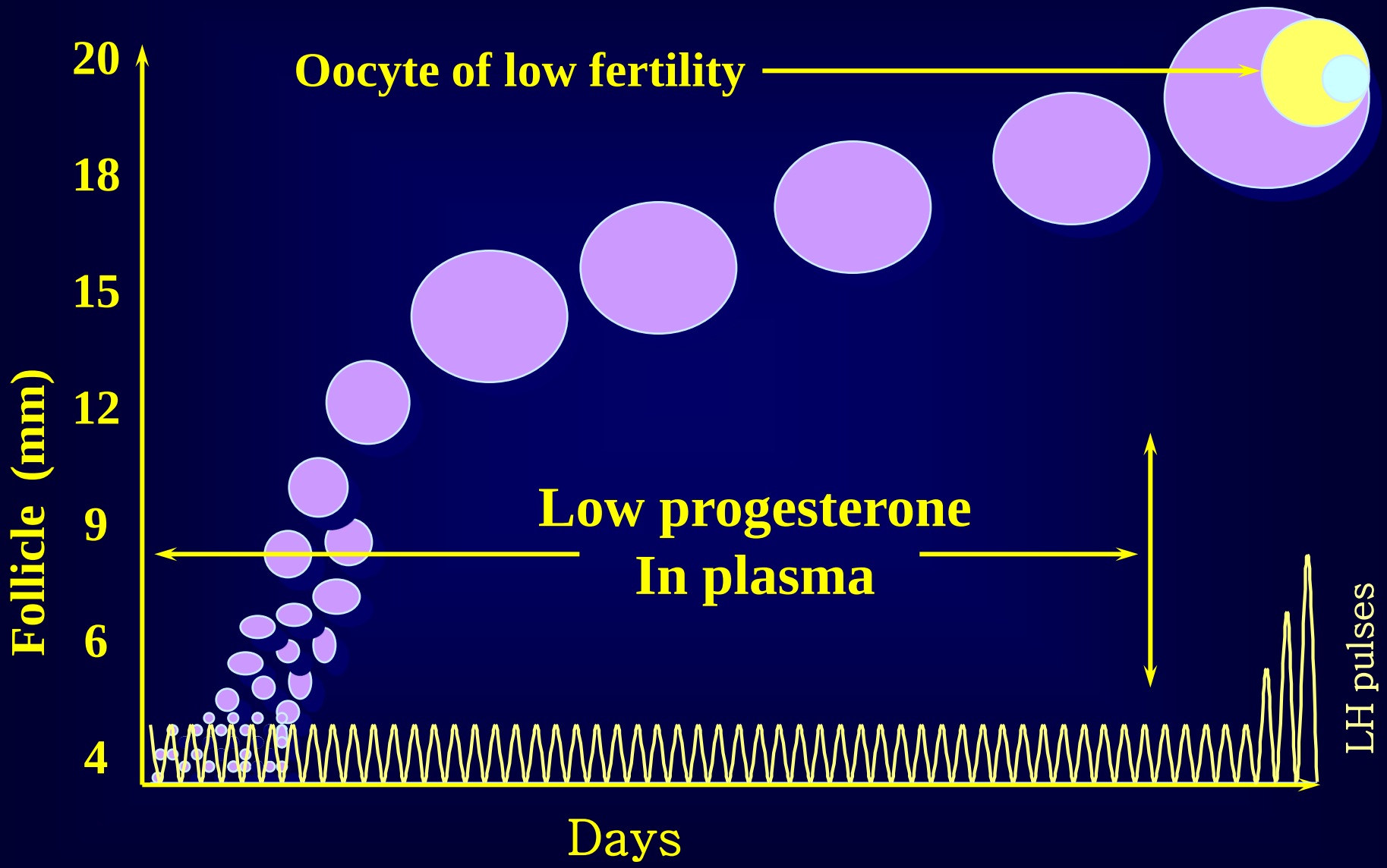
Distribution of heat in Holstein heifers given PGF 14 d apart



N = 132

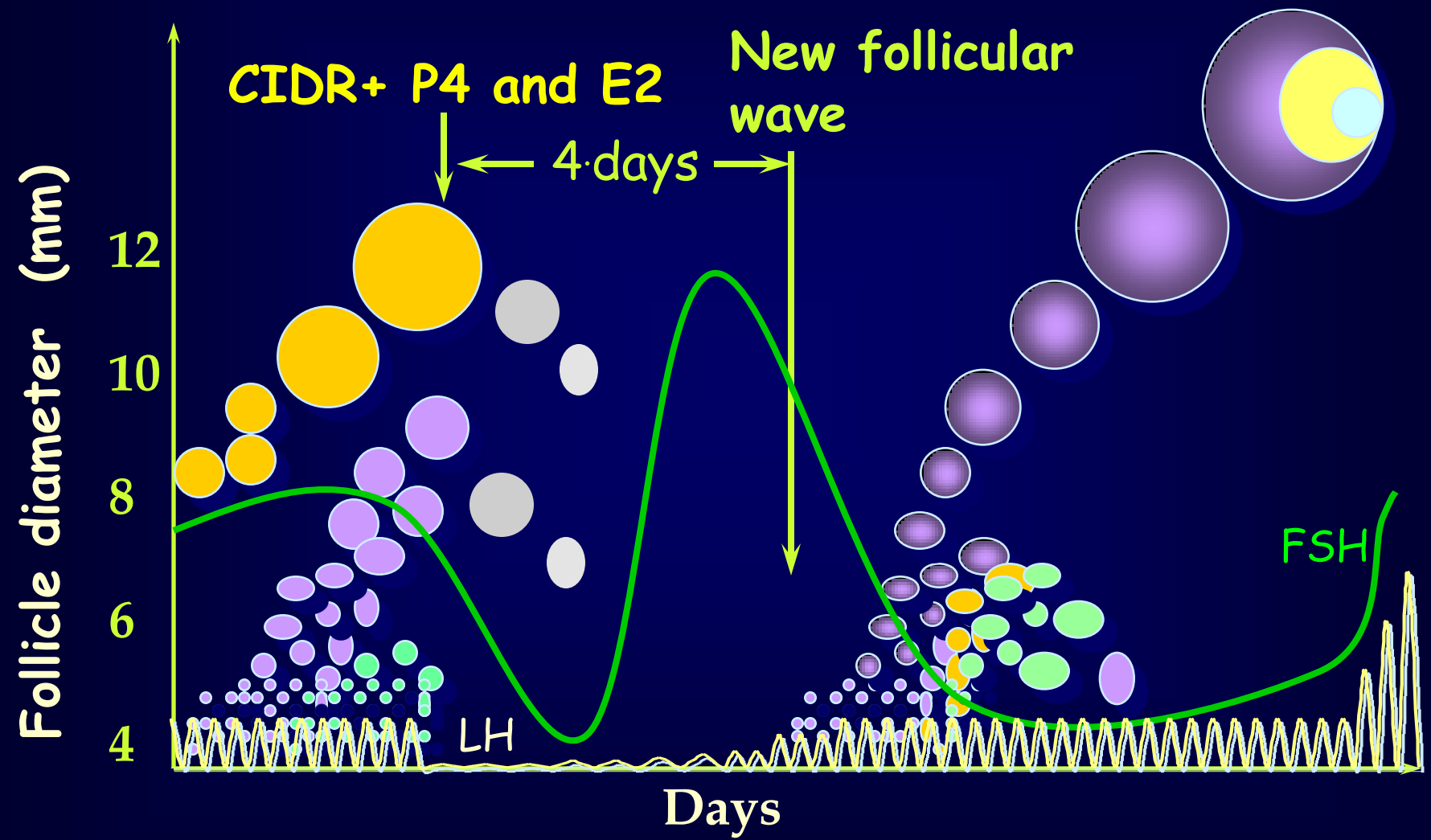
Colazo, unpublished

PERSISTENT FOLLICLE



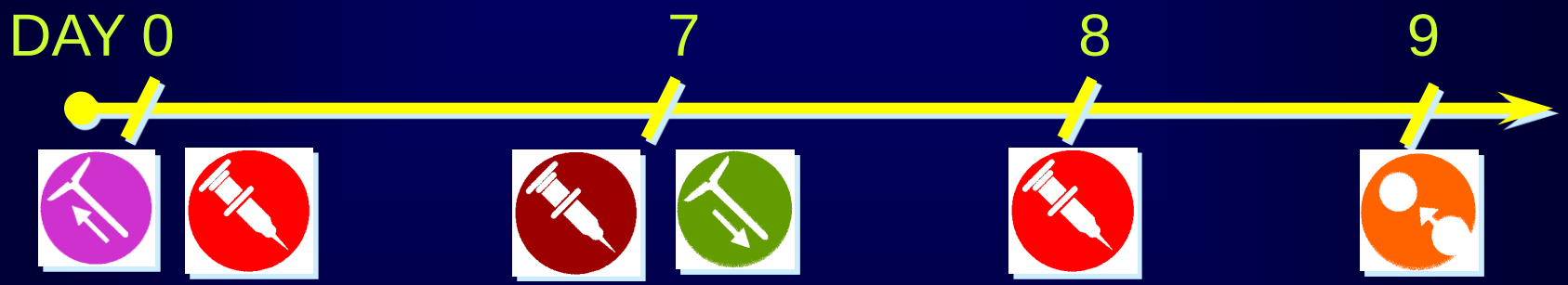
Protocols that synchronize follicular dynamics, CL regression and ovulation, and allow for timed artificial insemination (TAI)

Estradiol and Progesterone



Bo et al., 1995

TAI protocol (Progesterone & Estrogen)



Insert CIDR
Give
2 mg EB
or 5 mg E-17B

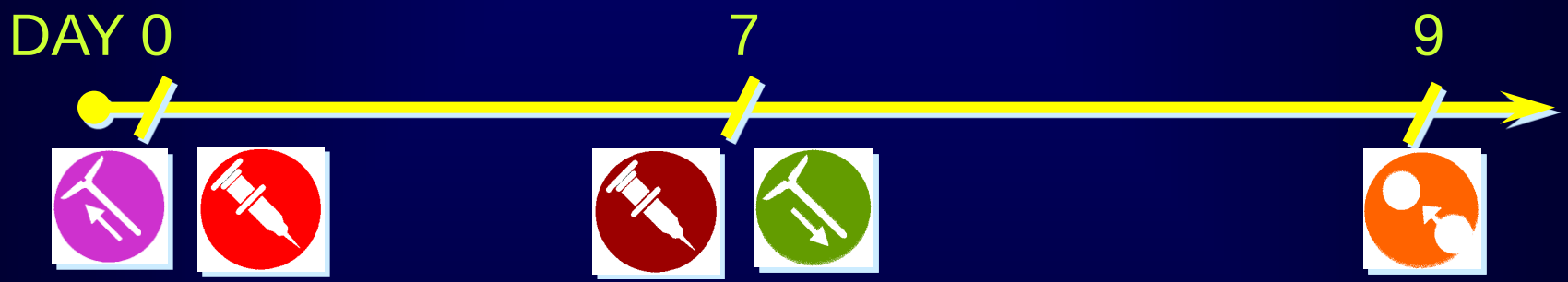
Remove CIDR
Give PGF2α

1 mg EB

TAI

Bo et al., 1995; Martinez et al., 2005

TAI protocol (Progesterone & Estrogen)



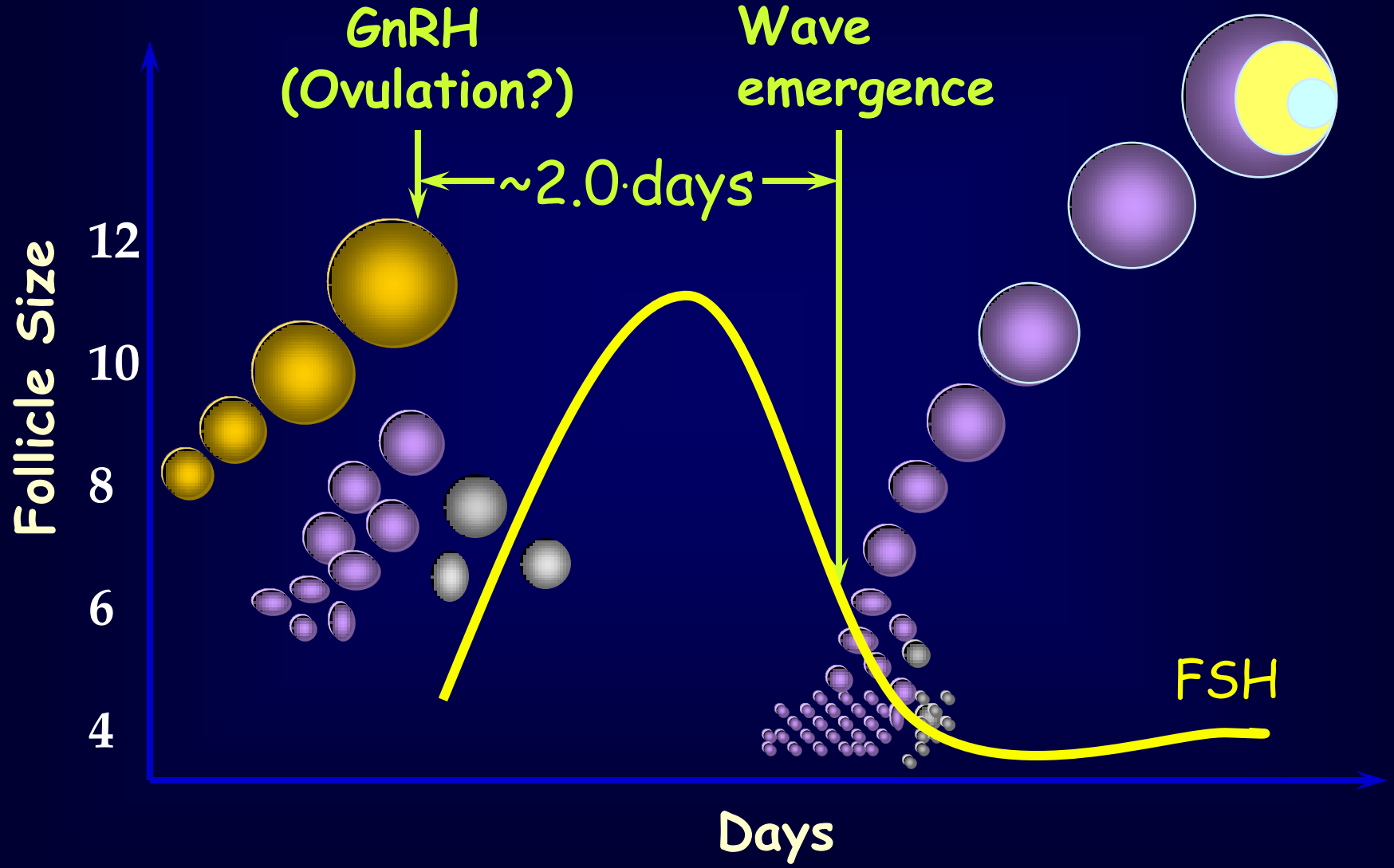
Insert CIDR
Give
5 mg E-17B

Remove CIDR
Give PGF
0.5 mg ECP

TAI

Colazo et al., 2003

GnRH or pLH



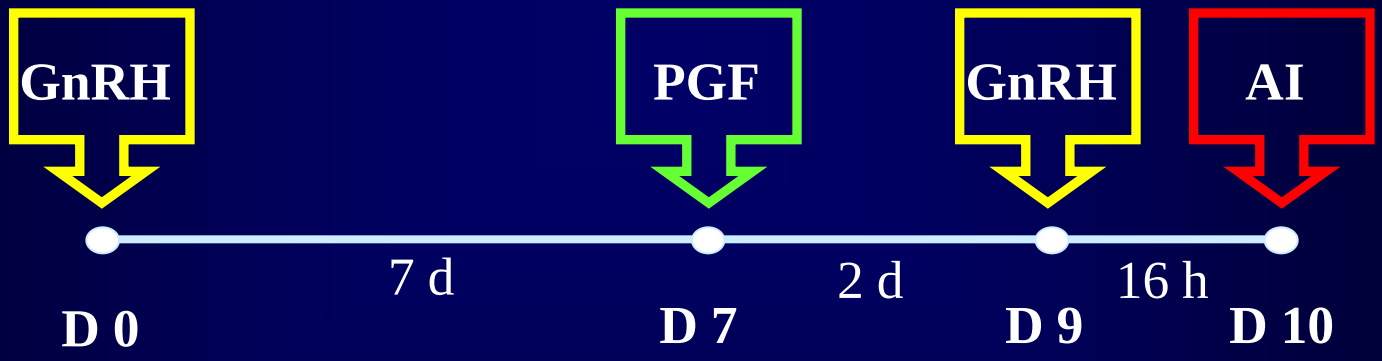
Martinez et al., 1999

Effect of presynchronization and cyclicity status on ovulatory response to first GnRH in cattle subjected to a GnRH-based protocol.

Animal category	Presynchronization		Cyclicity status		Reference
	Yes	No	Cyclic	Acyclic	
Lactating dairy cows	--	--	56/146 (38%)	17/20 (85%)	Colazo et al., 2009
Lactating dairy cows	149/241 (62%)	--	--	--	Colazo et al., 2013a
Lactating dairy cows	99/217 (46%)	110/391 (28%)	150/501 (30%)	59/107 (55%)	Colazo et al., 2013b
Dairy heifers	--	27/91 (30%)	--	--	Colazo and Ambrose, 2011
Suckled beef cows	59/79 (75%)	39/80 (49%)	--	--	Small et al., 2009
Suckled beef cows	99/129 (77%)	72/131 (55%)	--	--	Small et al., 2009
Beef heifers	78/128 (61%)	--	--	--	Small et al., 2009
Beef heifers	29/49 (59%)	30/49 (61%)	--	--	Colazo et al., 2007

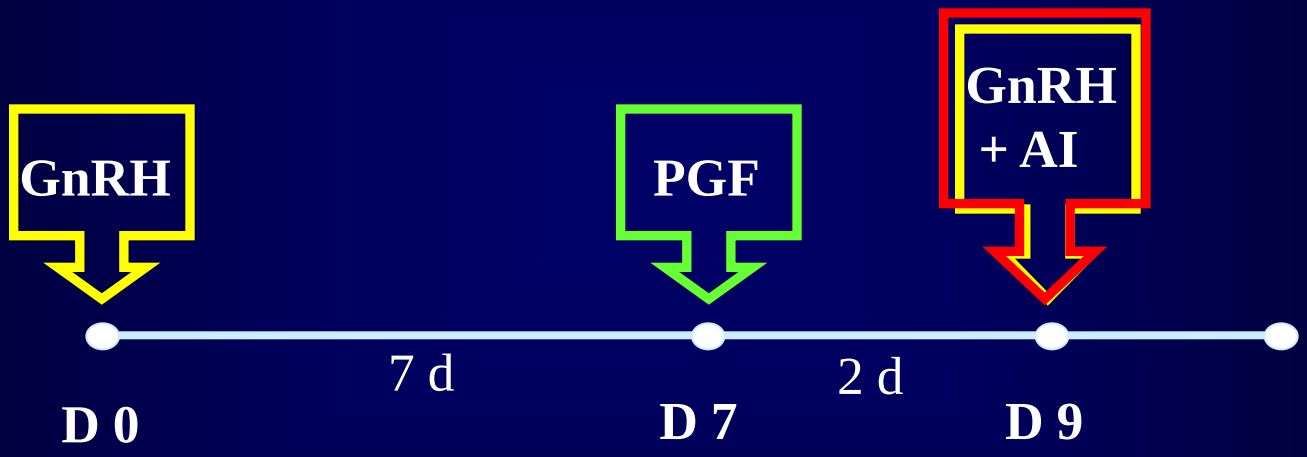
37%

7-d OVSYNCH



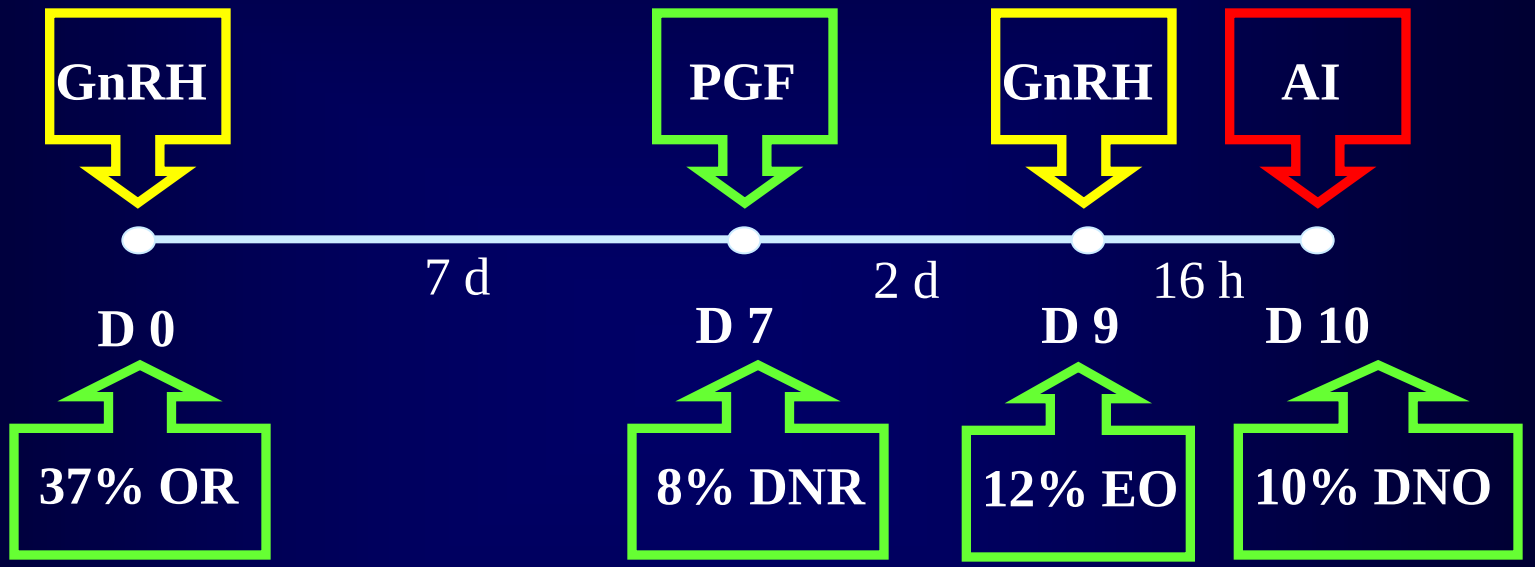
Pursley et al., 1995

7-d COSYNCH



Geary et al., 1998

7-d OVSYNCH



Conception rate between 28-35%

LACK OF SYNCHRONY!

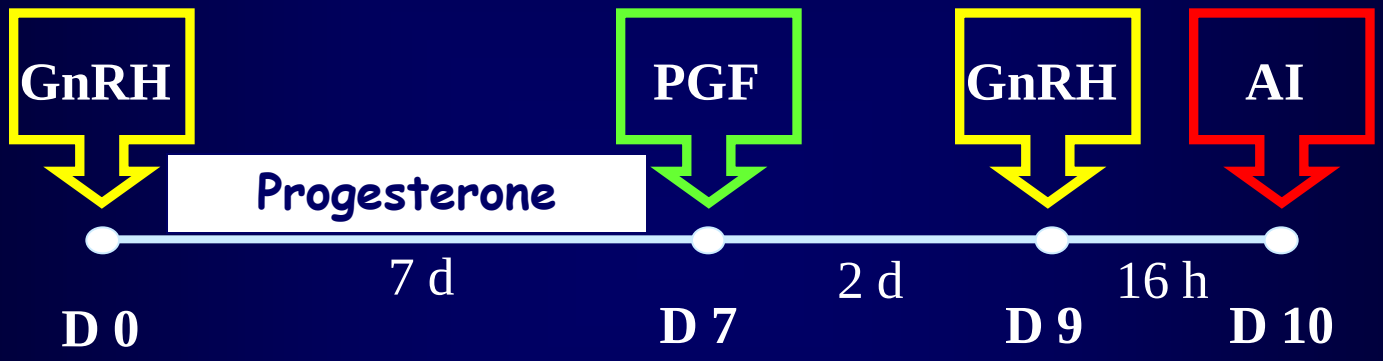
N = 744

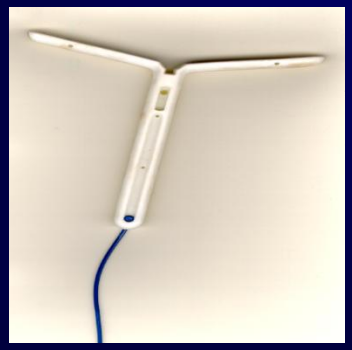
Colazo et al., 2009; 2013 and unpublished data

Improving the fertility of GnRH-based protocols

- Incorporate a progestin device
- Presynch
  - 2 doses of PGF
  - G6G or Double Ovsynch
  - Progestin presynchronization

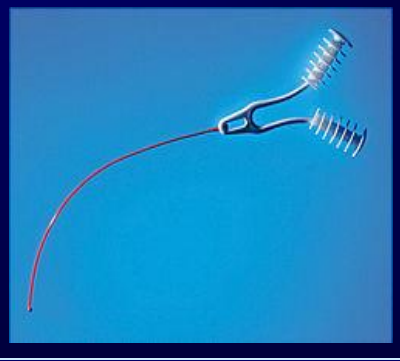
7-d OVSYNCH + P4





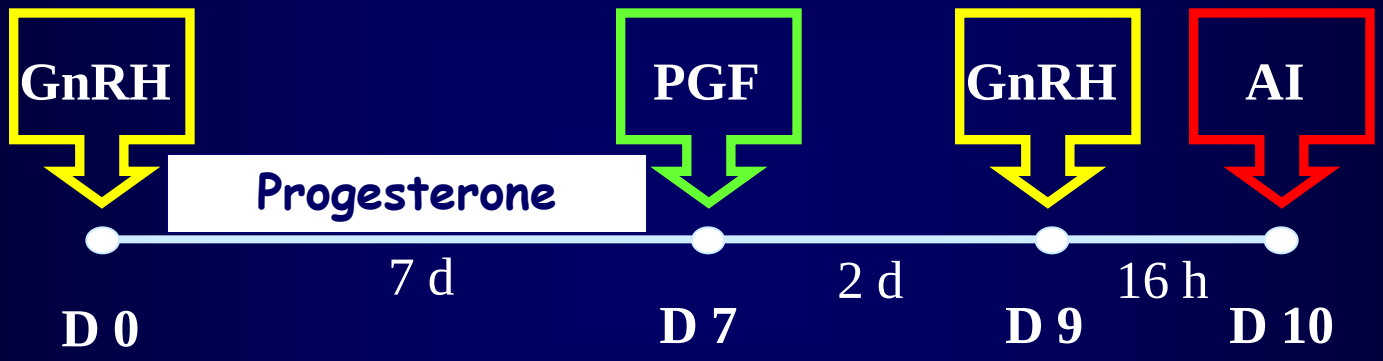
CIDR

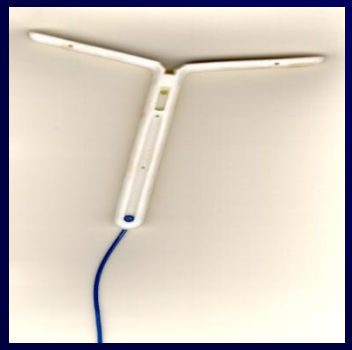
PRID



CUE-MATE

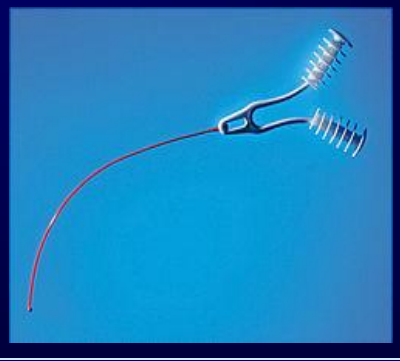
7-d OVSYNCH + P4





CIDR

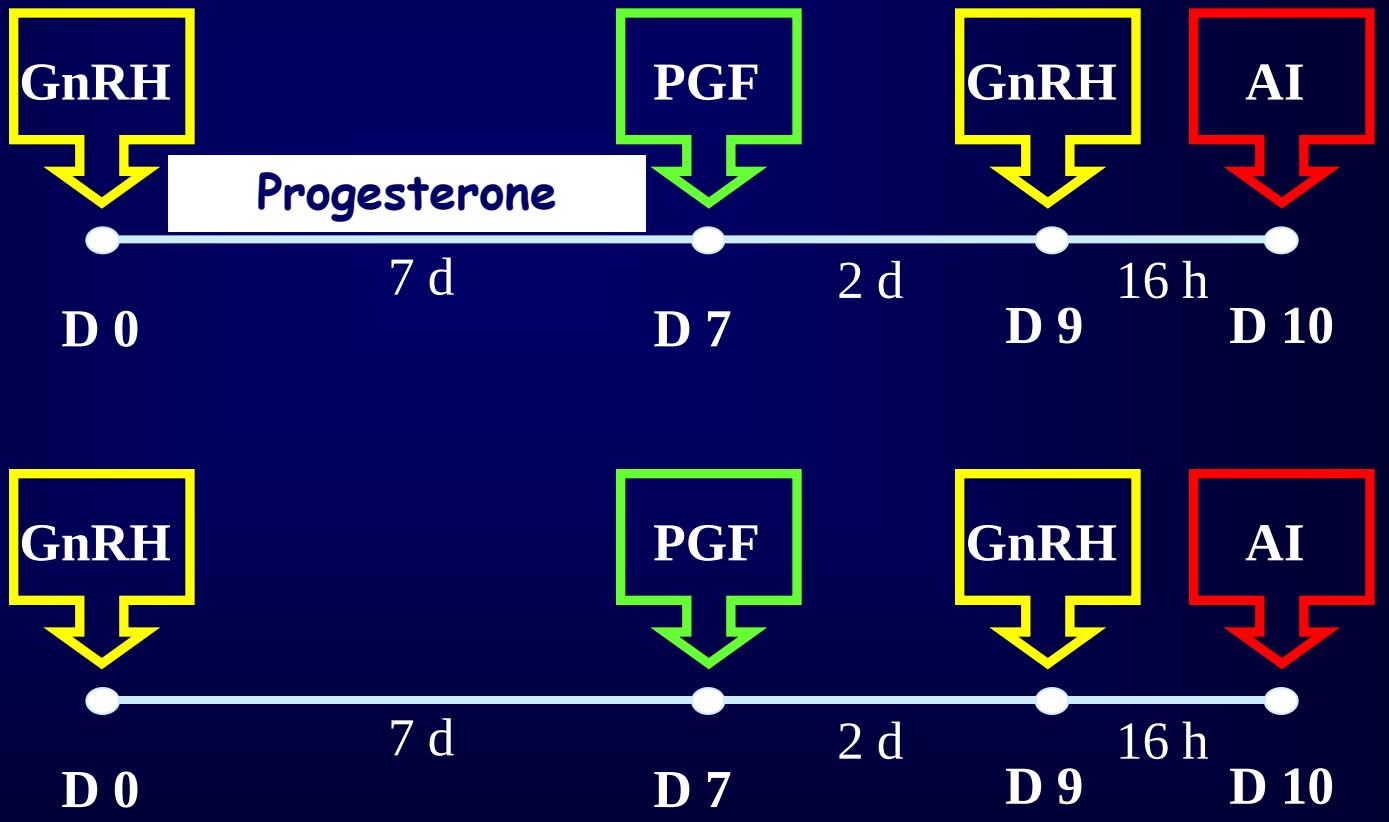
PRID



CUE-MATE

PRID

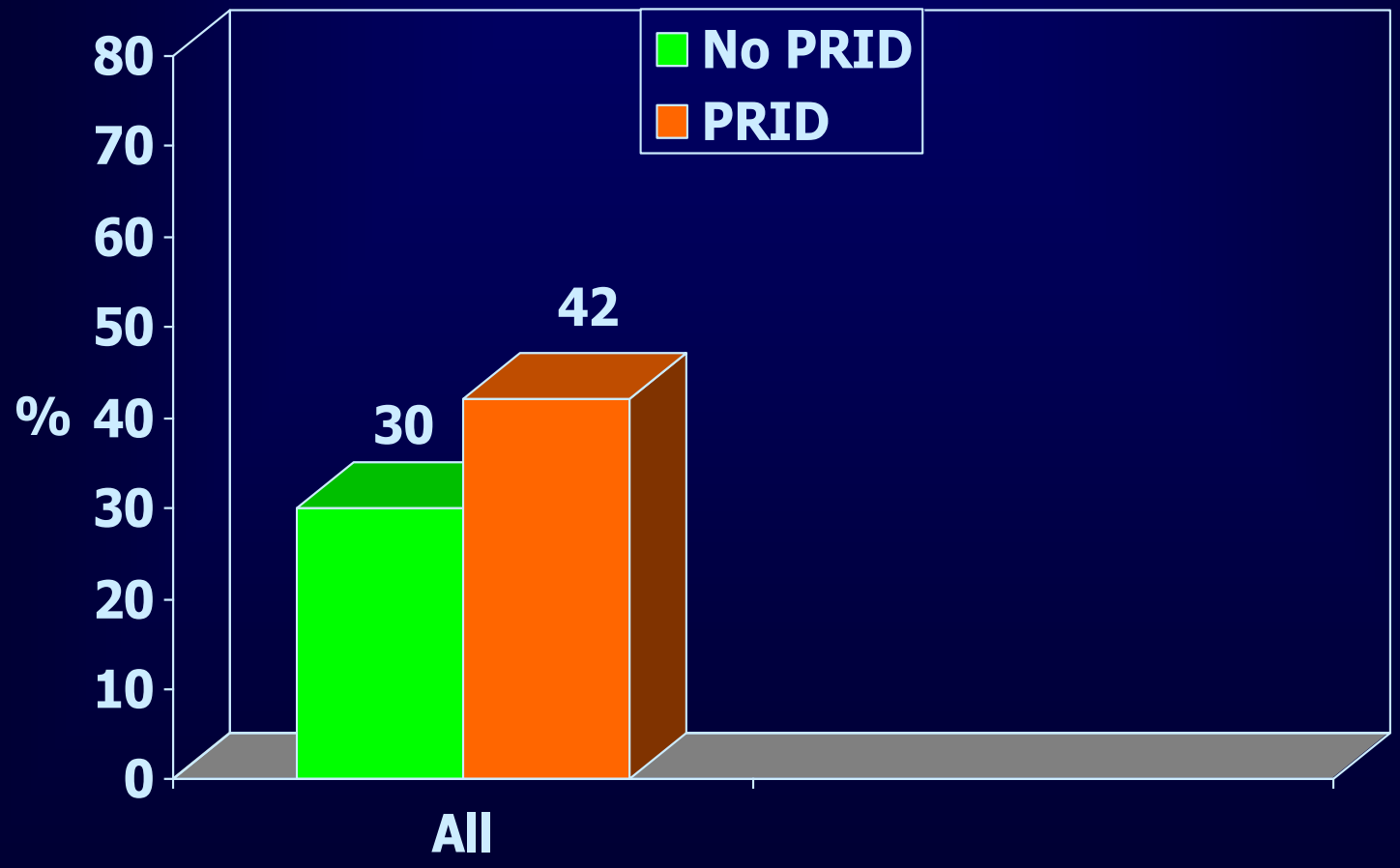
7-d OVSYNCH +/- P4



N = 608; Presynchronized N=217

Colazo et al., 2013

Pregnancy rate: PRID effect



N = 608; P <0.05

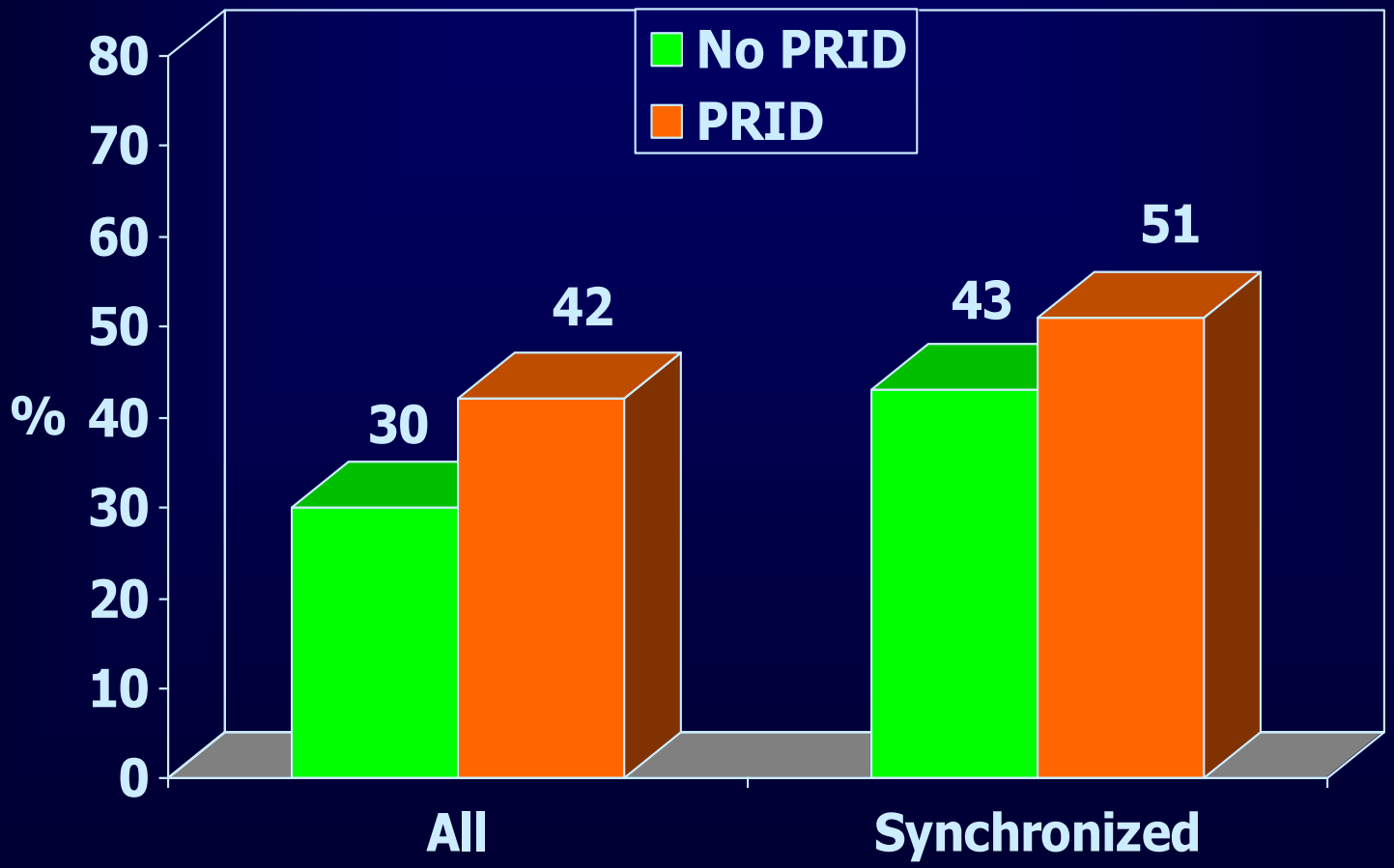
Colazo et al., 2013

	Ovsynch		Ovsynch + PRID
Ov. to 1st GnRH	35%		33%
Ov. to 2nd GnRH	83%		86%
Ov. before TAI	11%	*	6%
No resp. PGF	4%		3%
Double Ov.	11%		10%

N = 608

Colazo et al., 2013

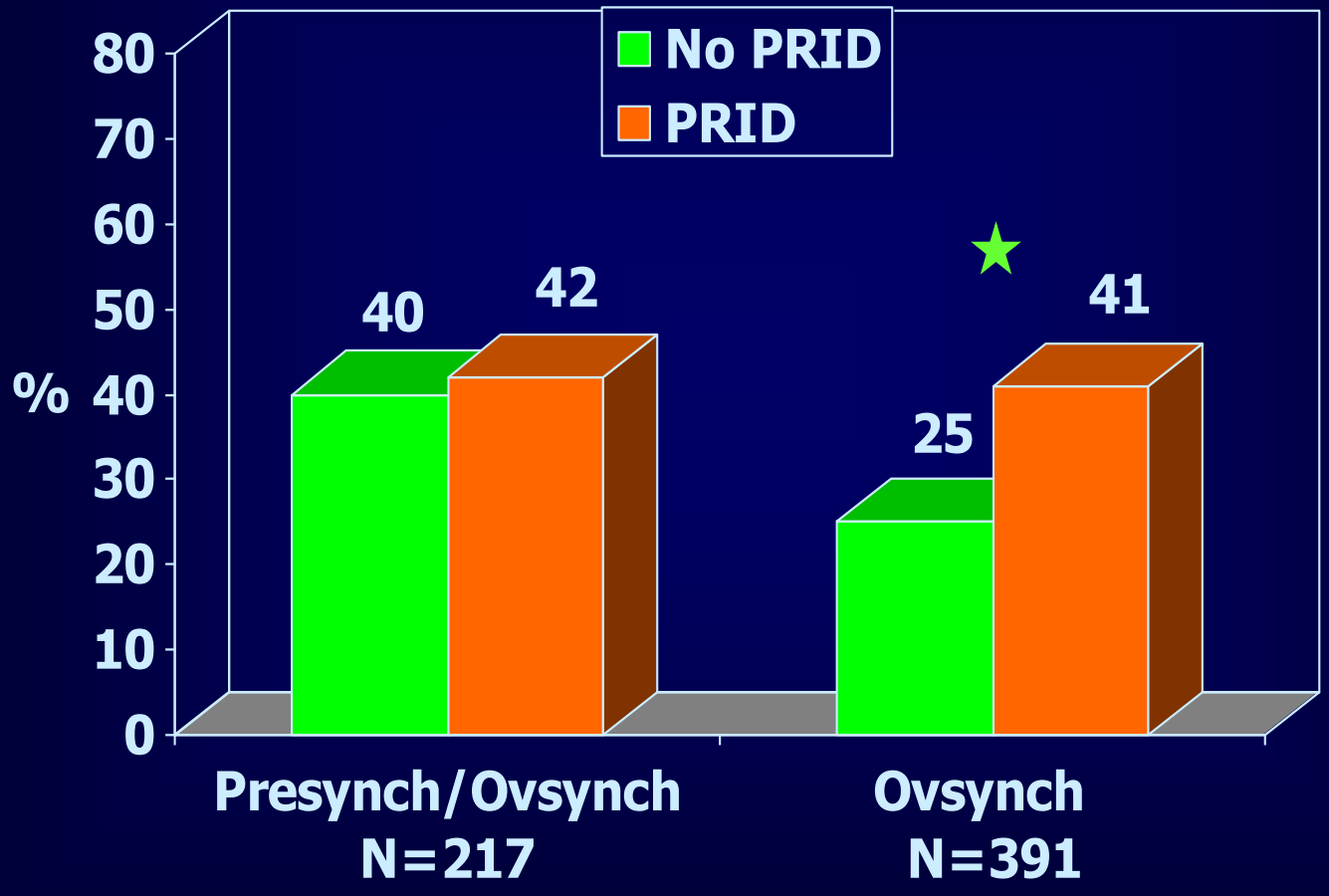
Pregnancy rate: PRID effect



N = 608; P <0.05

Colazo et al., 2013

PRID treatment by TAI protocol



Interaction P<0.05

Colazo et al., 2013

PRESYNCH-OVSYNCH 14/11 d

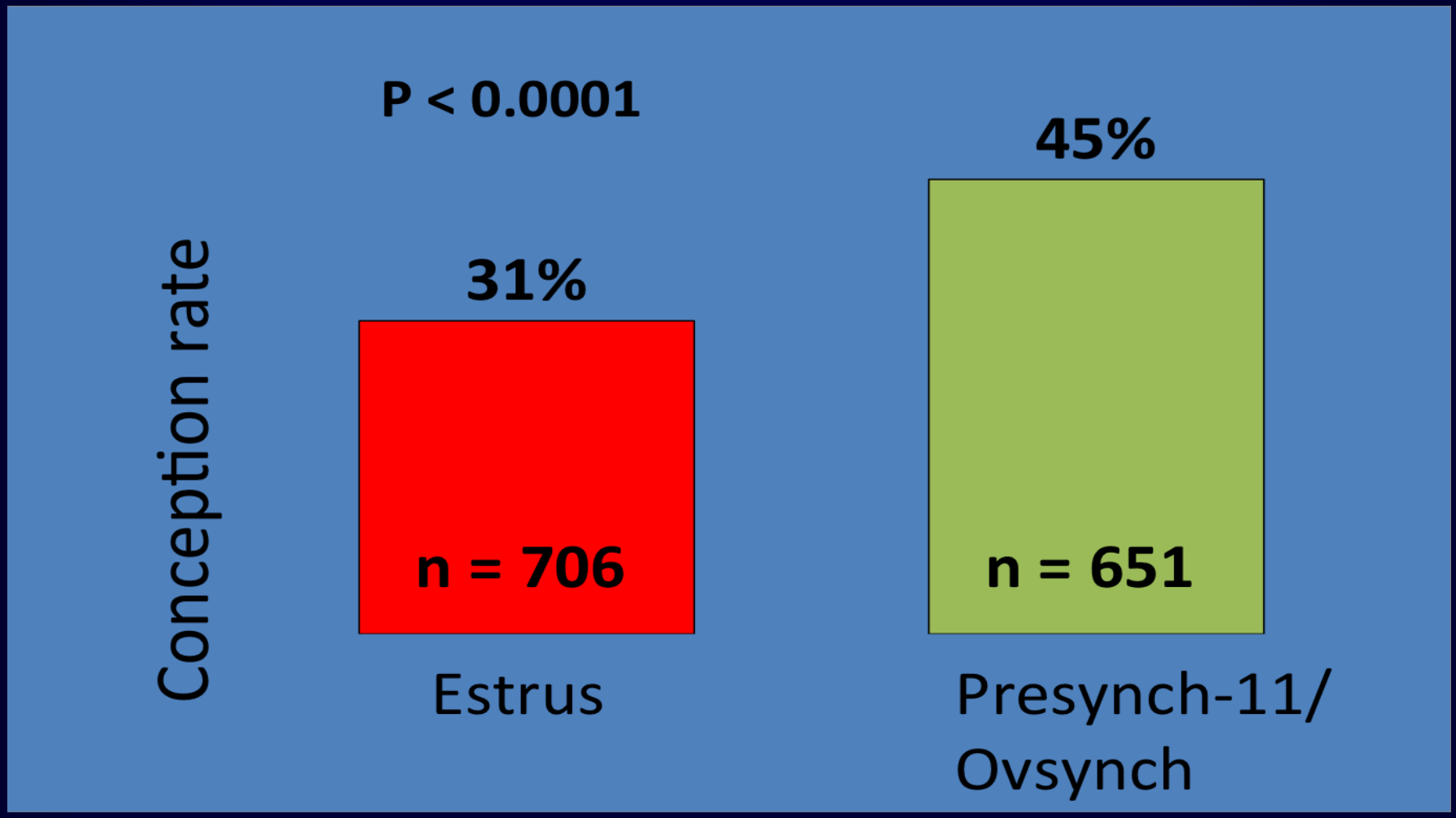
Sun	Mon	Tue	Wed	Thu	Fri	Sat
				PGF		
				PGF		
	GnRH					
	PGF		GnRH	TAI		

	Ovsynch		Presynch + Ovsynch
Ov. to 1st GnRH	39%	*	61%
Ov. to 2nd GnRH	83%		87%
Ov. before TAI	12%	*	5%
No resp. PGF	8%		5%
Double Ov.	13%		15%

N = 744

Colazo et al., 2009; 2013 and unpublished data

Conception rate to first AI

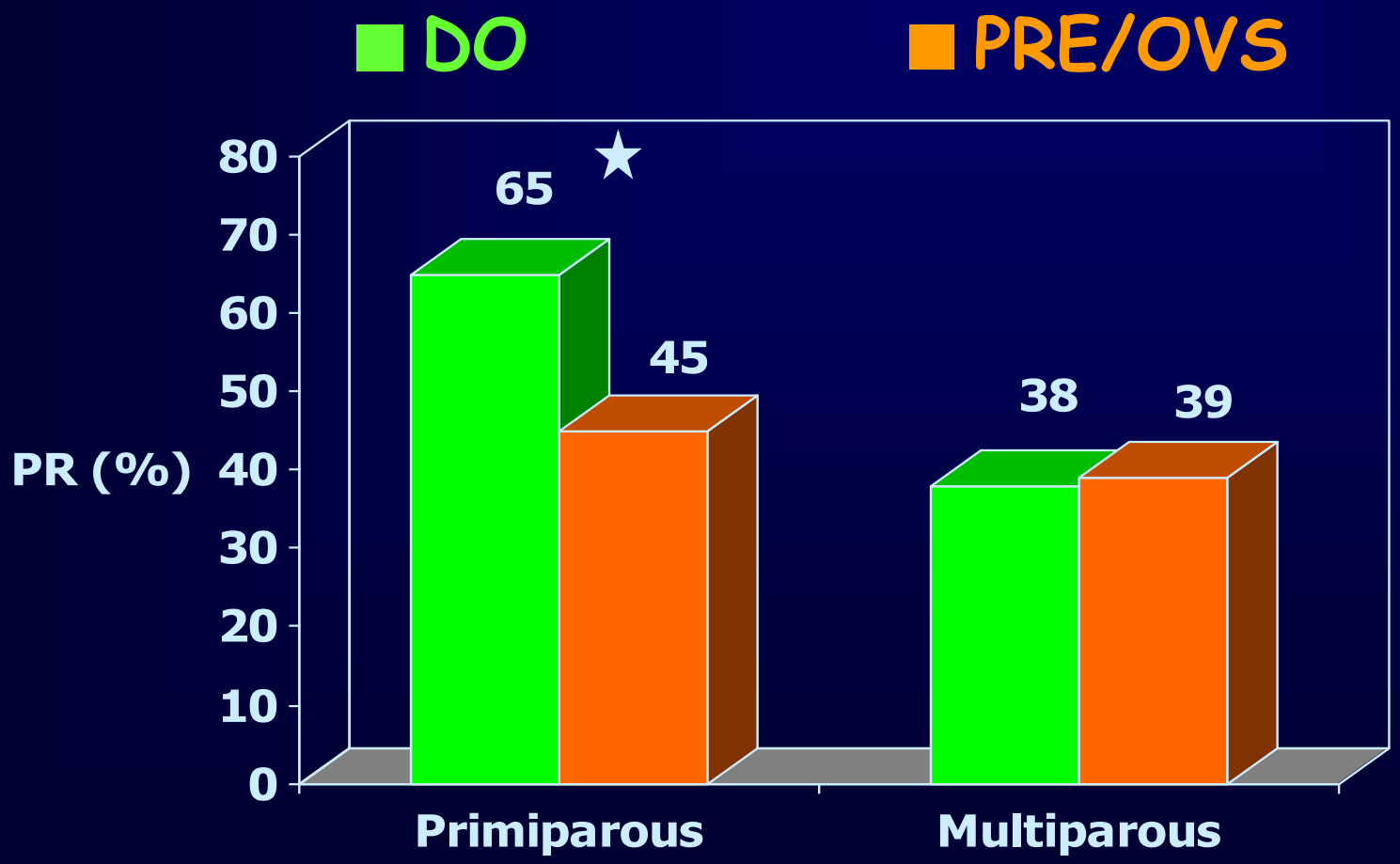


Strickland et al., 2010

DOUBLE OVSYNCH

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					GnRH	
					PGF	
	GnRH					
	GnRH					
	PGF		GnRH	TAI		

Double Ovsynch vs Presynch/Ovsynch

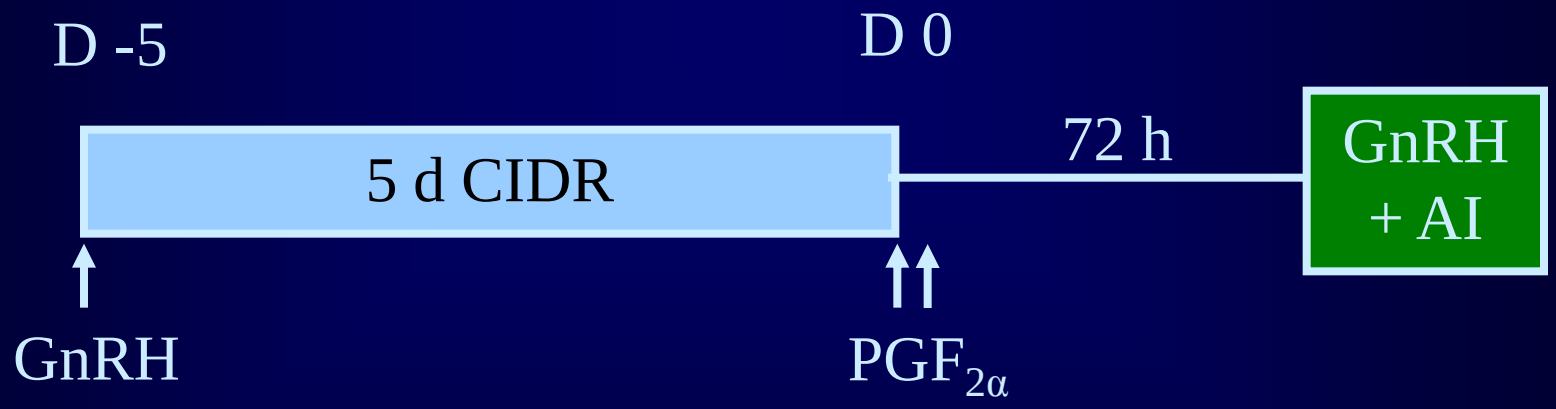


n = 337

Souza et al., 2008

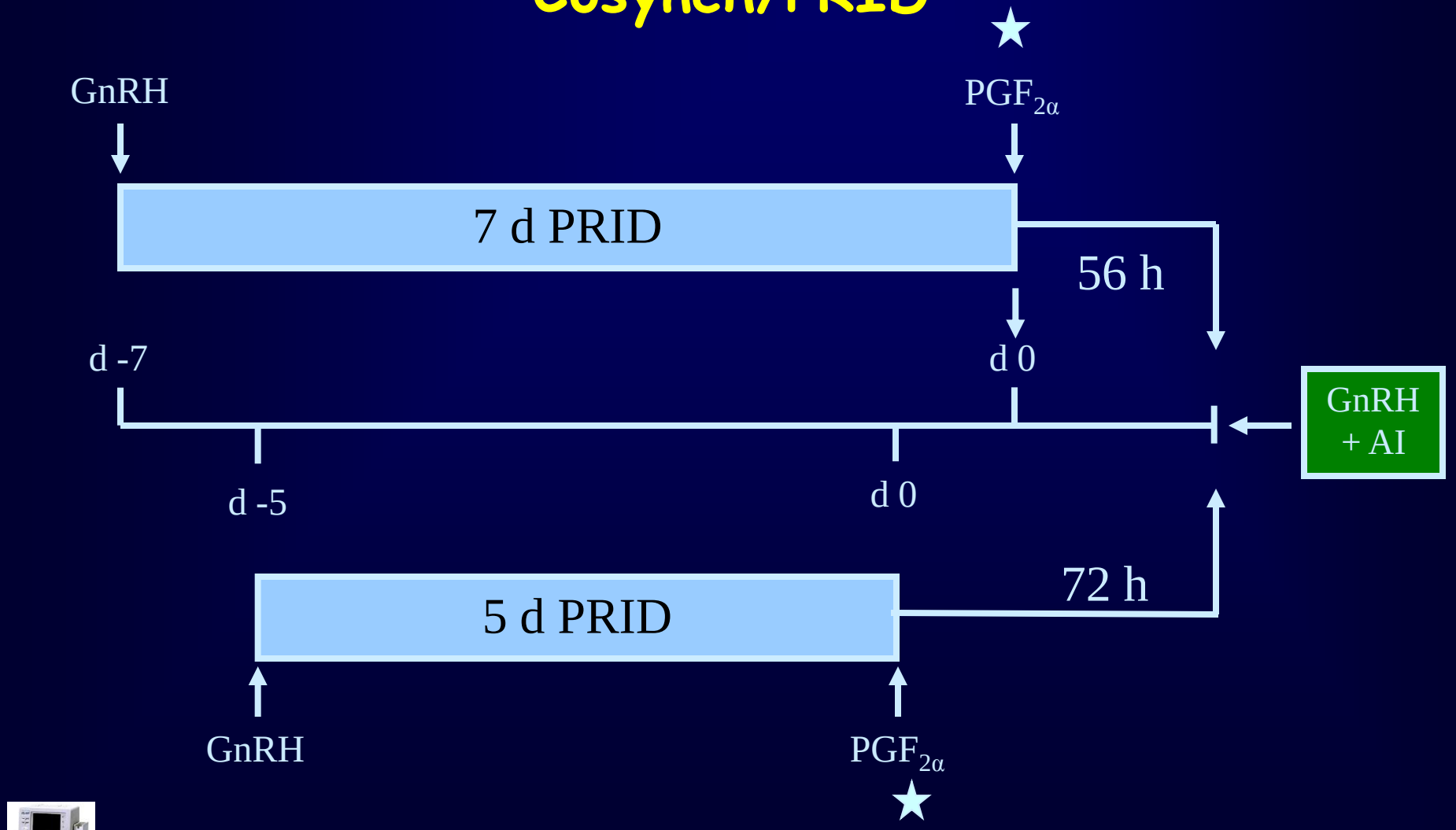
Improving the fertility of GnRH-based protocols

-5-d Cosynch + CIDR-



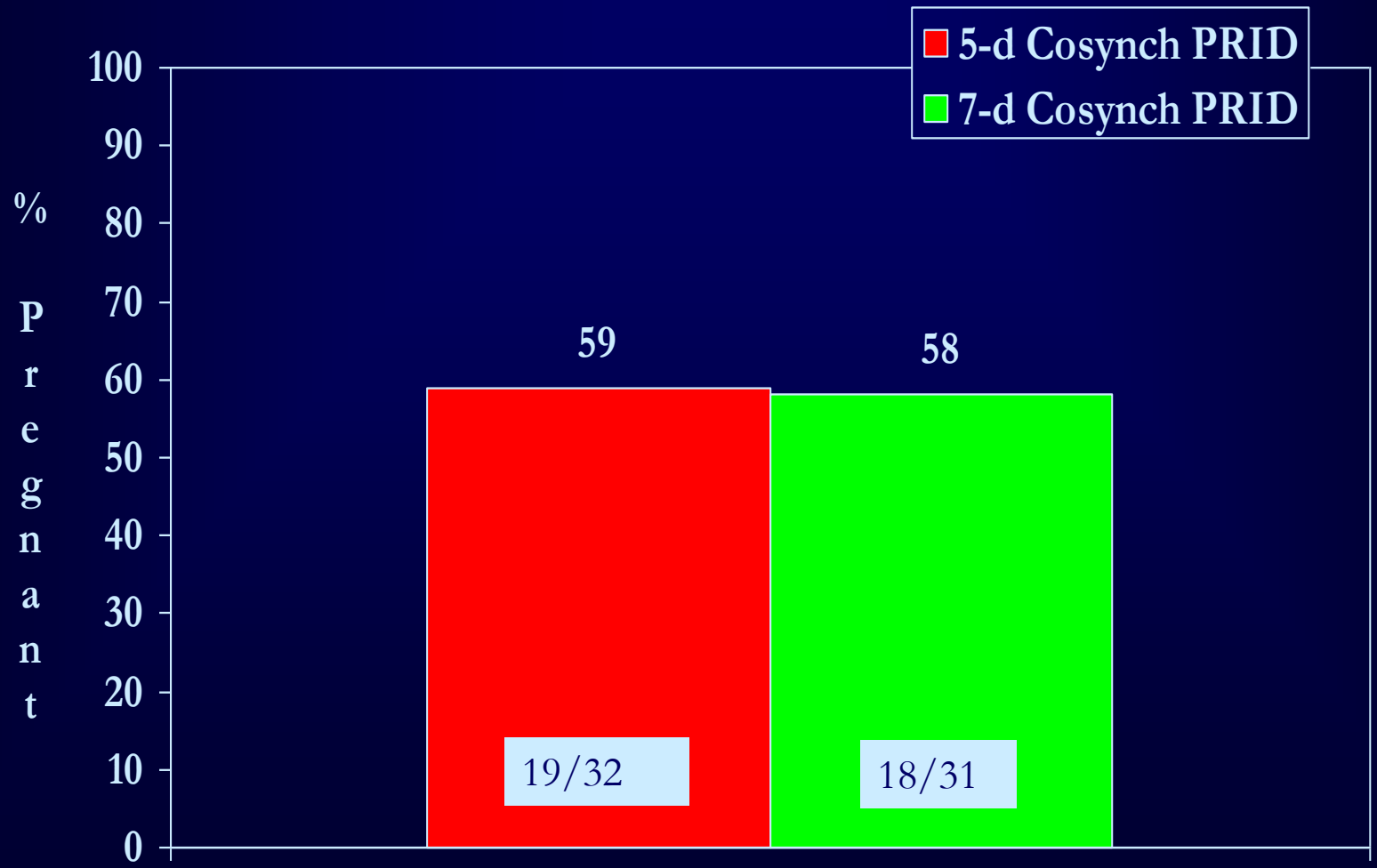
Bridges et al., 2008

Experimental Design – 5- vs 7-d Cosynch/PRID



Colazo and Ambrose, 2011

TAI Pregnancy Rate 28 d



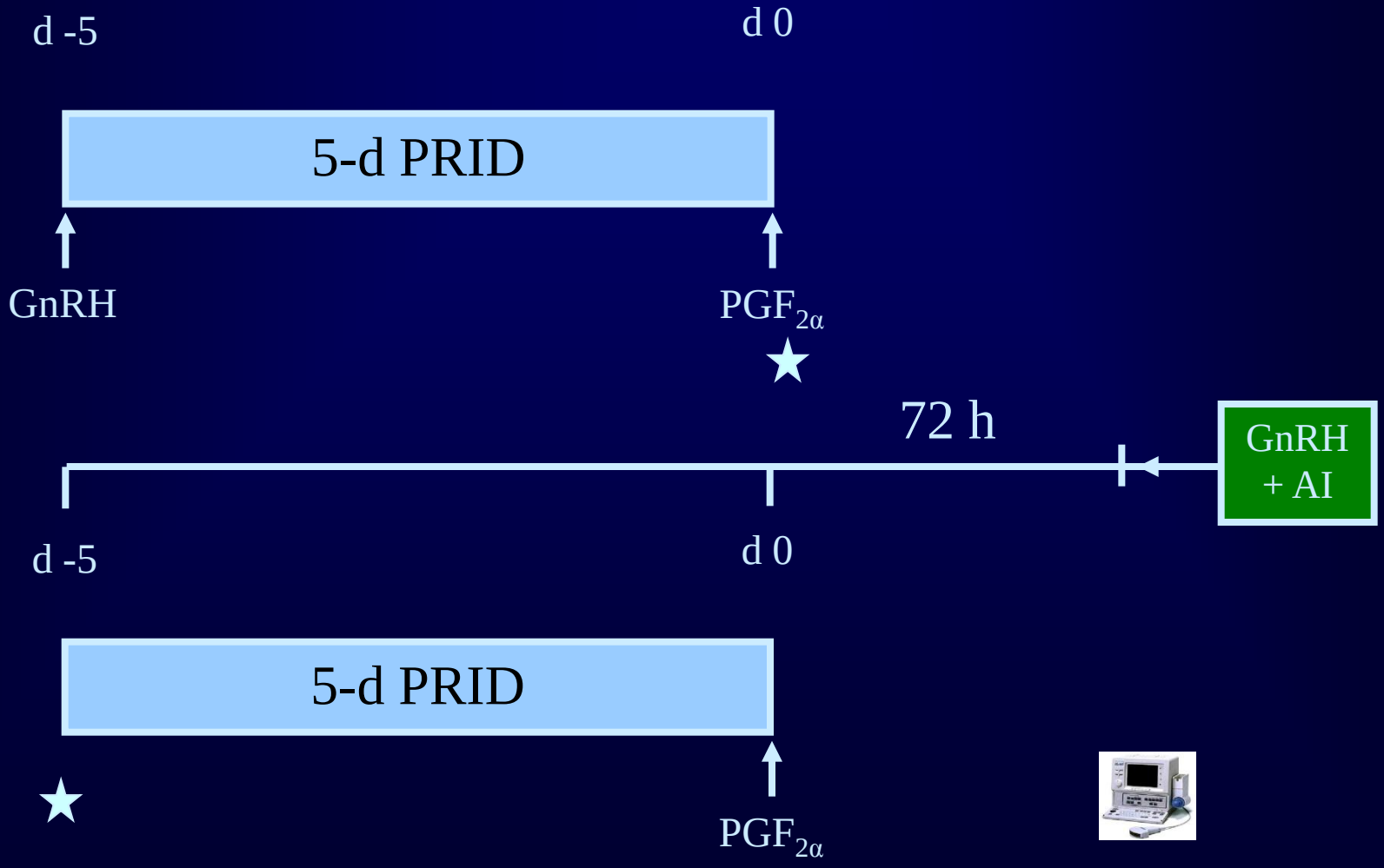
Trt, P >0.05

Colazo and Ambrose, 2011

	Cosynch/PRID 5-d		7-d
Ov. to 1st GnRH	25%	*	39%
Ov. to 2nd GnRH	65%		84%
Ov. before TAI	22%	*	10%
No resp. PGF	6%		0%

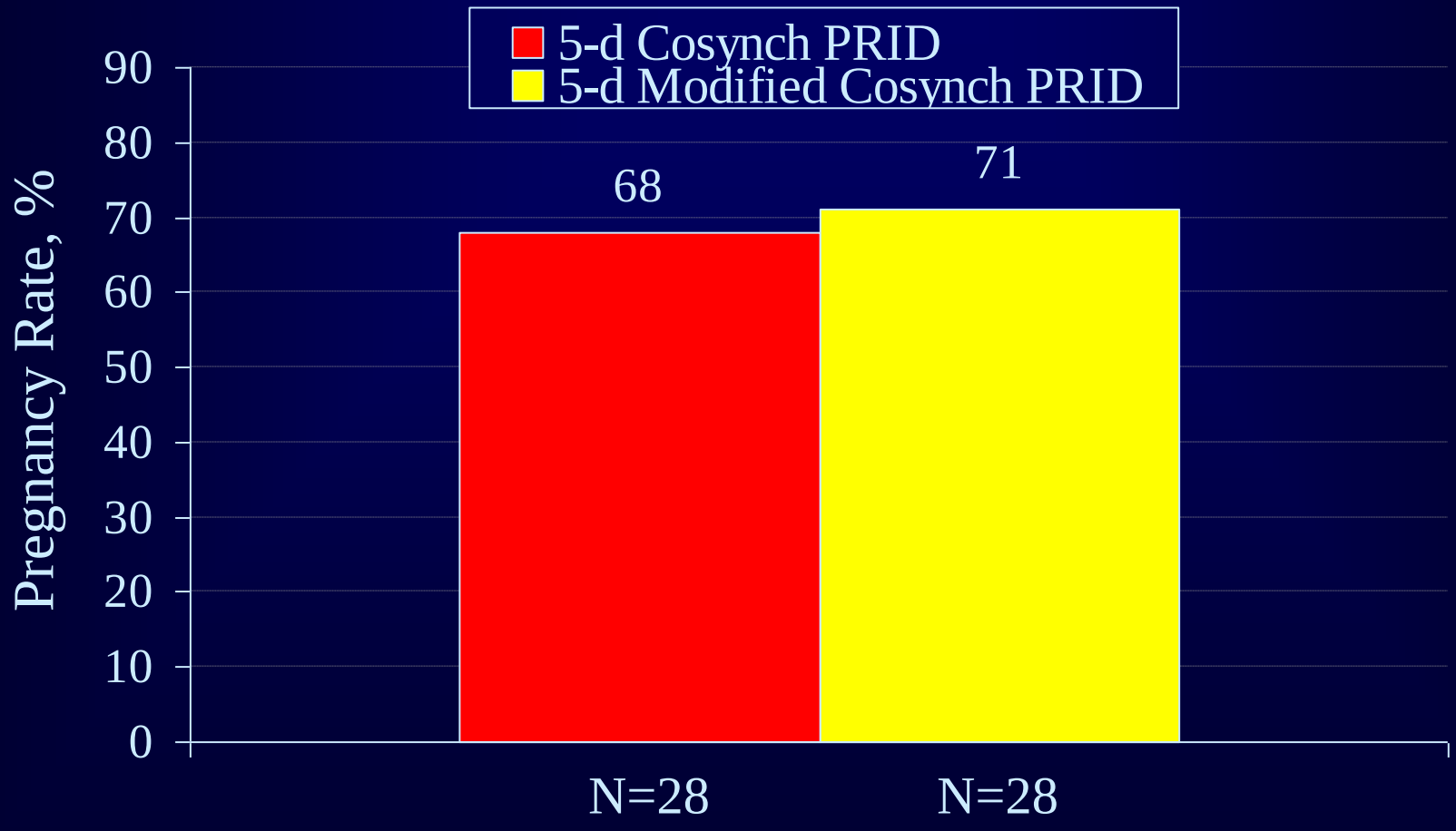
Colazo and Ambrose, 2011

Experimental Design – 5-d Modified Cosynch



Colazo and Ambrose, 2011

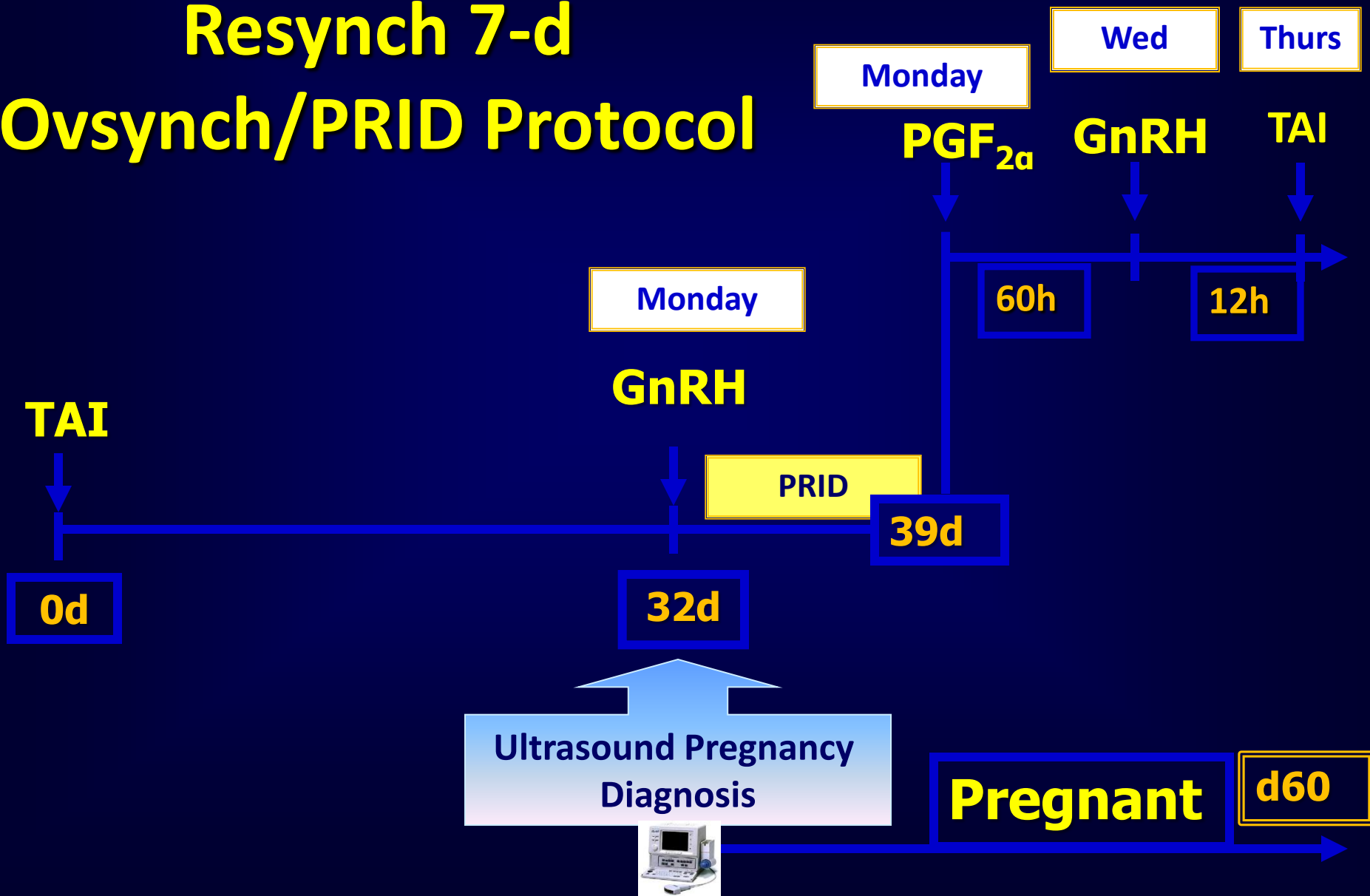
TAI Pregnancy Rate 28 d



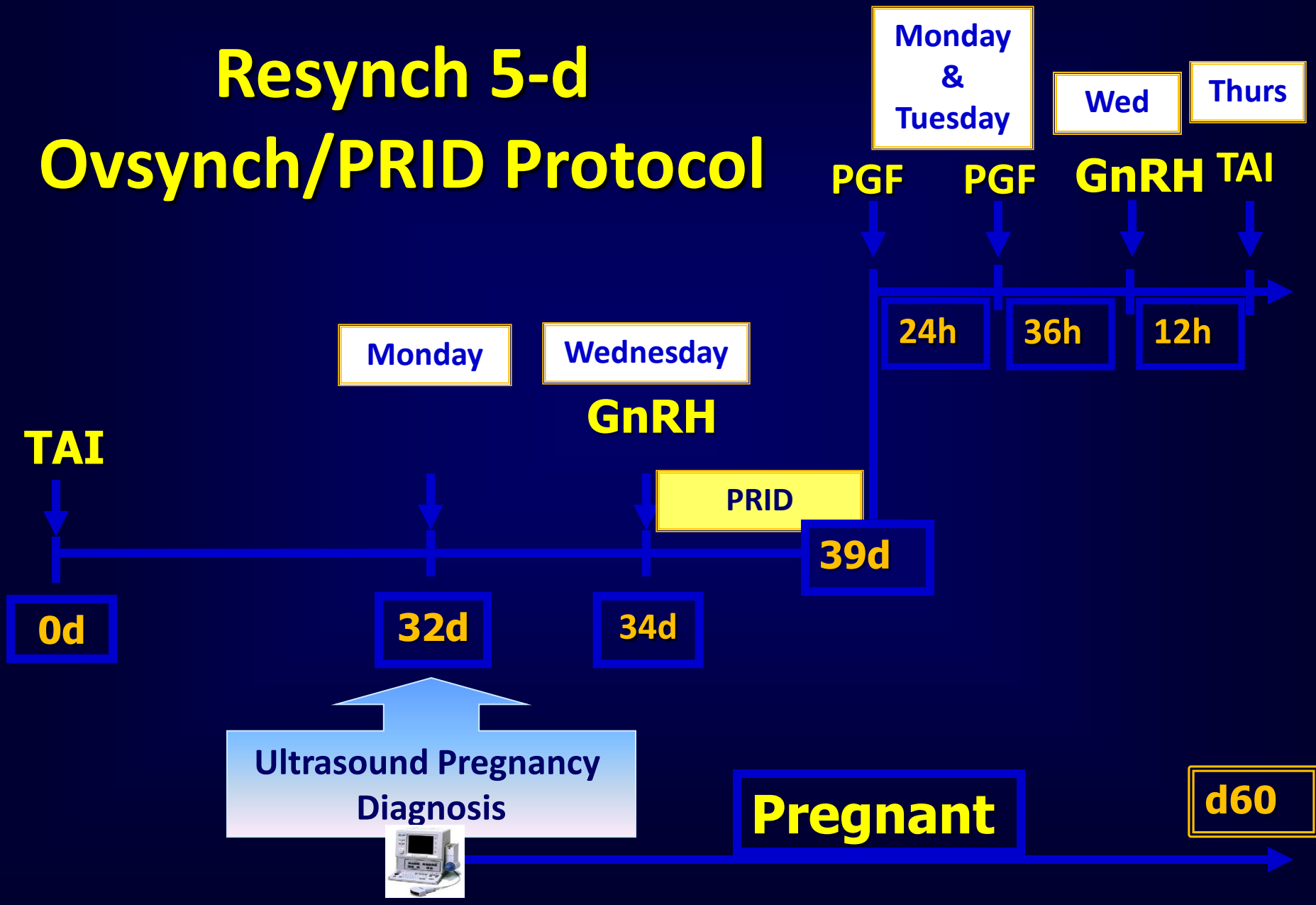
Trt, P >0.05

Colazo and Ambrose, 2011

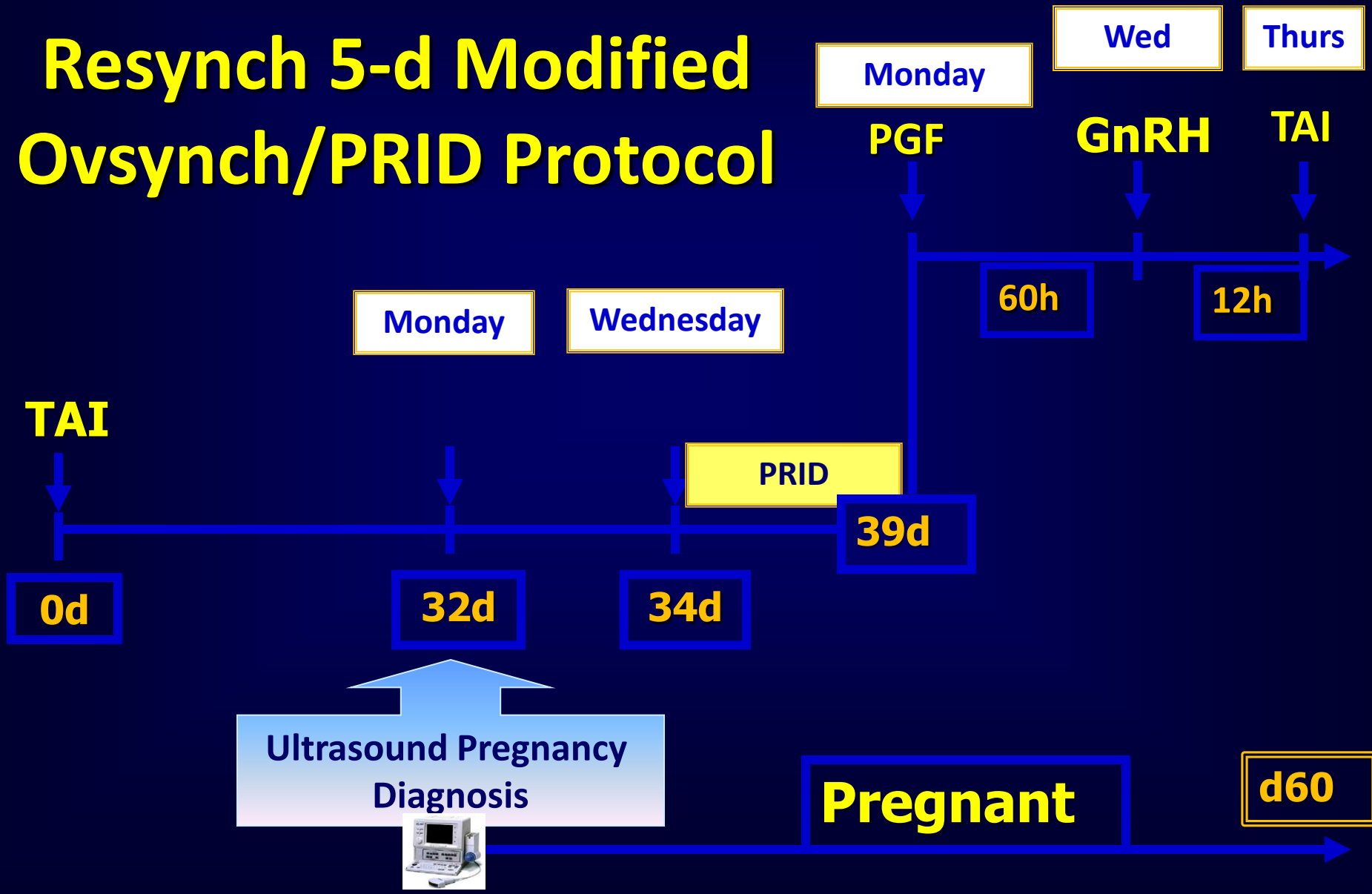
Resynch 7-d Ovsynch/PRID Protocol



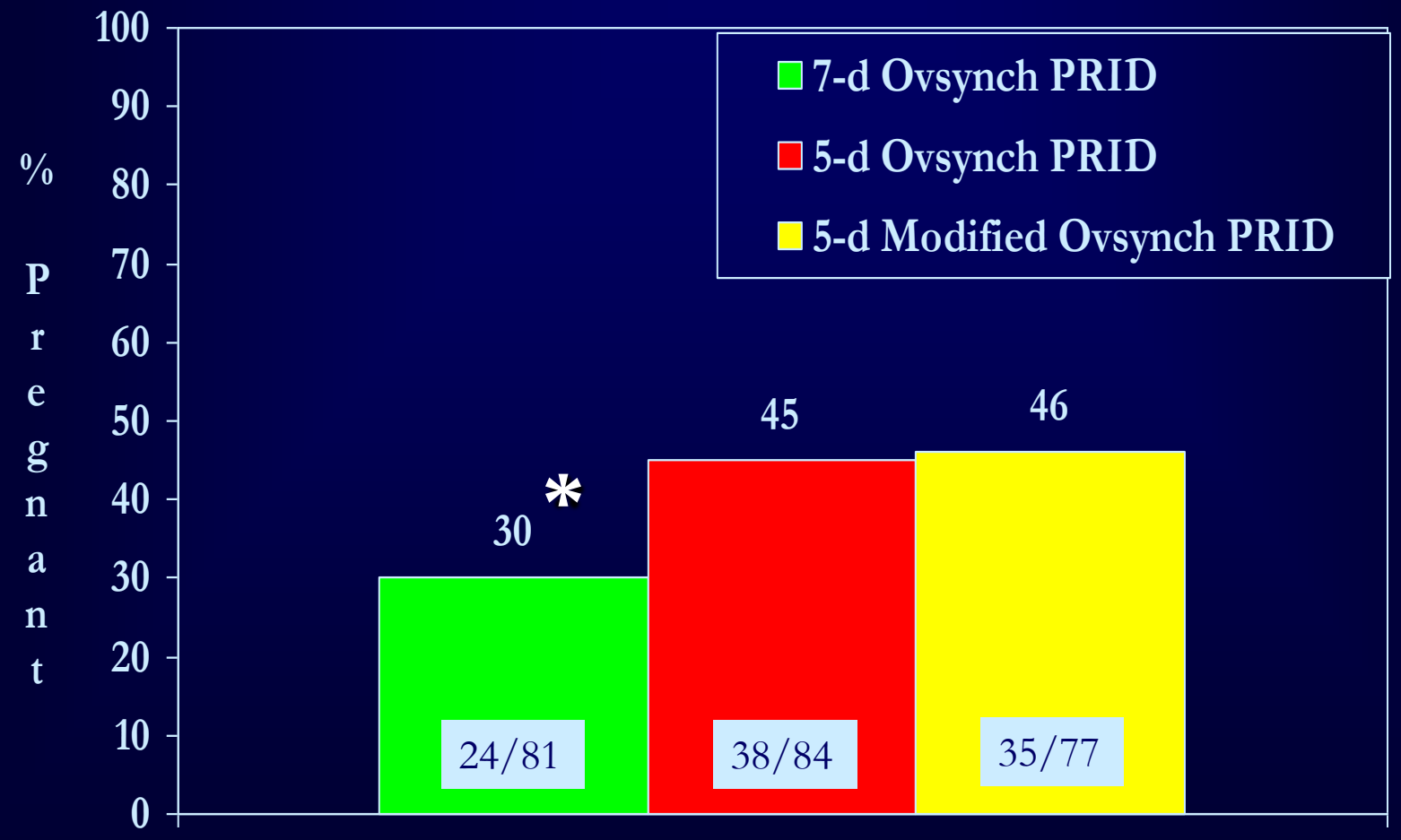
Resynch 5-d Ovsynch/PRID Protocol



Resynch 5-d Modified Ovsynch/PRID Protocol



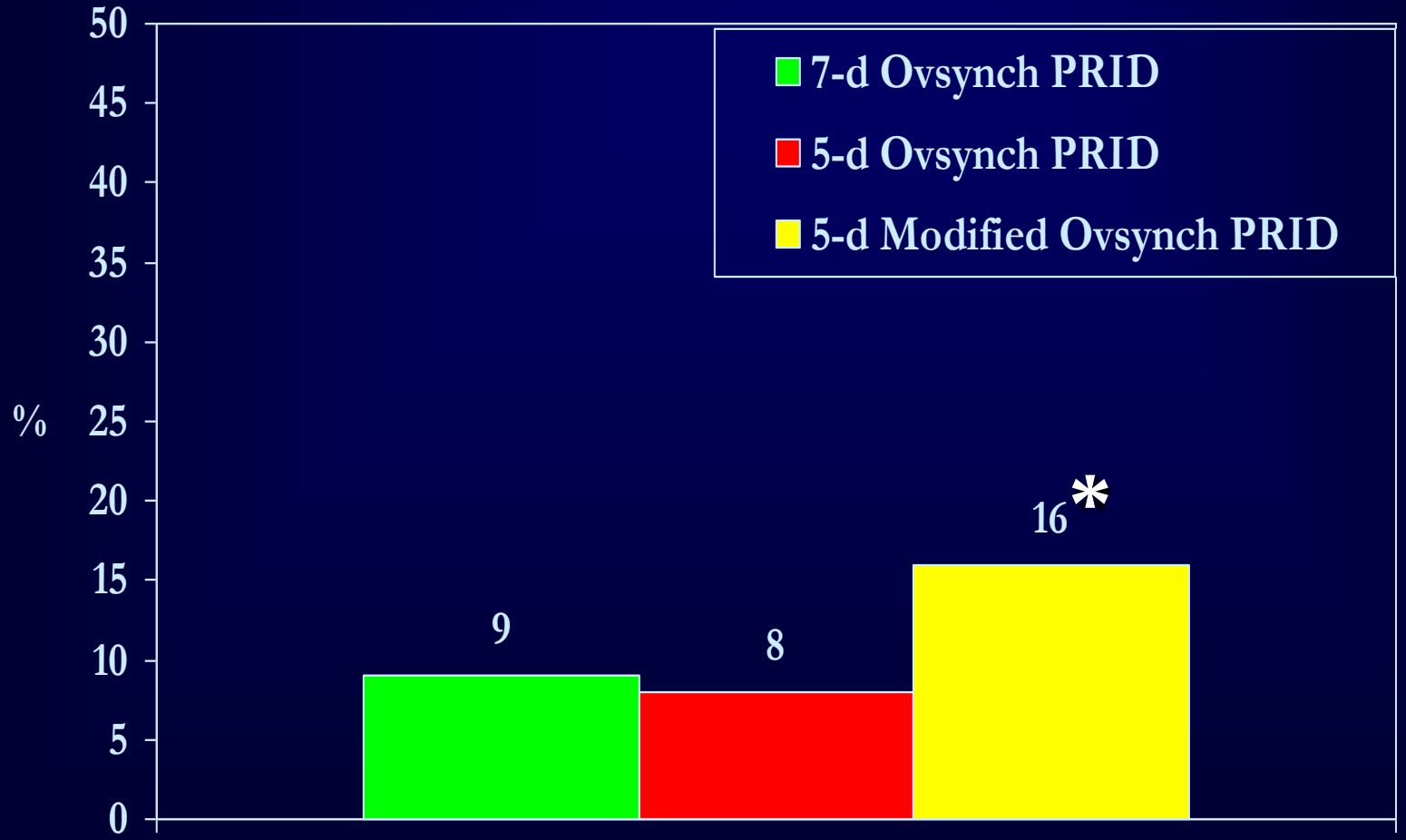
Resynch Pregnancy Rate 32 d



Trt, P <0.05

Colazo unpublished

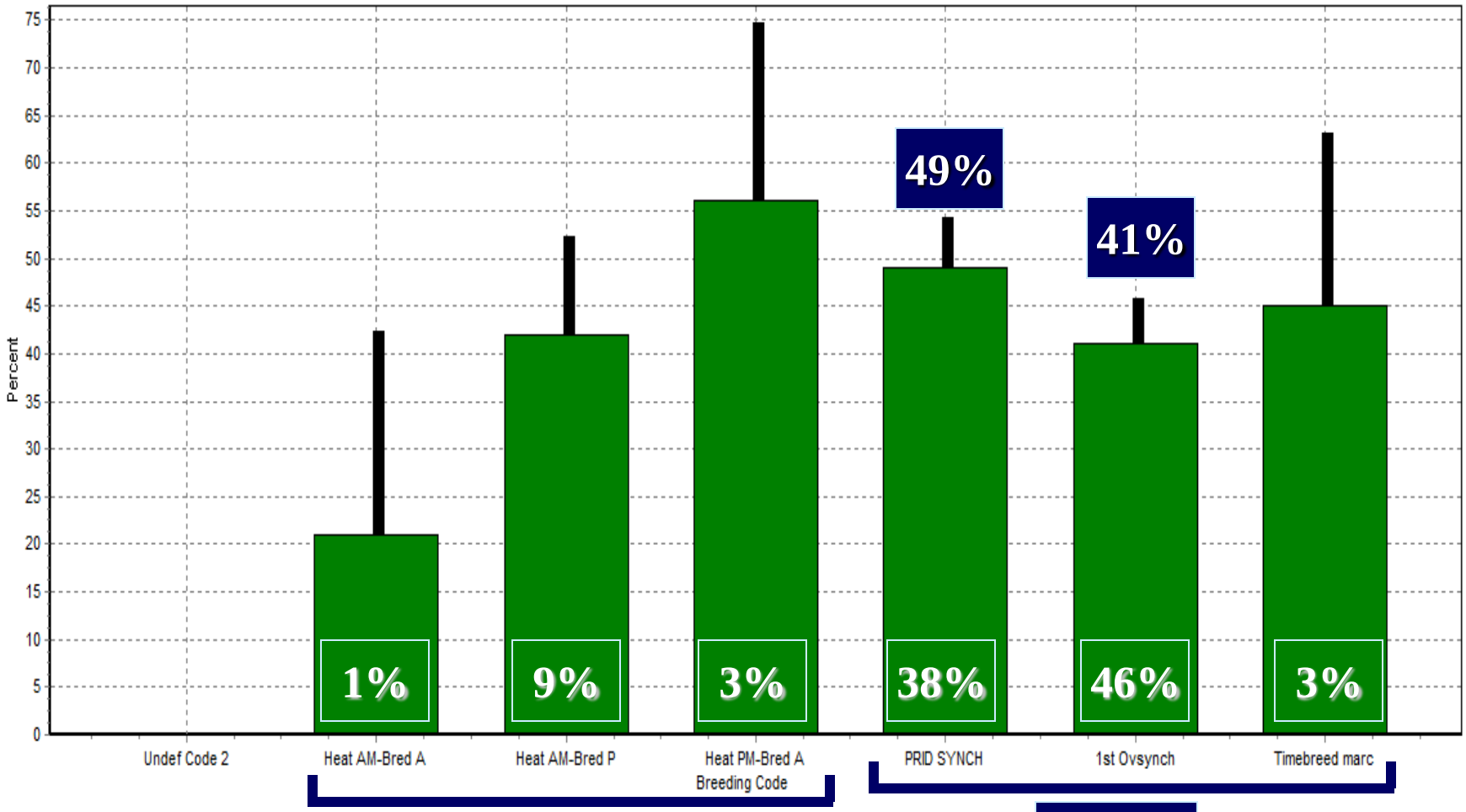
Pregnancy loss between 32 and 60 d



Trt, P <0.1

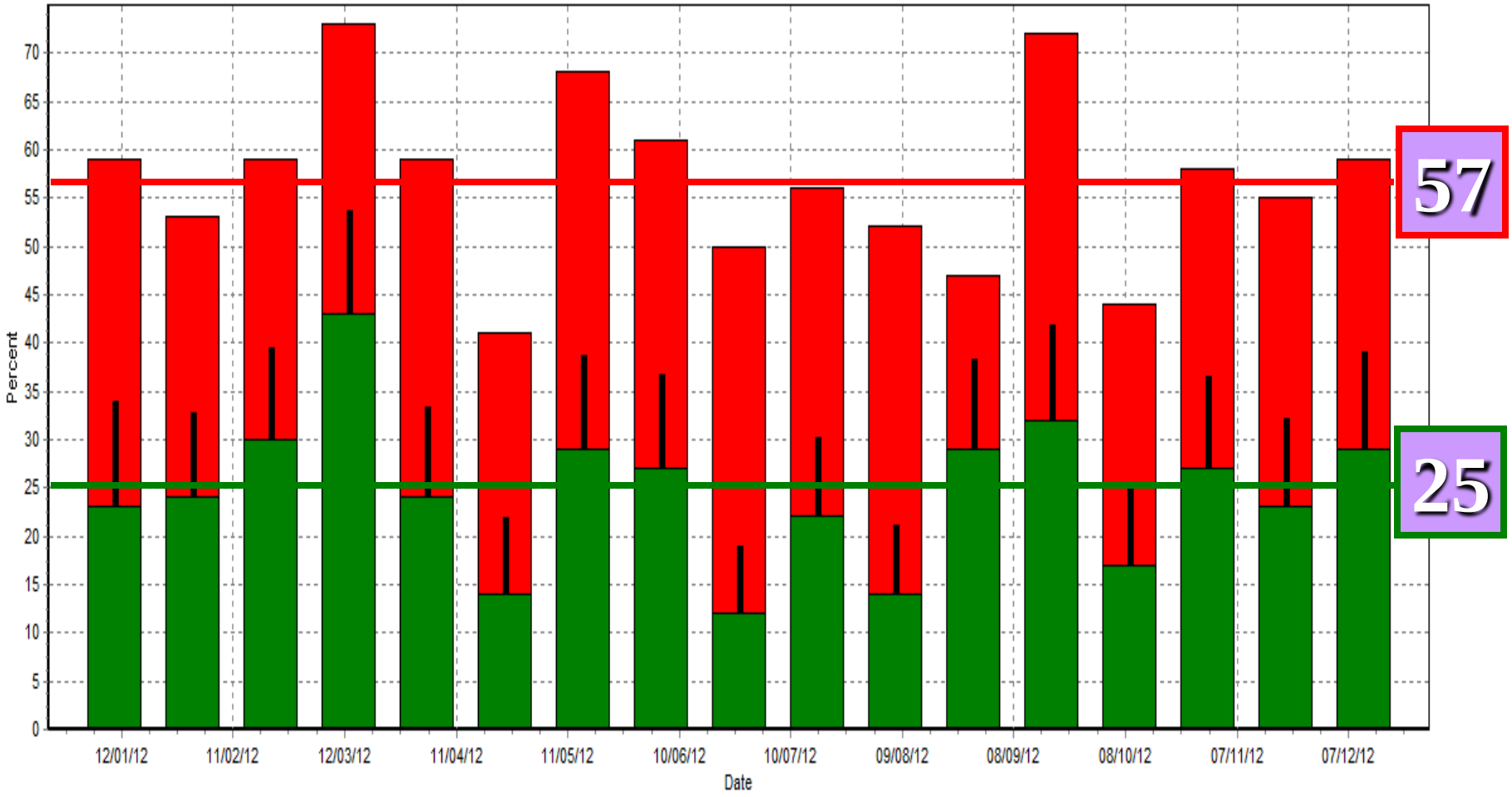
Colazo unpublished

Conception rates (957 AI - 2012)



Wetaskiwin, AB
475 Lac cows
11460 kg

21 d Insemination and Pregnancy risk (2012)

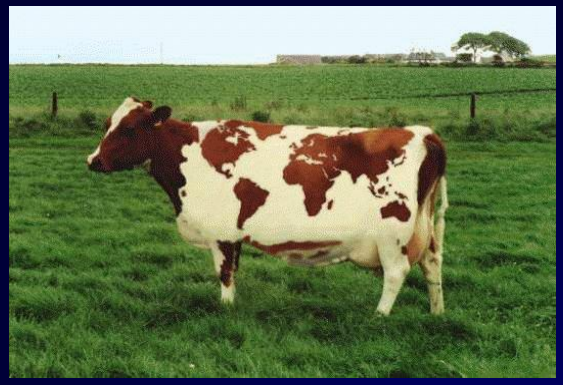


SUMMARY

- Estrus synchronization is a management tool that can help to overcome problems associated with estrus detection
- Treatments that synchronize estrus and ovulation improve the efficiency of timed-AI programs
  - Eliminating the need for estrus detection
  - Improving overall pregnancy rates by increasing the number of animals inseminated
- Both estradiol and GnRH are efficacious in timed-AI protocols, specially if combined with a progestin device

SUMMARY (Cont'd)

- Presynchronization improves pregnancy rates to GnRH-based TAI protocols by increasing the number of animals ovulating to the first GnRH
- The 5-d protocol improves pregnancy rates in resynchronized cows and the initial GnRH is not essential to achieve acceptable pregnancy rates in heifers



THANK YOU !

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