

**AN OVERVIEW OF RECENT OUTCOMES ASSOCIATING  
TIME TO INCREASE IN PREGNANCY SPECIFIC  
PROTEIN B IN MATERNAL CIRCULATION WITH  
PREGNANCY FATE IN LACTATING DAIRY COWS**

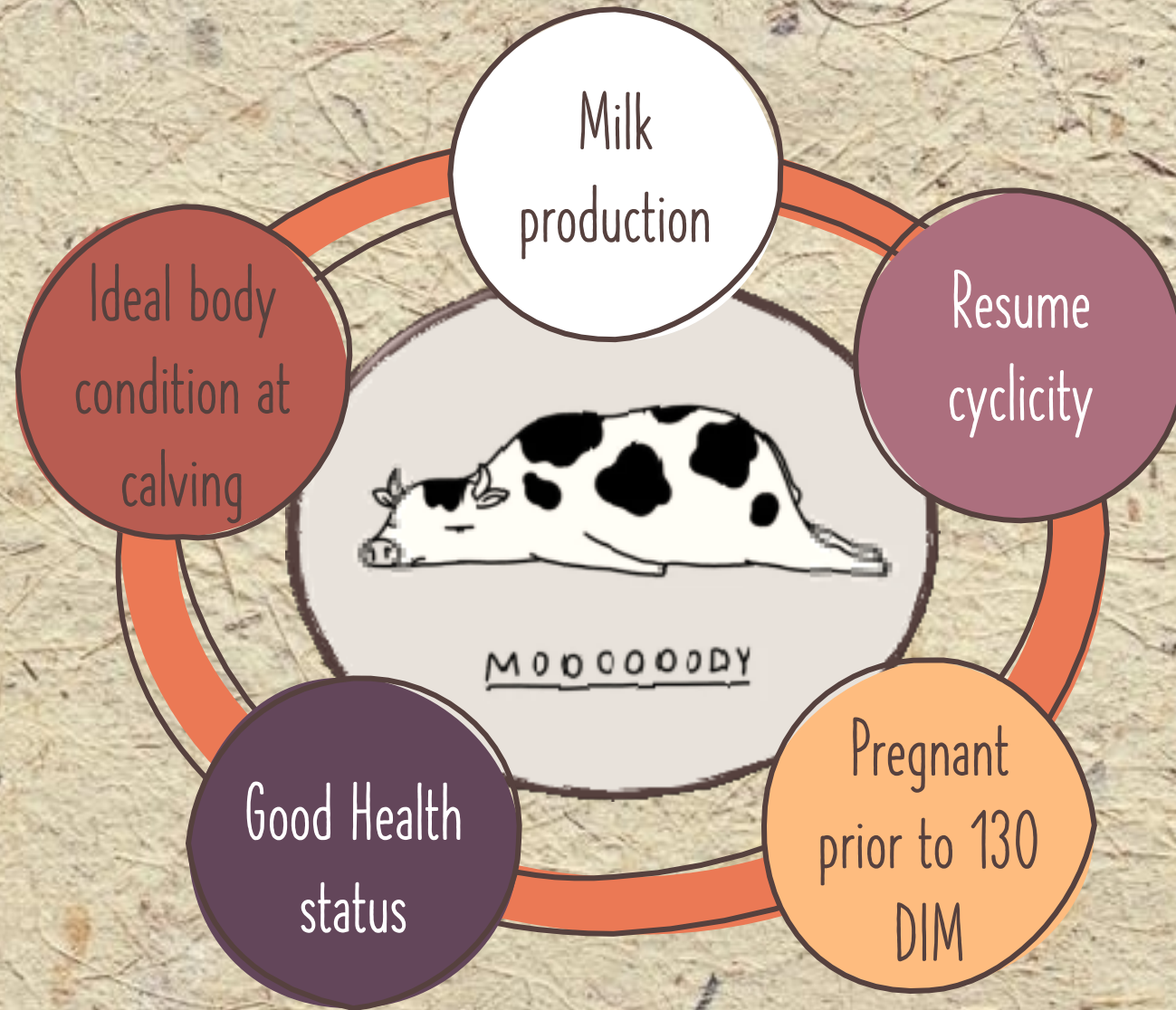
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*Thainá Minela, Alisson Santos and J. Richard Pursley*



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# THE HIGH PRODUCING LACTATING DAIRY COW



# COMMONLY UTILIZED STRATEGIES FOR FIRST SERVICE

## FERTILITY PROGRAMS

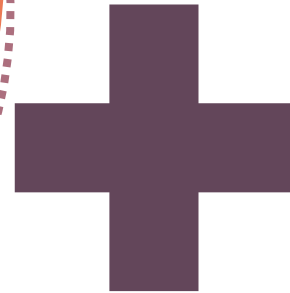
Service rate **100%**

Pregnancies/AI **45-60%**

Days to conception **~75 DIM**

Interval between services **~40 d**

DOUBLE-OVSYNCH,  
PRESYNCH-11



## ESTRUS DETECTION

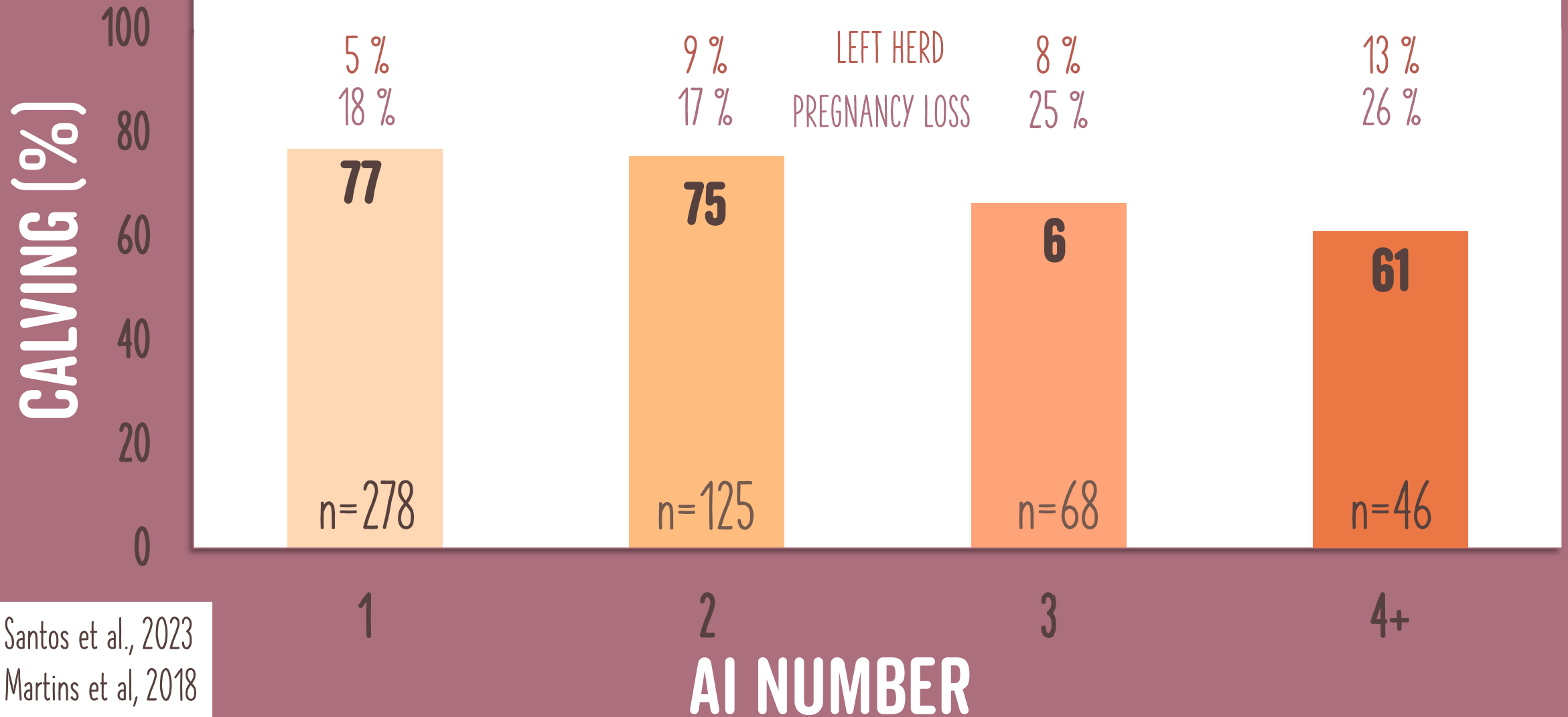
Service rate **~70%**

Pregnancies/AI **25-35%**

Days to conception **~70 DIM**

Interval between services **~22 d**

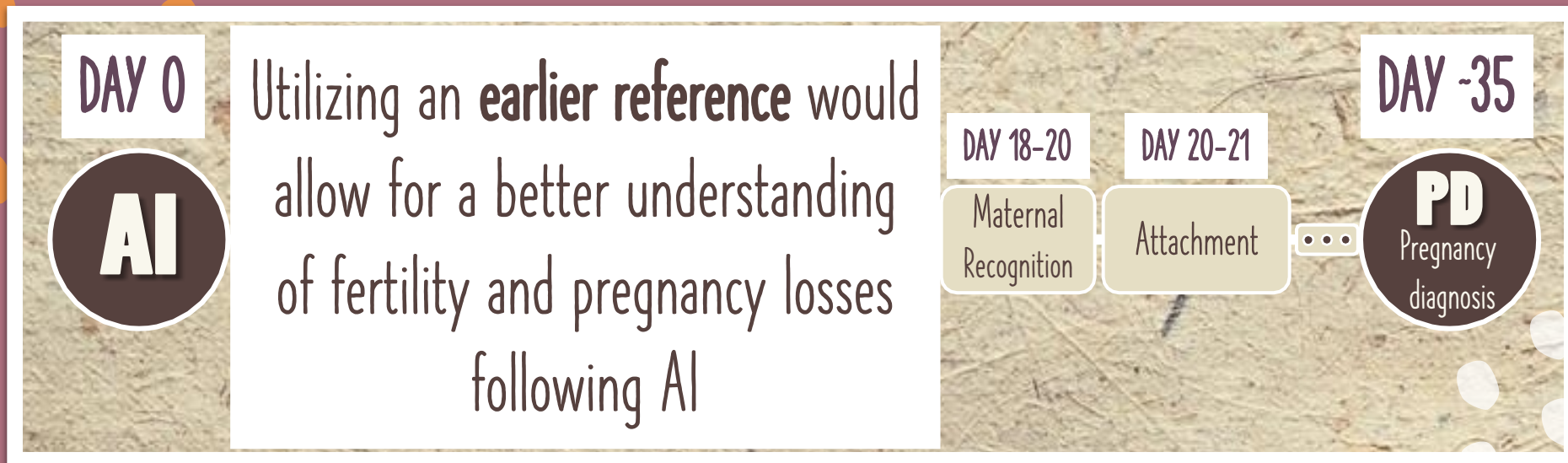
# CALVING RATES OF LACTATING DAIRY COWS FOLLOWING FERTILITY PROGRAMS



Santos et al., 2023  
Martins et al., 2018

# REFERENCE DIAGNOSIS TO MEASURE FERTILITY AND PREGNANCY LOSSES FOLLOWING AI OF DAIRY CATTLE

Most data since mid- to late 1930's



# Pivotal periods for pregnancy loss during the first trimester of gestation in lactating dairy cows

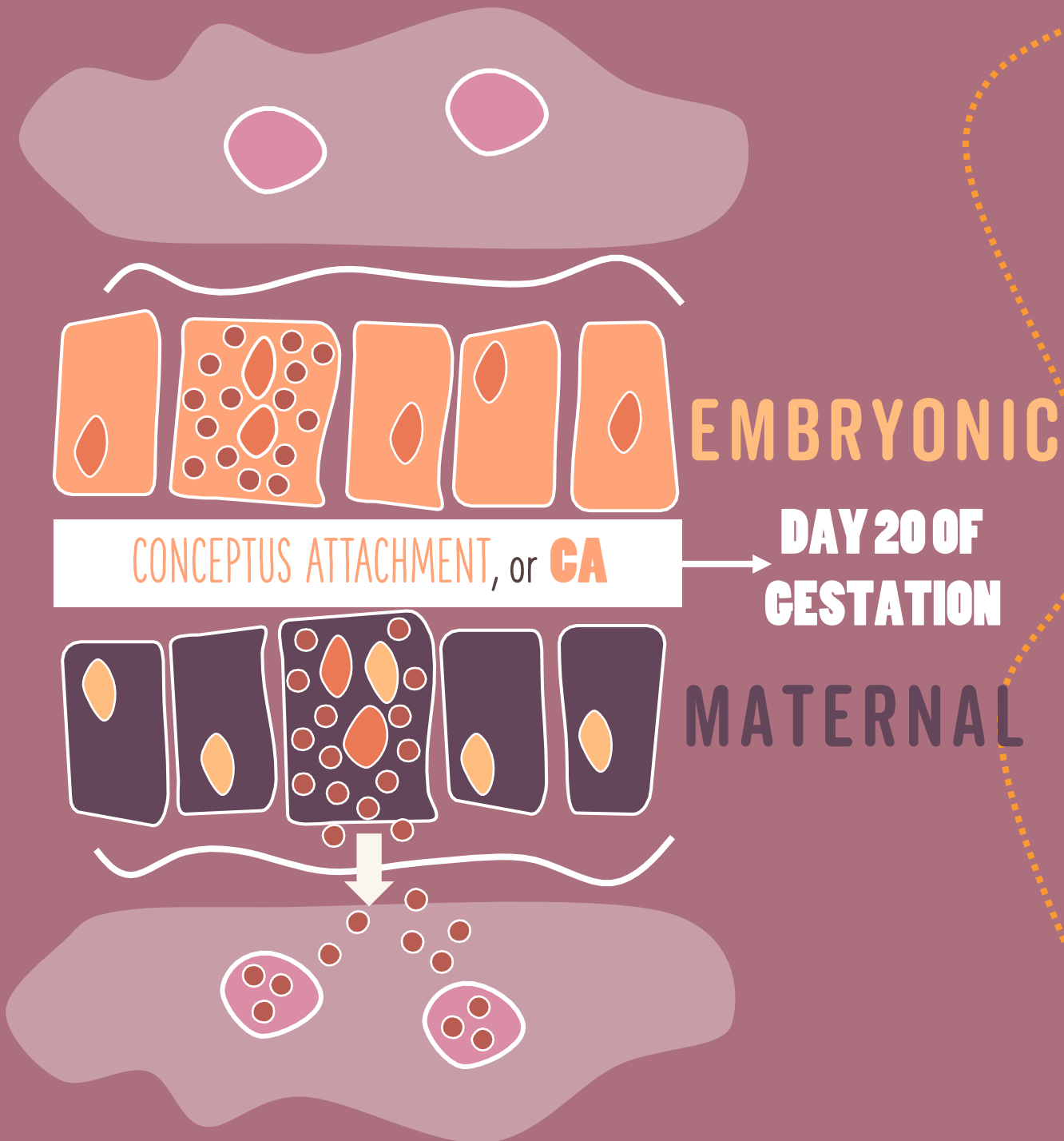
Milo C. Wiltbank<sup>a,\*</sup>, Giovanni M. Baez<sup>a</sup>, Alvaro Garcia-Guerra<sup>a</sup>, Mateus Z. Toledo<sup>a</sup>, Pedro L.J. Monteiro<sup>a,b</sup>, Leonardo F. Melo<sup>a,b</sup>, Julian C. Ochoa<sup>a</sup>, José E.P. Santos<sup>c</sup>, Roberto Sartori<sup>a,b</sup>

Cited  
**367** times

PIVOTAL PERIOD	ESTIMATED % FAILURE
Period 2 - <u>Day 8 to 28</u>	



- No established *in vitro* models post-hatching
- No method to assess elongation without terminating pregnancy
- Interferon-stimulated genes
- **PREGNANCY ASSOCIATED GLYCOPROTEINS (PAGs)**



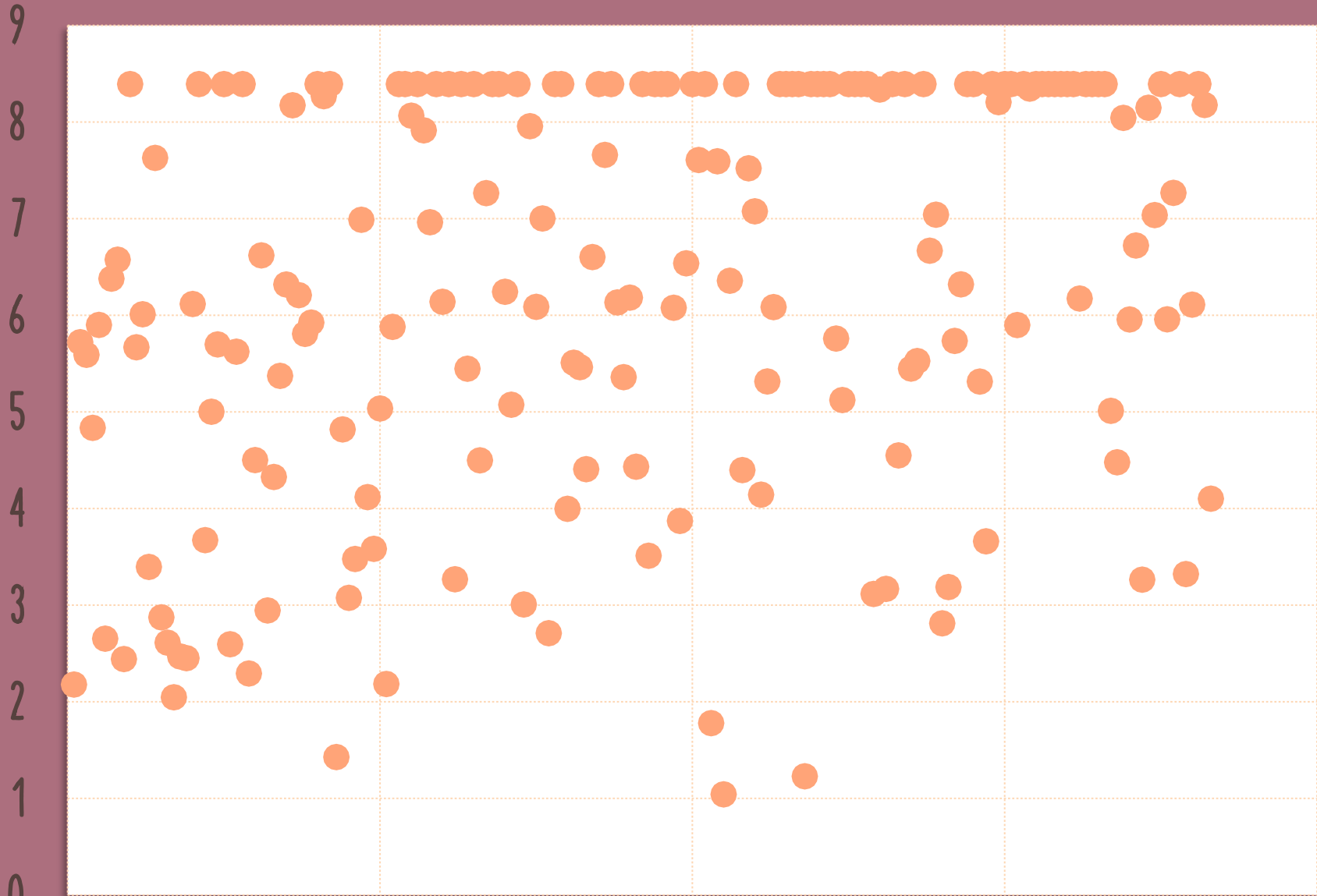
20% of trophoblast cells are trophoblast giant cells (TGC)

Cytoplasmic granules:  
Pregnancy Associated Glycoproteins (PAGs)  
or pregnancy specific protein B (PSPB)

TGC have migratory behavior and can fuse with endometrium cells, forming trinucleate cells

After fusing, the granules are released and reach the maternal circulation

**CONCENTRATIONS PSPB D 24 POST-AI**



**183 PREGNANT COWS AT D 34 POST-AI**

**MPLES**

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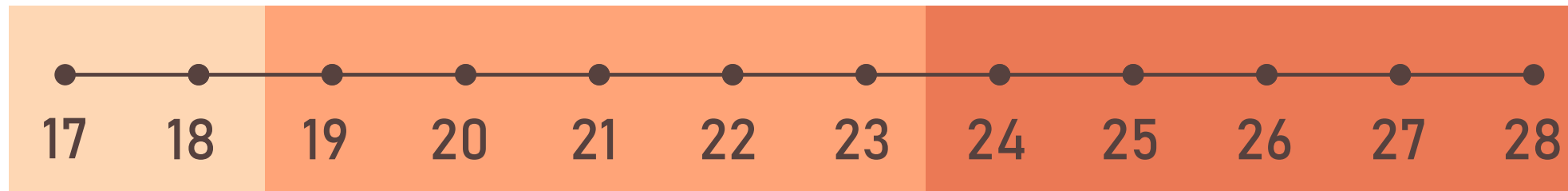
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# DETERMINATION OF INITIAL INCREASE IN PSPB OR CA

Daily serum PAG/PSPB after AI/ovulation



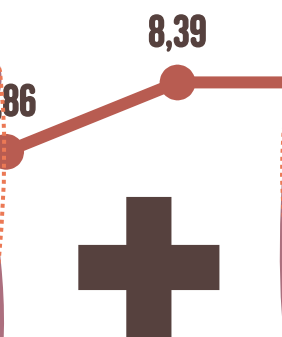
PRE-CA  
OR  
BASELINE

PERI-CA

POST-CA



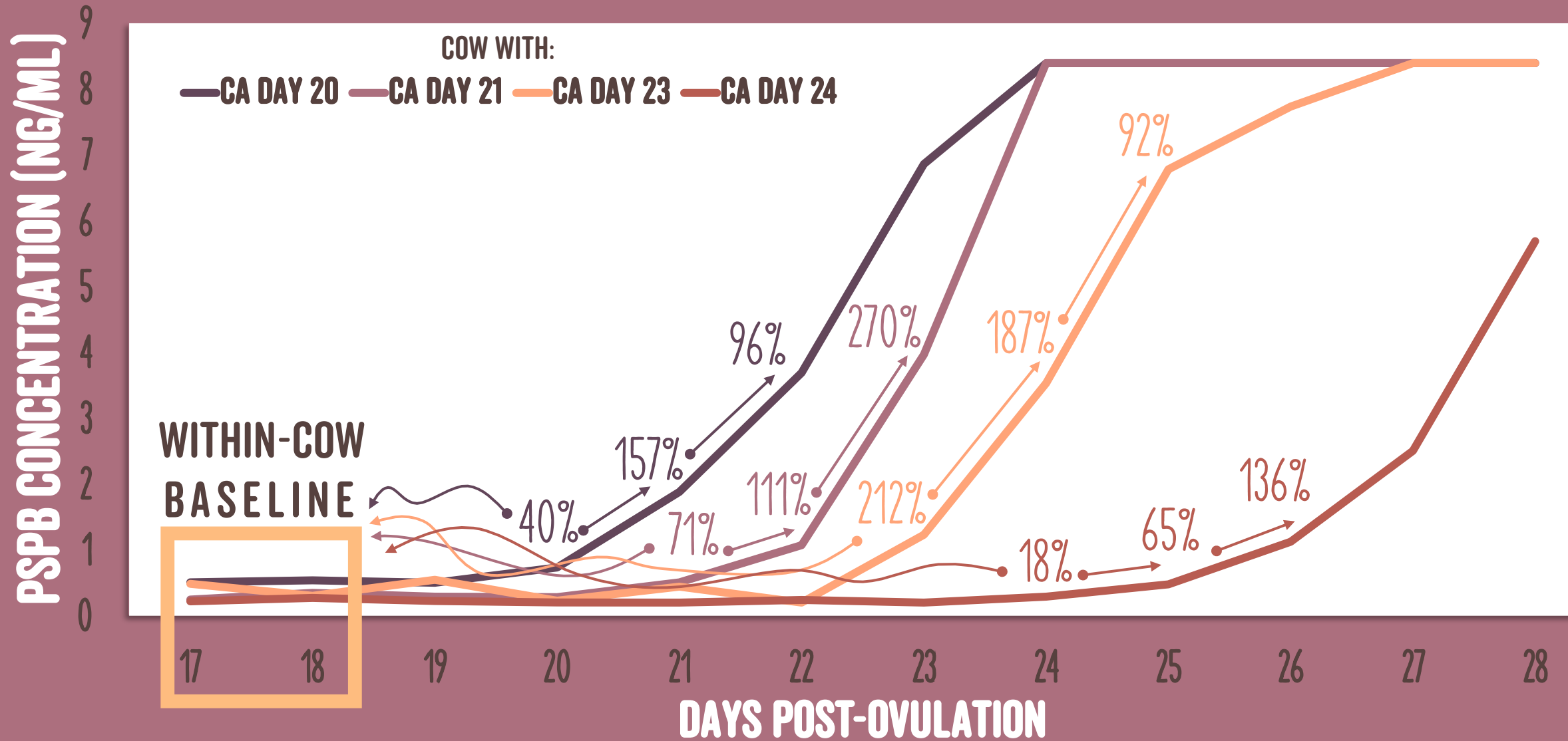
INCREASE OF  
 **$\geq 12.5\%$**   
FROM BASELINE



TWO MORE DAYS WITH  
 **$\geq 12.5\%$  INCREASE**  
FROM THE PREVIOUS DAY

SE 100% SP 75%

# DIFFERENTIAL TIME TO PSPB INCREASE OR CA



# DELAYED CA WAS ASSOCIATED WITH PARITY



Middleton et al. 2022

FERTILITY FOLLOWING ESTRUS



**HEIFERS**  
**74% P/AI**

Pursley et al. 1997



**PRIMI.**  
**43% P/AI**

Minela et al. unpub.



**MULTI.**  
**30% P/AI**

Minela et al. unpub.

Our lab has finalized analyses of  $n = 3$  randomized controlled trials with daily PSPB concentrations  
Totaling  $n = 839$  lactating dairy cows

### STUDY 1 – A. SANTOS\*

$n = 368$  | 1<sup>st</sup> through 6<sup>th</sup> AI

Treatment with hCG on days  
2, 5, 2&5 post-ov, and  
control.

**OBJECTIVE WAS TO MODULATE  
PROGESTERONE MILIEU  
DURING EARLY EMBRYONIC  
DEVELOPMENT**

### STUDY 2 – T. MINELA

$n = 362$  | 1<sup>st</sup> through 7<sup>th</sup> AI

Treatment with GnRH on  
days 18+25+32, 25+32, and  
32 post-AI.

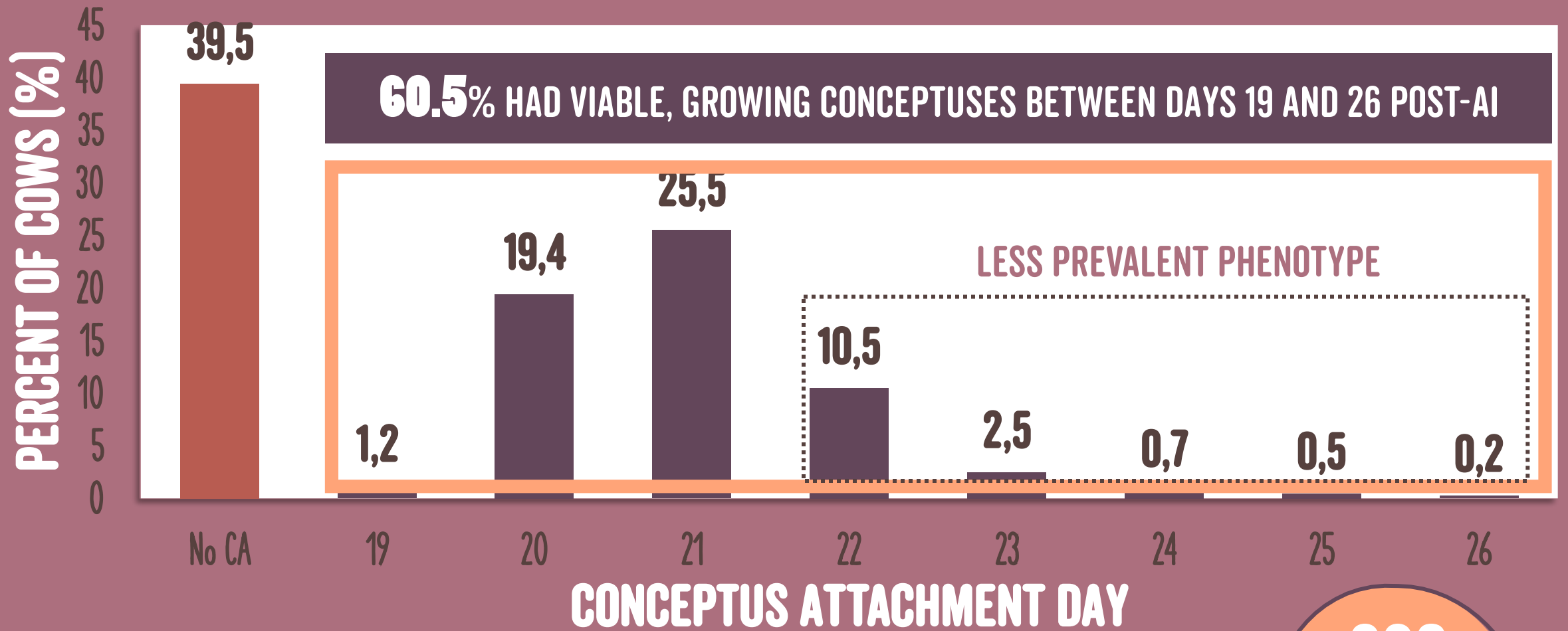
**OBJECTIVE WAS TO INDUCE  
ACCESSORY CL AROUND CA TO  
RESCUE PREGNANCIES**

### STUDY 3 – T. MINELA

$n = 109$  | 1<sup>st</sup> AI only

Treatments were: AI  
following estrus detection or  
Double-Ovsynch.

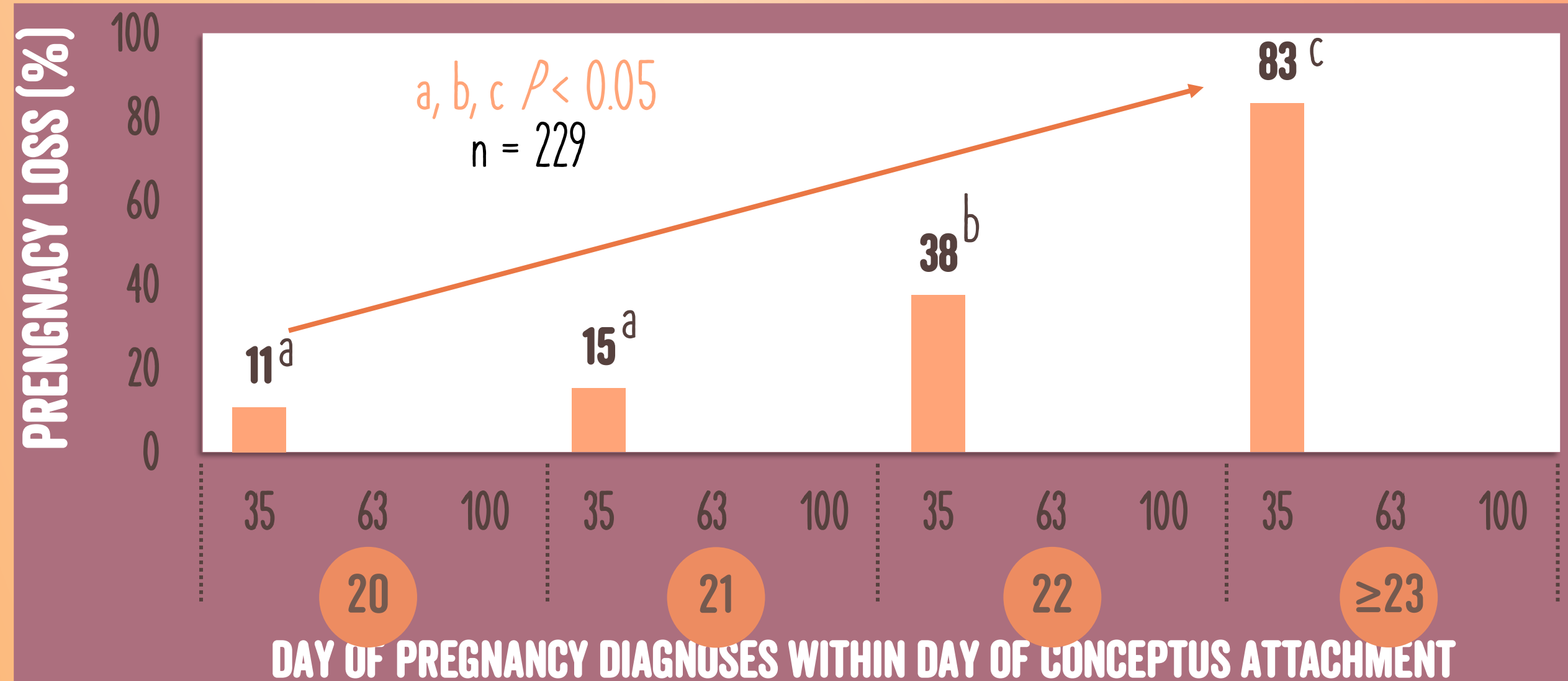
**OBJECTIVE WAS TO  
DETERMINE DIFFERENCES IN  
EARLY PREGNANCY (CA)  
BETWEEN THESE STRATEGIES**



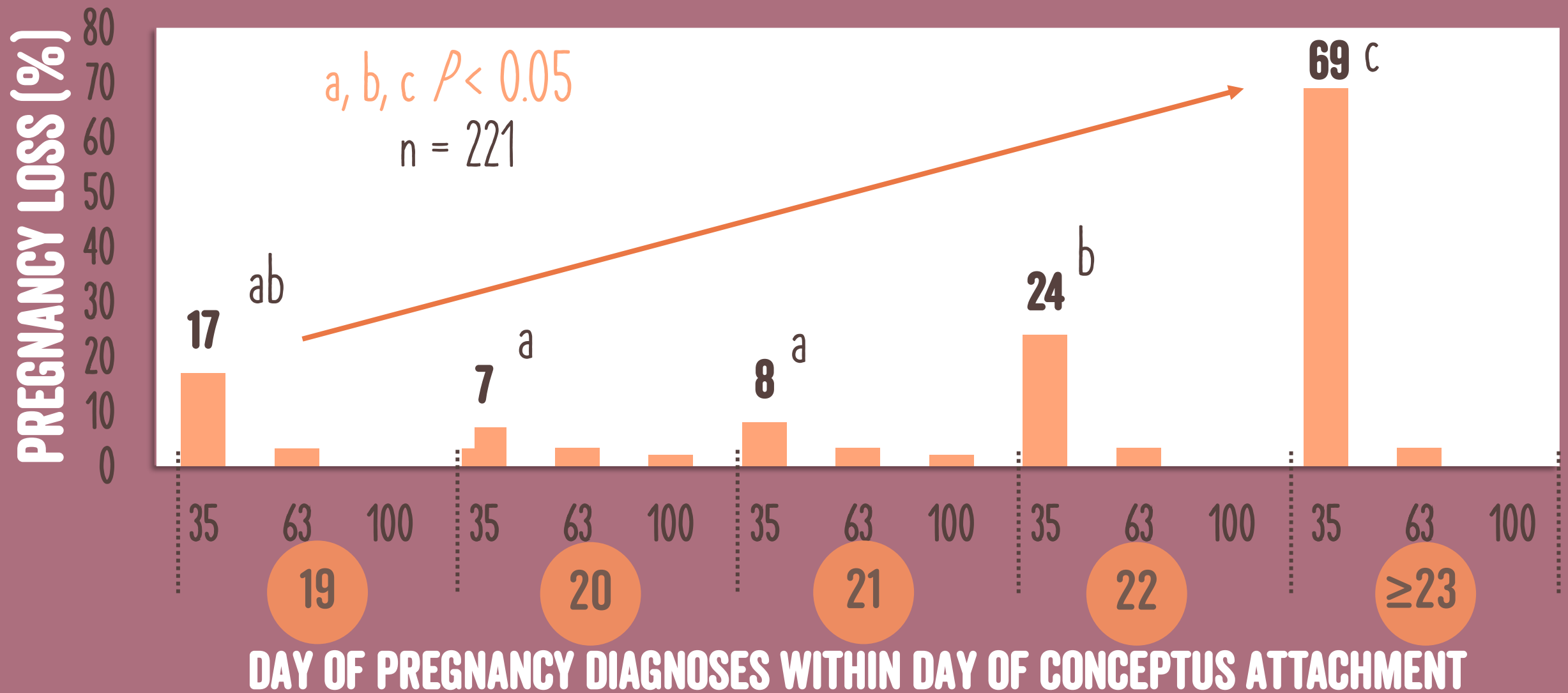
**OUTCOMES FROM 3 STUDIES – ALL SERVICES**

- STUDY 1: hCG treatment early post-AI. n = 368
- STUDY 2: GnRH treatment late post-AI. n = 362
- STUDY 3: Estrus detection vs. Double-Ovsynch. n = 109

# DELAYED CA IS ASSOCIATED WITH GREATER LOSSES BEFORE FIRST PREGNANCY DIAGNOSIS – STUDY 1, ALL SERVICES



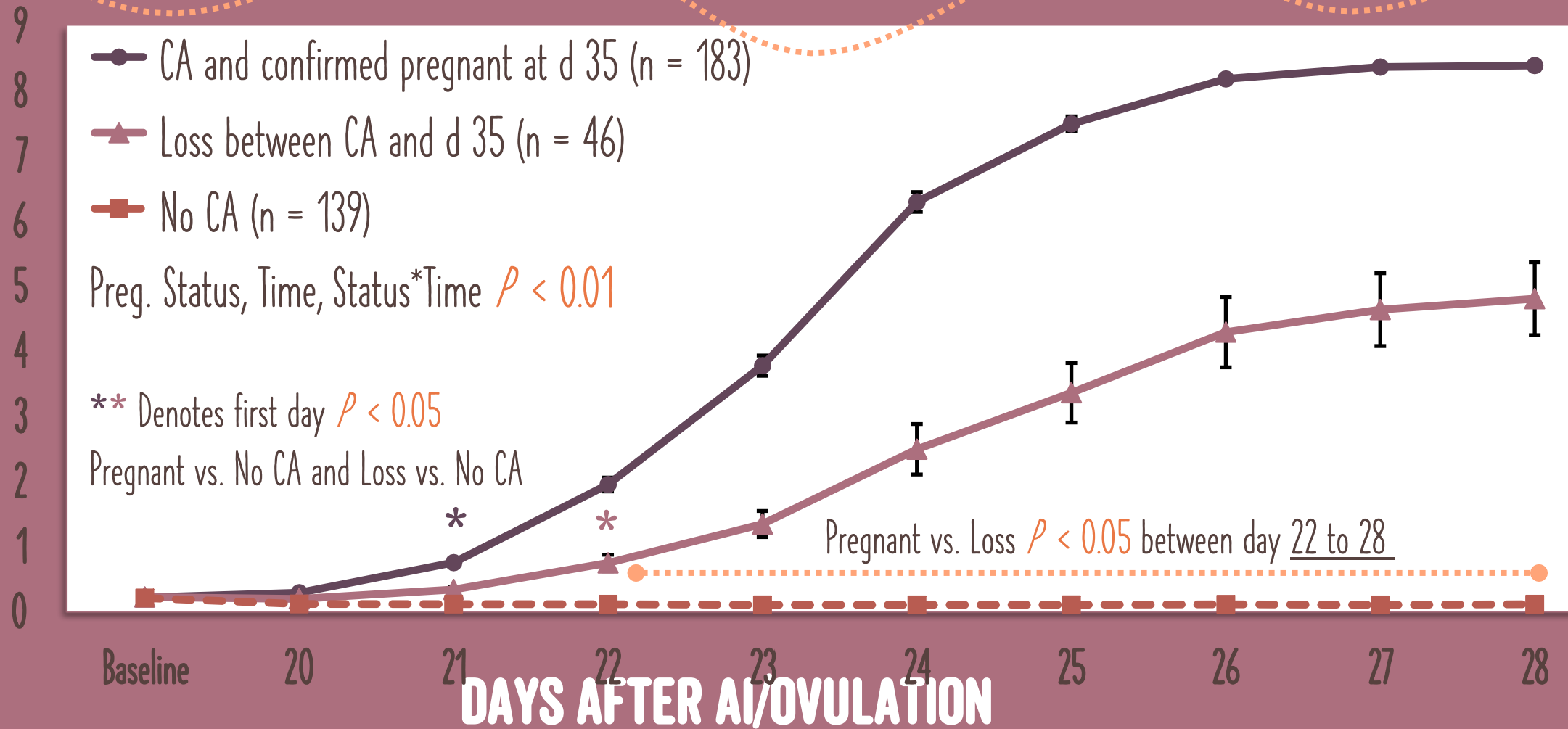
# DELAYED CA IS ASSOCIATED WITH GREATER LOSSES BEFORE FIRST PREGNANCY DIAGNOSIS – STUDY 2, ALL SERVICES



# SECRETION OF PSPB IS COMPROMISED IN NON-SUSTAINED PREGNANCIES

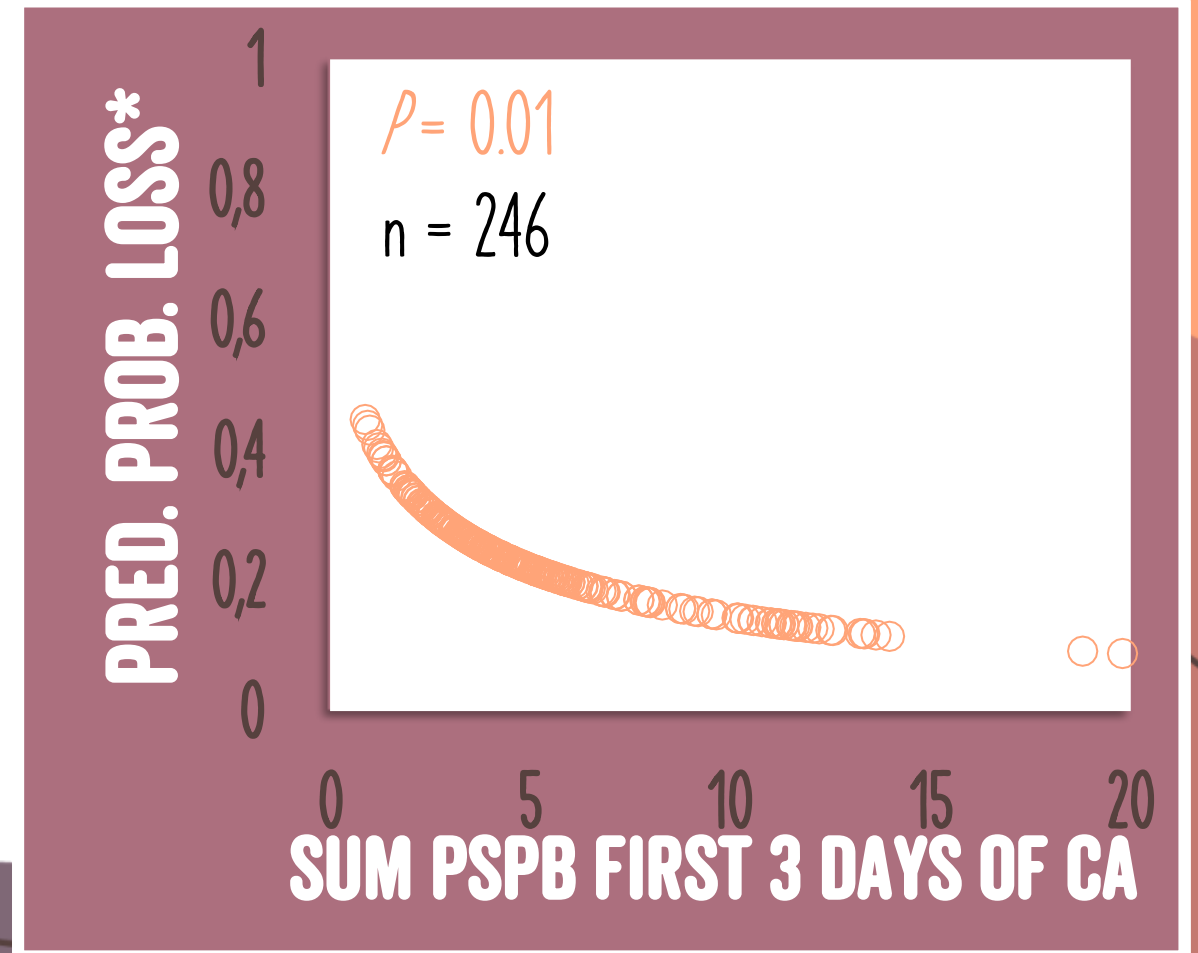
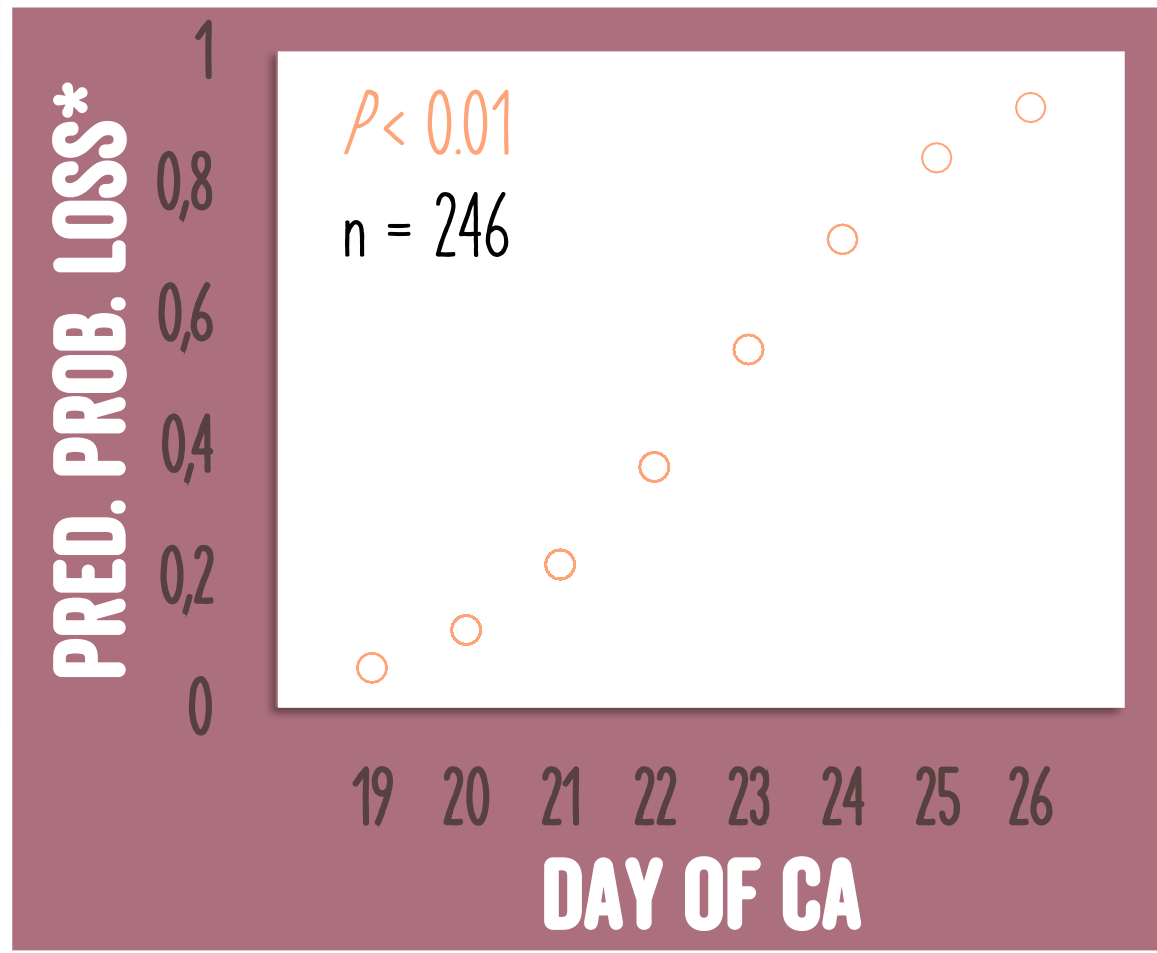
## STUDY 1, ALL SERVICES

SERUM PSPB (NG/ML)



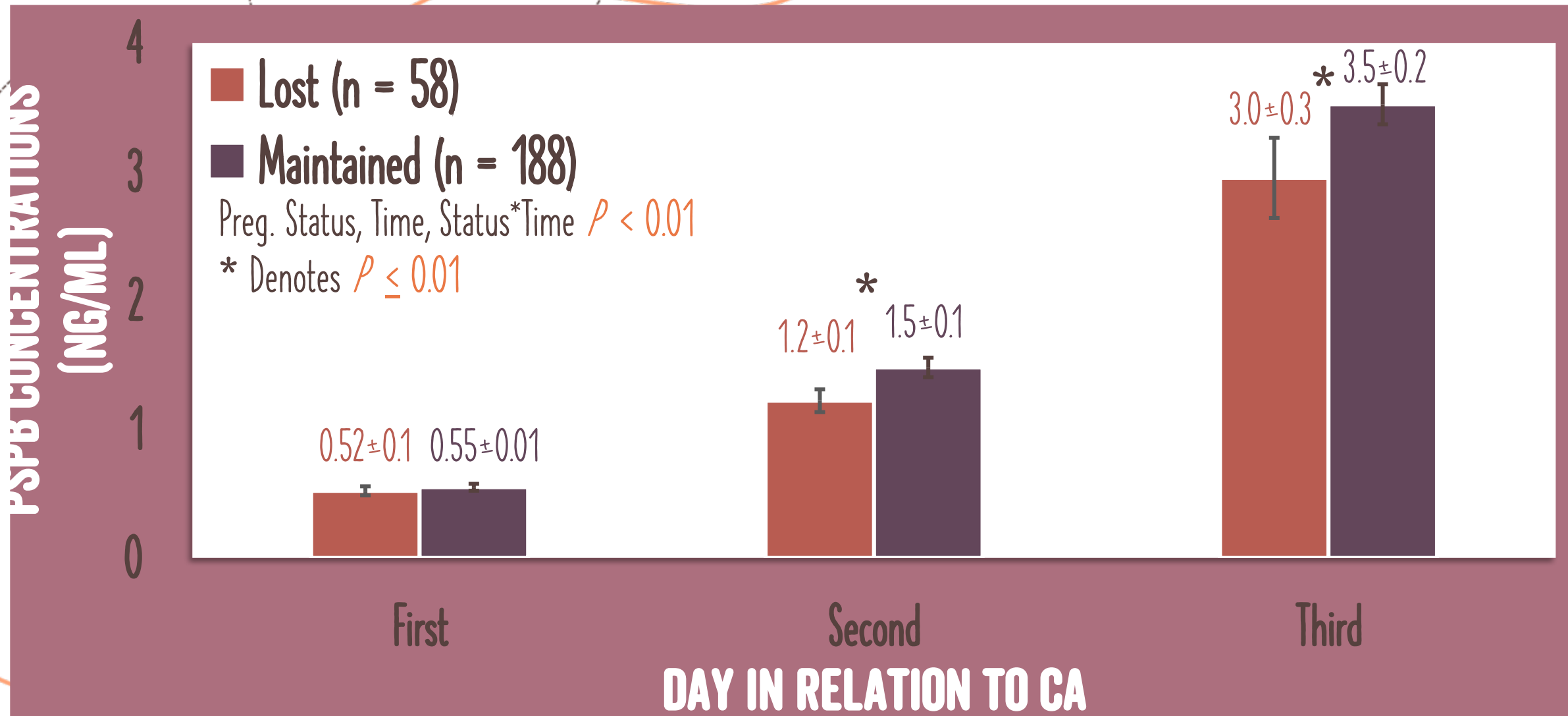
# COWS SYNCHRONIZED WITH DOUBLE-OVSYNCH FOR FIRST SERVICE

## STUDIES 1, 2 AND 3



\*MODELED FOR LOSSES OCCURRING BETWEEN CA AND DAY 63 POST-AI.

# CONCEPTUSES OF UNSUCCESSFUL PREGNANCIES HAD DIMINISHED PSPB SECRETION AS SOON AS THE SECOND DAY FOLLOWING CA.



Cows synchronized with Double-Ovsynch for first service. Modeled for losses occurring between CA and day 63 post-AI. Studies 1, 2 and 3.

PRIMIPAROUS HAVE **GREATER** PROPORTION OF CA, TENDED TO HAVE **FEWER LOSSES**, HAVE **EARLIER CA** AND CONCEPTUS SECRETE **GREATER PSPB**: THEY ARE MORE FERTILE!

PRIMIPAROUS

MULTIPAROUS

$\beta$ -value

Cows synchronized with Double-Ovsynch for first service. Modeled for losses occurring between CA and day 63 post-AI. Studies 1, 2 and 3.



# MAIN TAKEAWAY

**CONCEPTUSES OF NON-SUSTAINED PREGNANCIES HAVE  
DELAYED AND DIMINISHED PSPB SECRETION**

**IT IS UNCLEAR IF THE DECREASED PREGNANCY SURVIVAL IS  
DUE TO THIS DISFUNCTION IN PSPB SECRETION BY THE  
CONCEPTUS OR JUST AN ARTIFACT OF AN UNDERDEVELOPED  
CONCEPTUS FATED TO FAILURE.**



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