



# **Age at First Calving Affected Reproductive Performance of Primiparous Cows Managed with a Program that Favored Insemination at Detected Estrus or Timed AI**

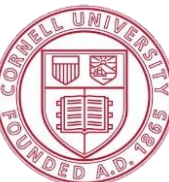
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**E. M. Sitko\*, M. M. Pérez, G. E. Granados, M. Masello, and J. O. Giordano**  
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University, Ithaca, NY

# Age at First Calving and Profitability

Age at first calving (AFC) impacts **profitability** of dairy herds

- **Direct cost of rearing heifers** (Tozer and Heinrichs, 2001)
- **Indirect cost of subsequent performance**
  - Milk production per day of herd life (Van Amburgh et al., 1998; Hoffman et al., 1996; Ettema and Santos, 2004)
  - Fertility (Ettema and Santos, 2004)
  - Calving performance (Hoffman et al., 1996; Ettema and Santos, 2004)



# Effect of AFC on Reproductive Performance of Primiparous Cows Managed with a Program that Favored Insemination at Detected Estrus or Timed AI

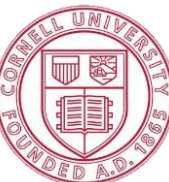
## Hypothesis

Age at first calving would affect the proportion of cows inseminated at detected estrus (AI<sub>E</sub>), pregnancy per AI (P/AI), time to pregnancy, proportion of cows pregnant during lactation, and herd exit dynamics

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## Research Objective

Evaluate the **association between AFC and reproductive performance and herd exit** of primiparous Holstein cows submitted to AI with a program that favored insemination at detected estrus or timed AI



# Effect of AFC on Reproductive Performance of Primiparous Cows Managed with a Program that Favored Insemination at Detected Estrus or Timed AI

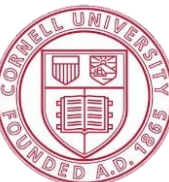
## Hypothesis

Age at first calving would affect the proportion of cows inseminated at detected estrus (AIE), pregnancy per AI (P/AI), time to pregnancy, proportion of cows pregnant during lactation, and herd exit dynamics

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## Research Objective

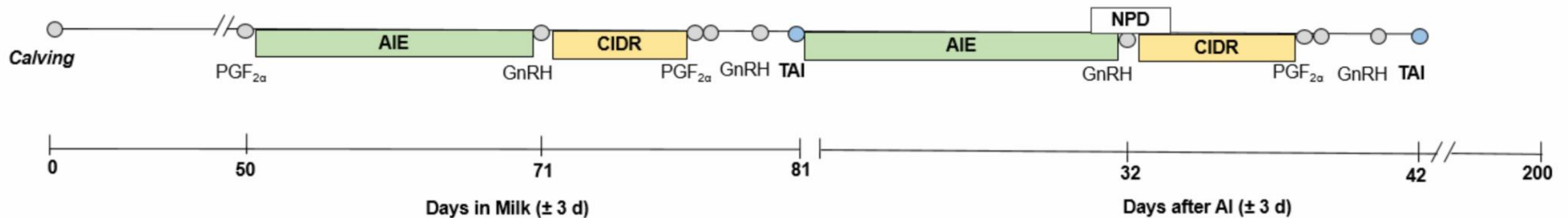
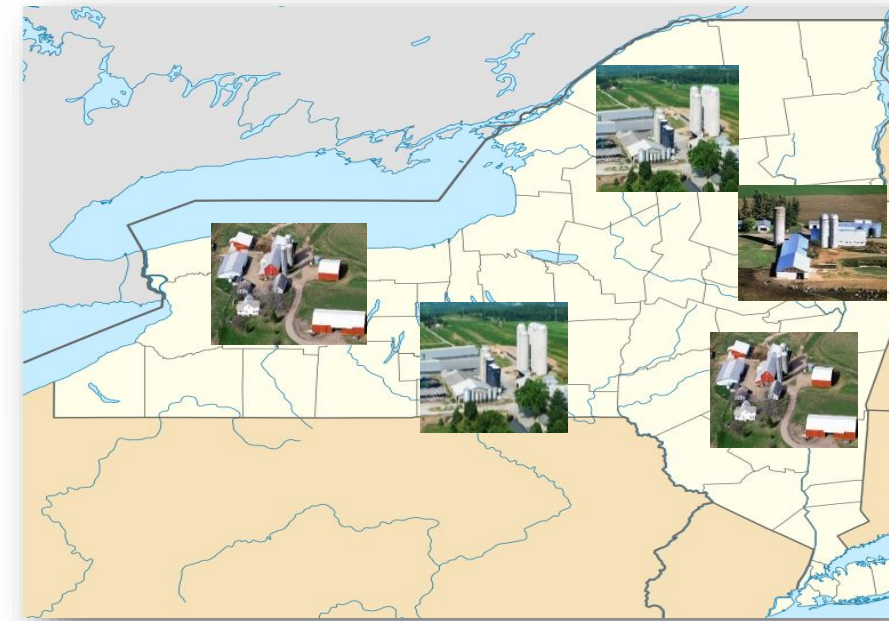
Evaluate the **association between AFC and reproductive performance and herd exit** of primiparous Holstein cows submitted to AI with a program that favored insemination at detected estrus or timed AI



# Research Design

## Retrospective Cohort Study

- ✓ Primiparous Holstein lactating dairy cows from 5 commercial farms in NY (n = 1,163)
- ✓ Cows retrospectively grouped by AFC tertiles within farm (n; mean; range):
  - Low (n= 373; 21.4; 20.3-22.4)**
  - Medium (n= 421; 22.1; 21.3-23.3)**
  - High (n= 369, 23.5; 21.9-29.7)**
- ✓ Reproductive Management: designed to inseminate as many cows **at detected estrus** as possible



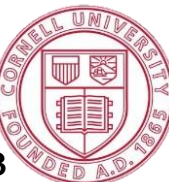
AIE= Insemination at detected estrus  
NPD = Nonpregnancy diagnosis

# Statistical Analysis



## Model Building:

- ✔ **Fixed effect:** Age at first calving group. **Random effect:** Farm
- ✔ *Confounders:* Daughter Pregnancy Rate (DPR) group (high, medium, low), milk production group (high, medium, low), season of insemination (cold vs. warm), AI type (TAI vs. AIE)

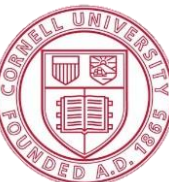


# Statistical Analysis



## Model Building:

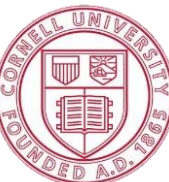
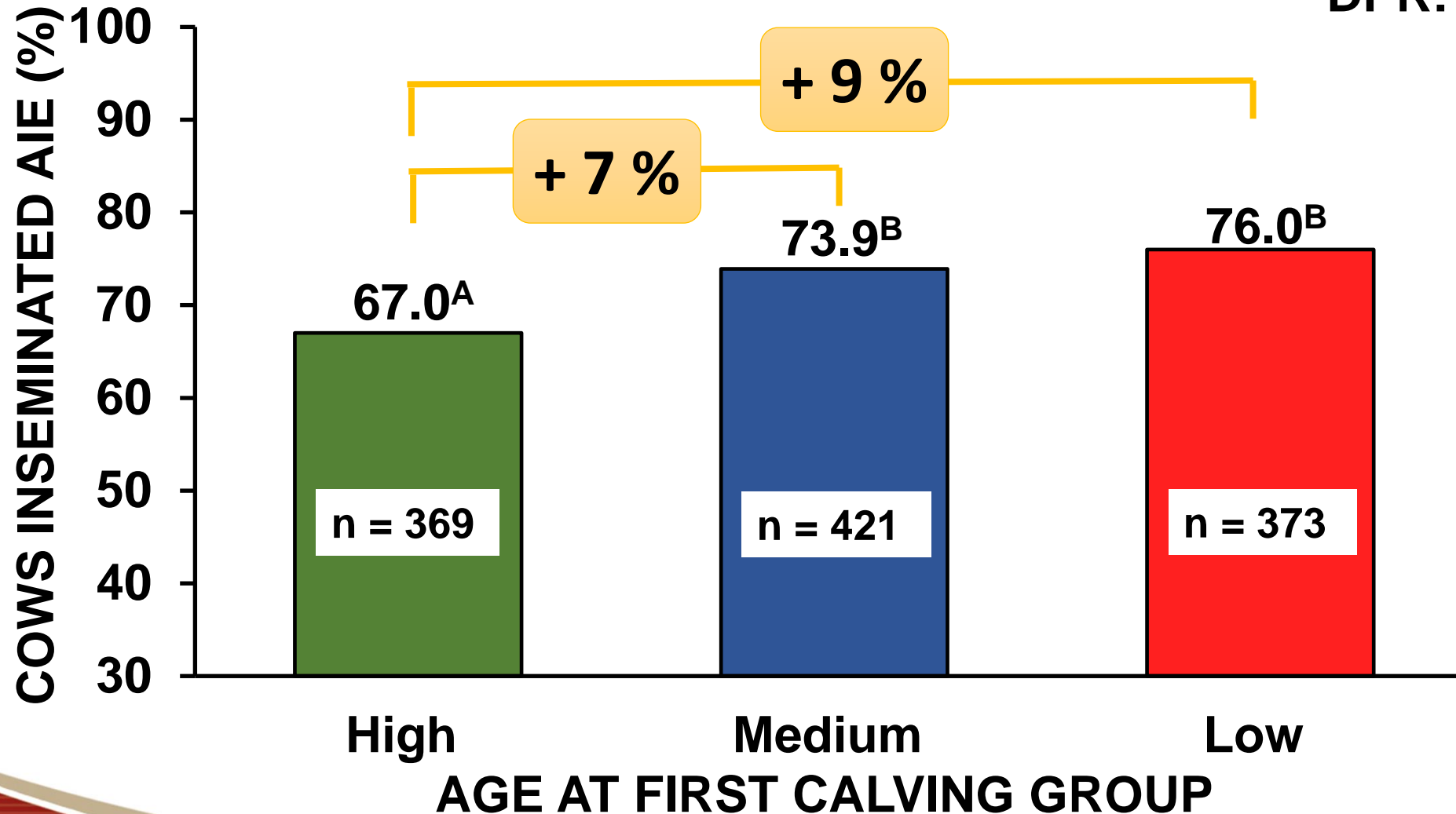
- ✔ **Fixed effect:** Age at first calving group. **Random effect:** Farm
  - ✔ *Confounders:* Daughter Pregnancy Rate (DPR) group (high, medium, low), milk production group (high, medium, low), season of insemination (cold vs. warm), AI type (TAI vs. AIE)
- ✔ Binary outcomes - Logistic Regression
- ✔ Time to pregnancy and herd exit - Cox's Proportional Hazard Regression



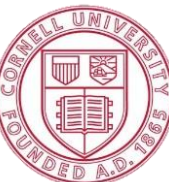
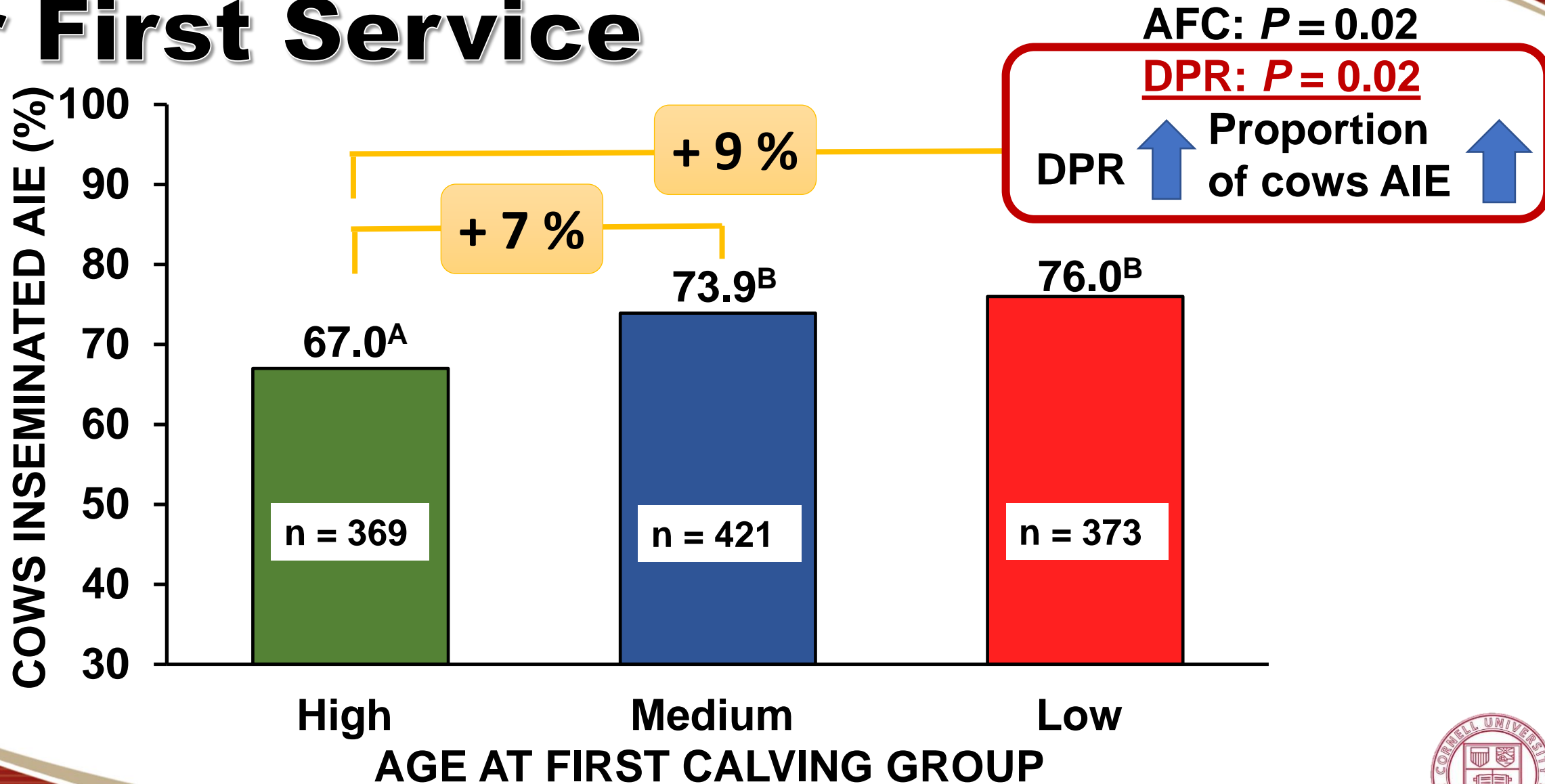
# Results- Proportion of Cows AIE for First Service

AFC:  $P = 0.02$

DPR:  $P = 0.02$



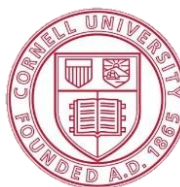
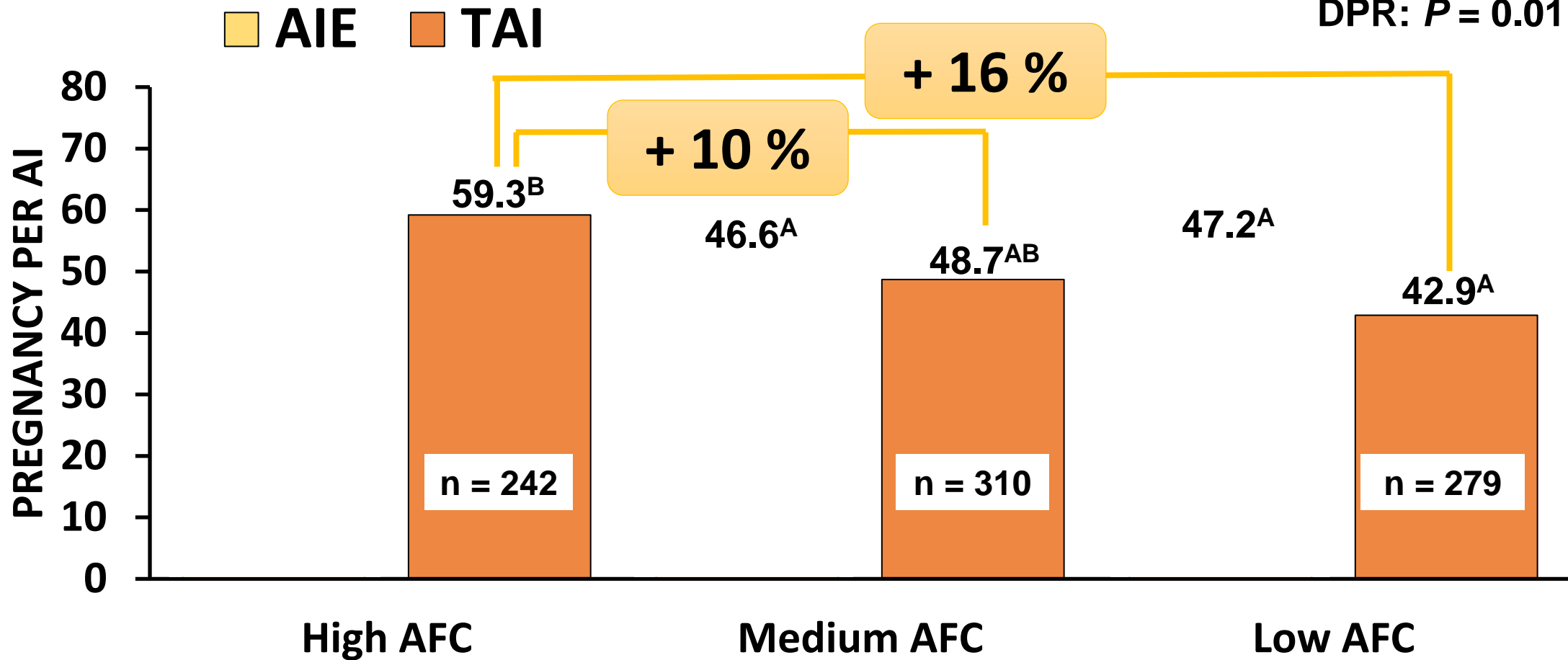
# Results- Proportion of Cows AIE for First Service



# Results- First Service P/AI

Observed an AFC by AI type interaction

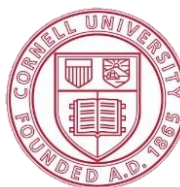
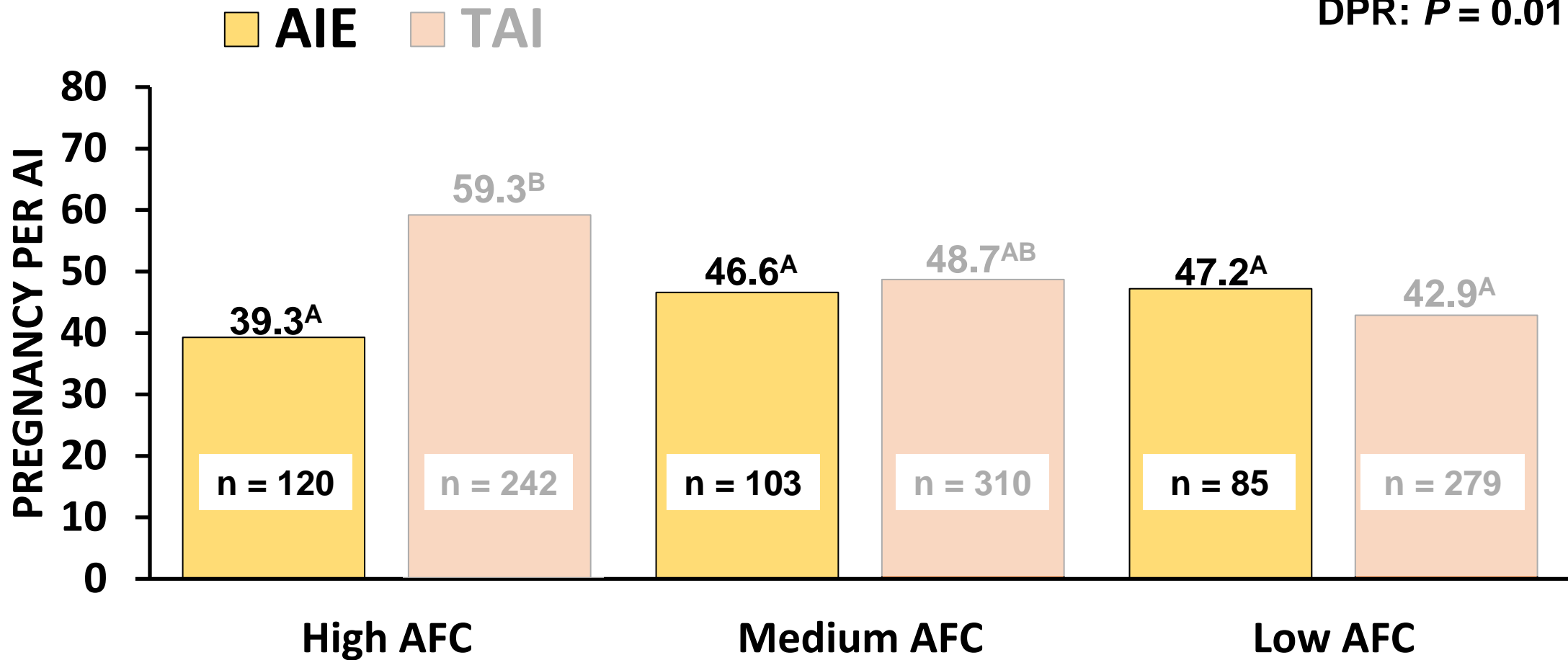
AFC:  $P = 0.61$   
 AI type:  $P = 0.08$   
**AFC\*AI type:  $P = 0.01$**   
 DPR:  $P = 0.01$



# Results- First Service P/AI

Observed an AFC by AI type interaction

AFC:  $P = 0.61$   
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**AFC\*AI type:  $P = 0.01$**   
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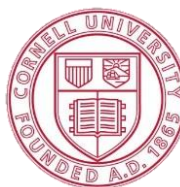
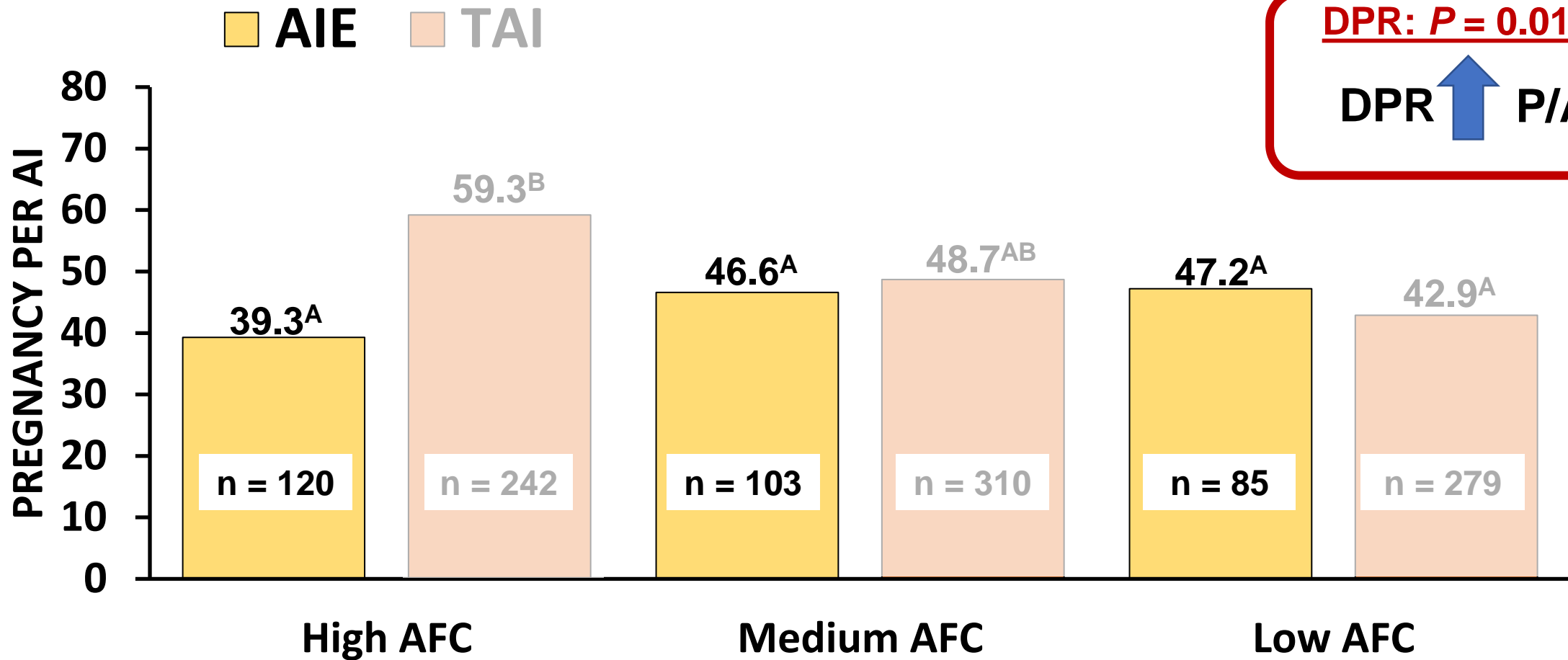
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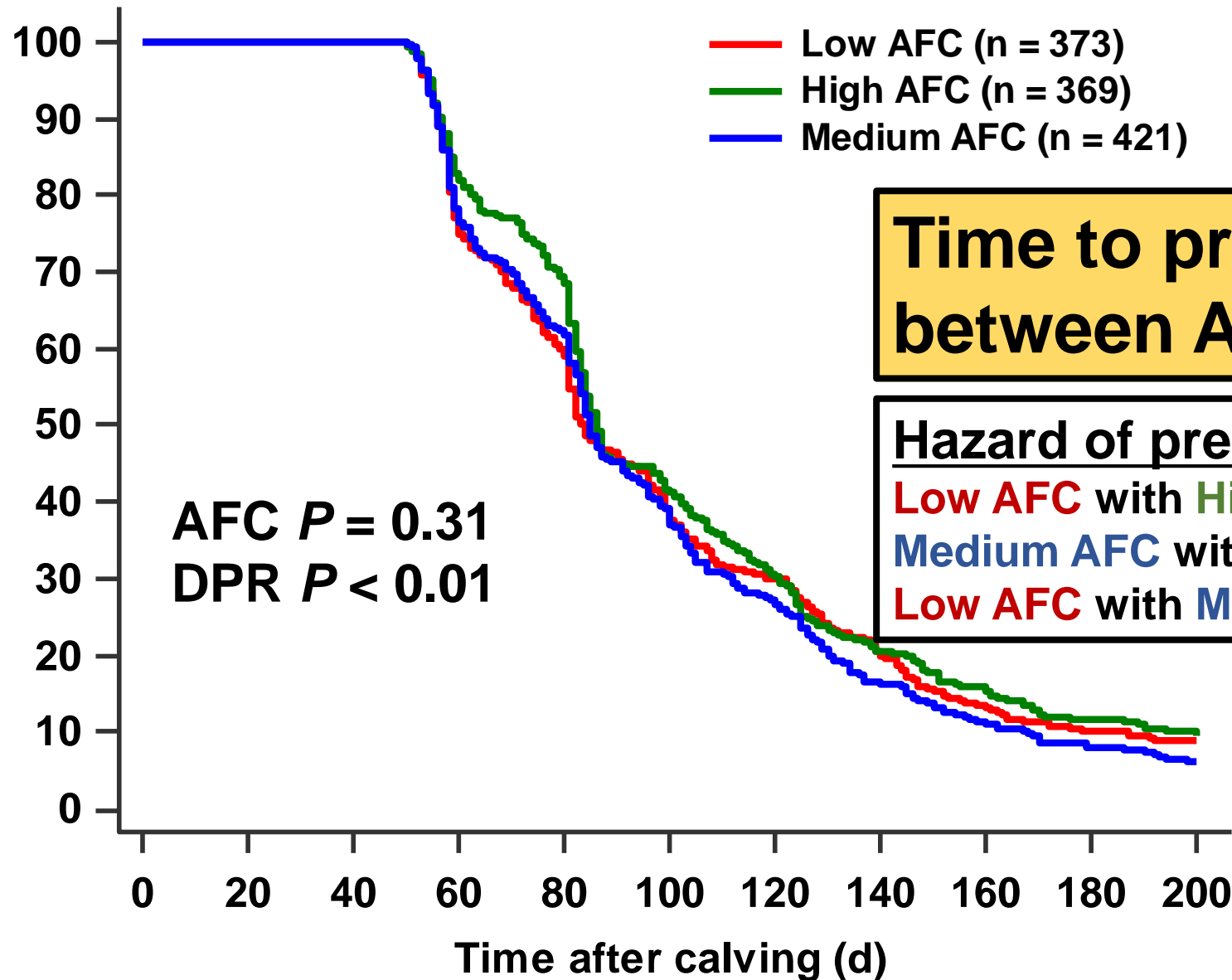
AFC:  $P = 0.61$   
 AI type:  $P = 0.08$   
 AFC\*AI type:  $P = 0.01$

**DPR:  $P = 0.01$**

DPR ↑ P/AI ↑



# Results- Time to Pregnancy



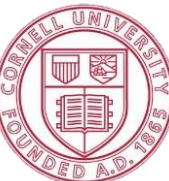
Time to pregnancy similar  
between AFC groups

## Hazard of pregnancy

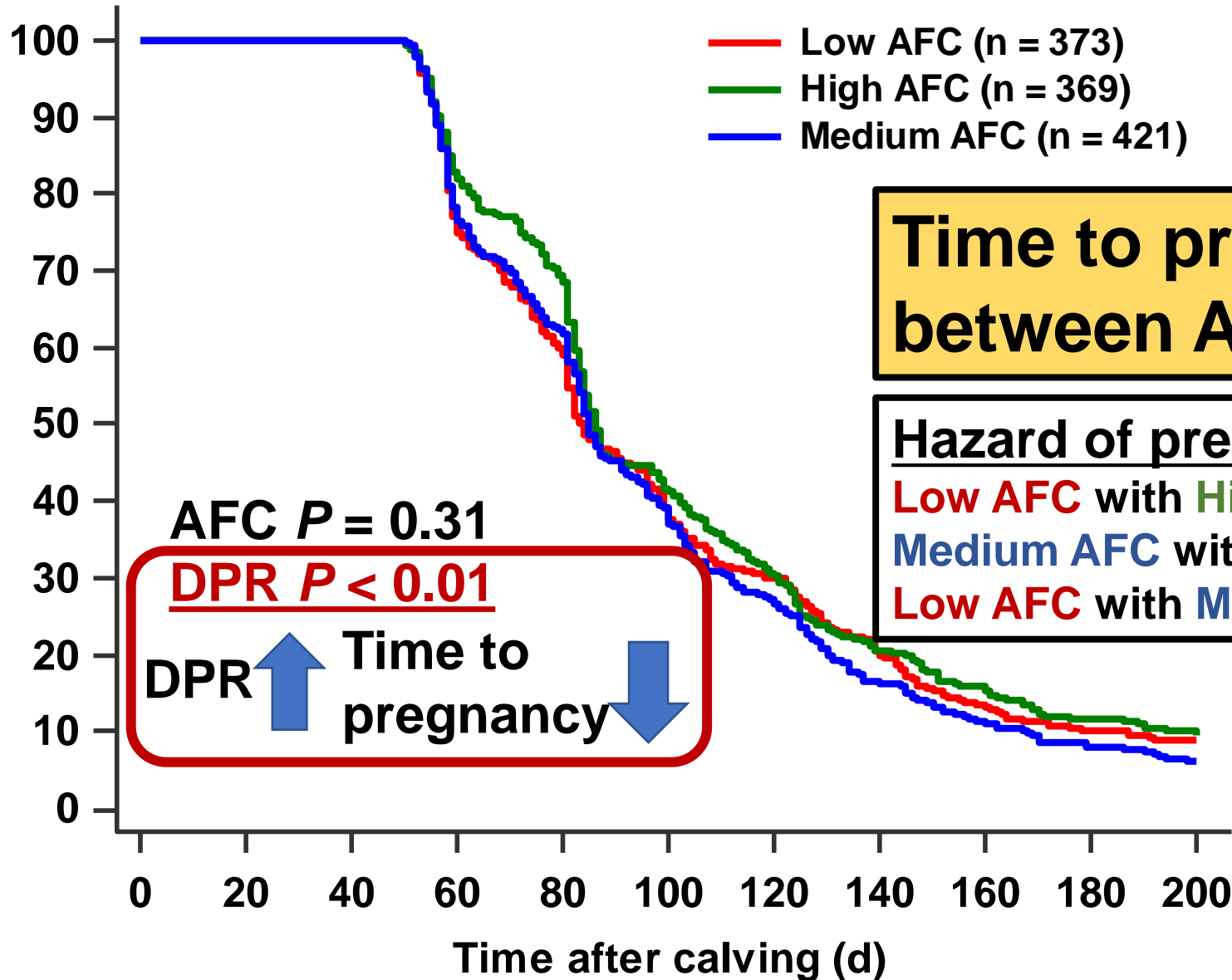
Low AFC with High AFC = 1.07, 95% CI:0.92-1.25

Medium AFC with High AFC = 1.12, 95% CI:0.97-1.30

Low AFC with Medium AFC = 0.89, 95% CI:0.77-1.04

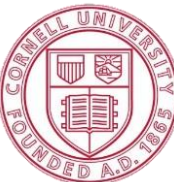


# Results- Time to Pregnancy

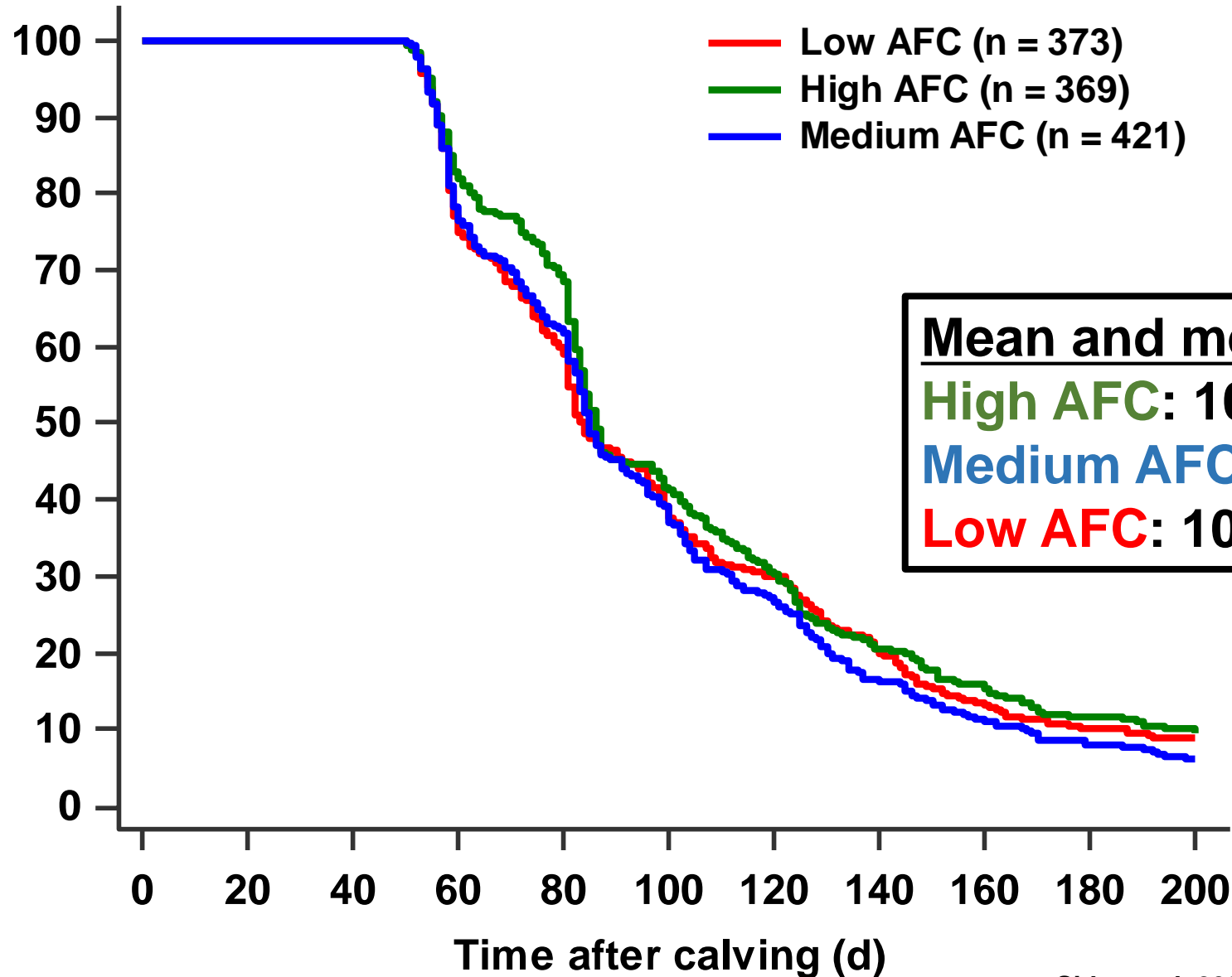


**Time to pregnancy similar between AFC groups**

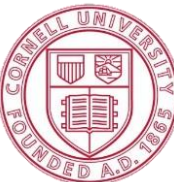
**Hazard of pregnancy**  
Low AFC with High AFC = 1.07, 95% CI:0.92-1.25  
Medium AFC with High AFC = 1.12, 95% CI:0.97-1.30  
Low AFC with Medium AFC = 0.89, 95% CI:0.77-1.04



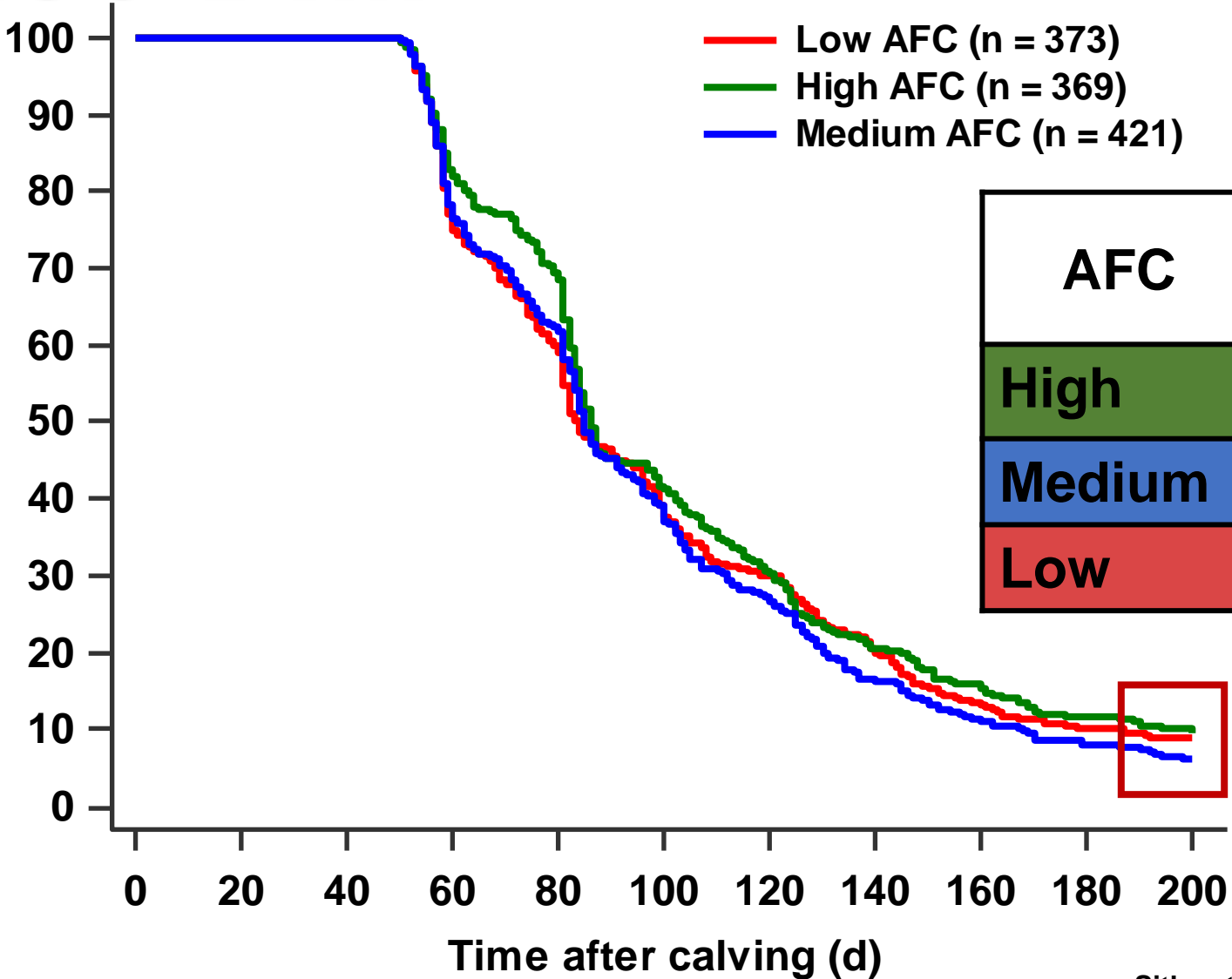
# Results- Time to Pregnancy



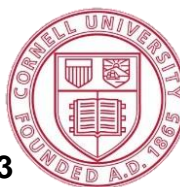
**Mean and median days to pregnancy:**  
**High AFC: 105, 86**  
**Medium AFC: 99, 85**  
**Low AFC: 100, 84**



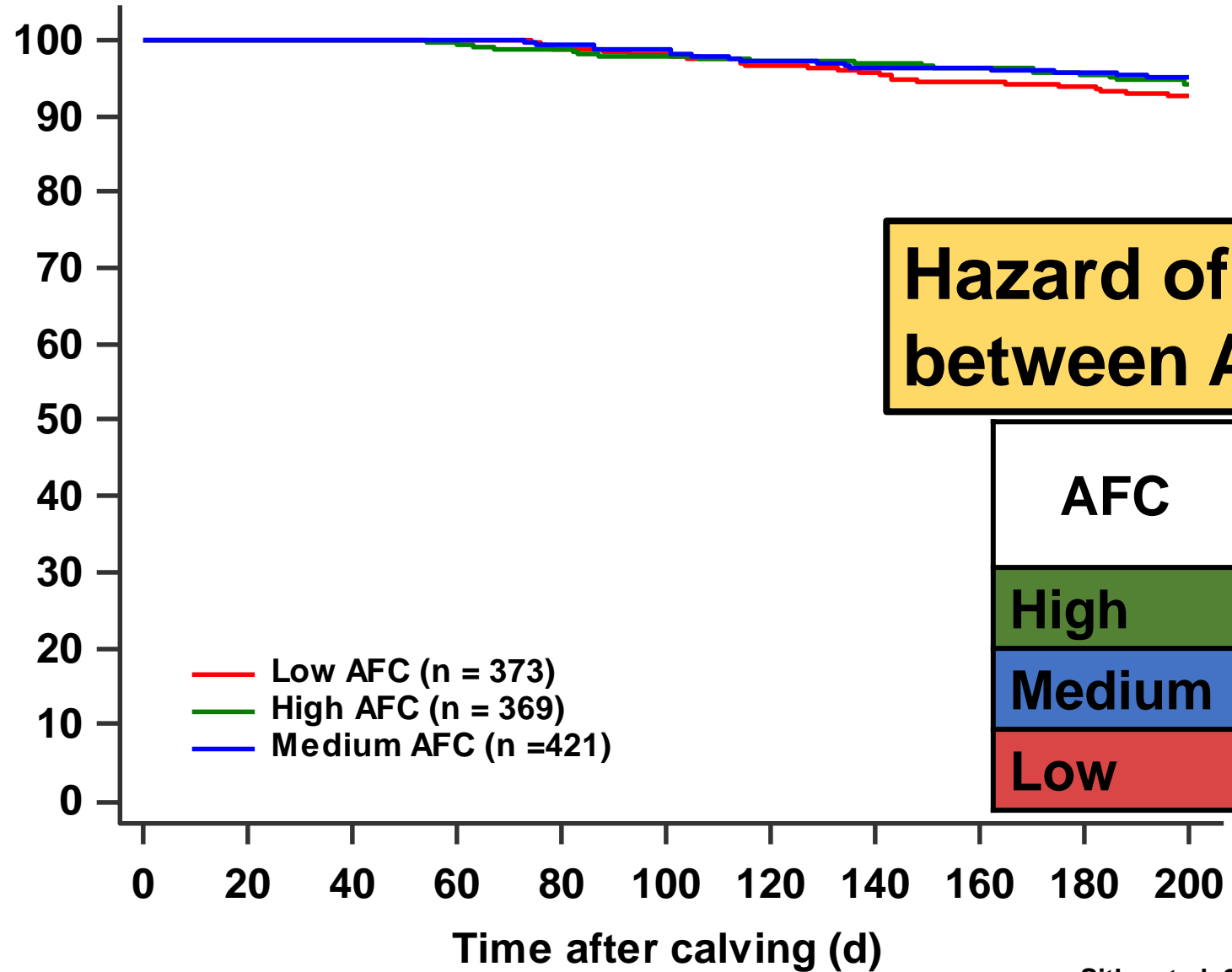
# Results- Proportion Cows Pregnant 200 DIM



AFC	Proportion pregnant by 200 days	P value
High	88.1%	0.27
Medium	91.2%	
Low	88.2%	



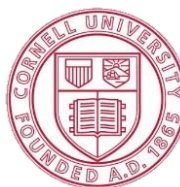
# Results- Herd Exit



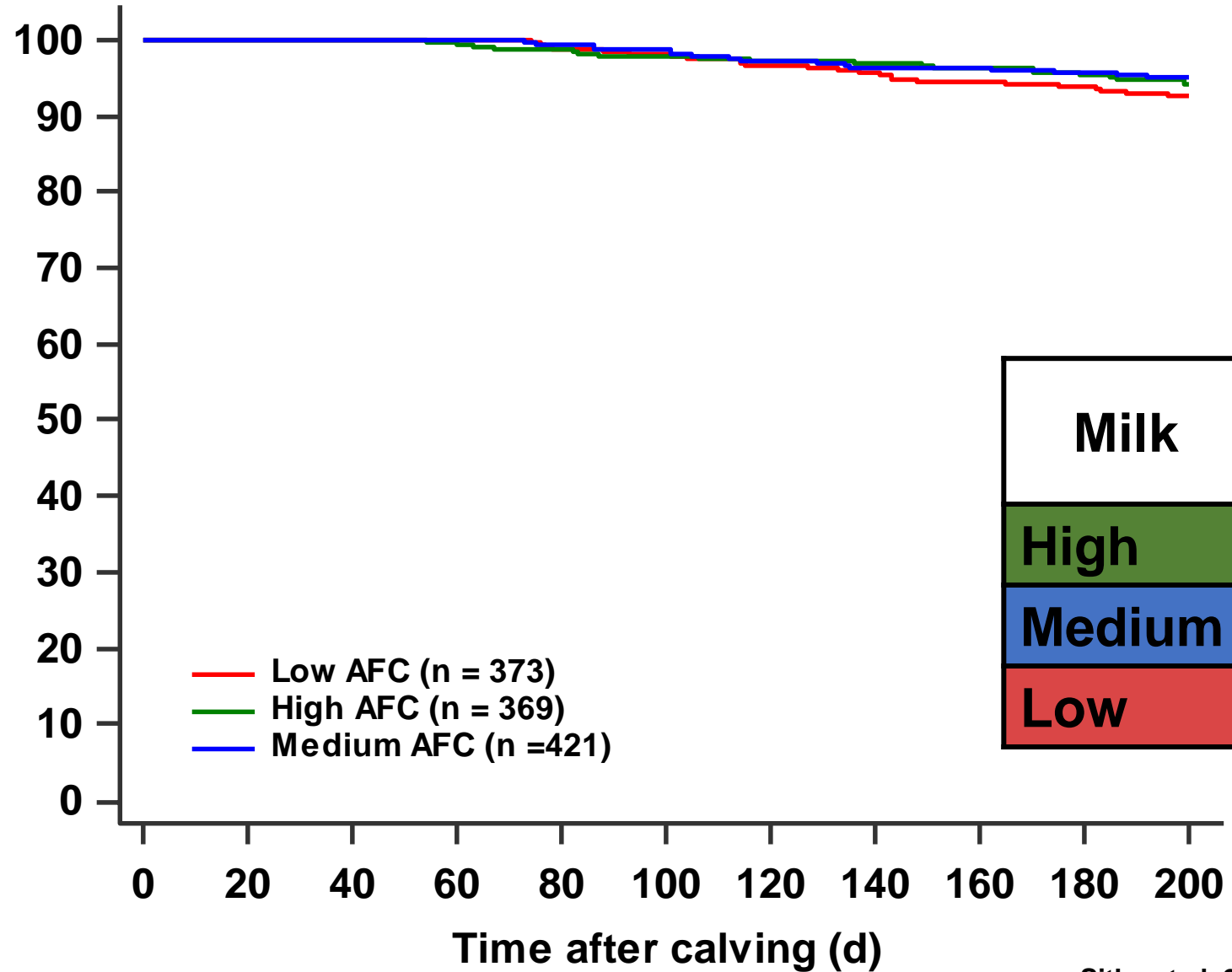
AFC  $P = 0.31$   
 DPR  $P = 0.04$   
 Milk production  $P < 0.01$

**Hazard of herd exit similar between AFC groups**

AFC	Proportion of cows that left herd	<i>P</i> value
High	4.3%	<b>0.82</b>
Medium	3.8%	
Low	4.6%	



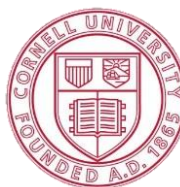
# Results- Herd Exit



AFC  $P = 0.31$   
 DPR  $P = 0.04$

**Milk production  $P < 0.01$**   
 Milk ↓ Hazard ↑  
 herd exit

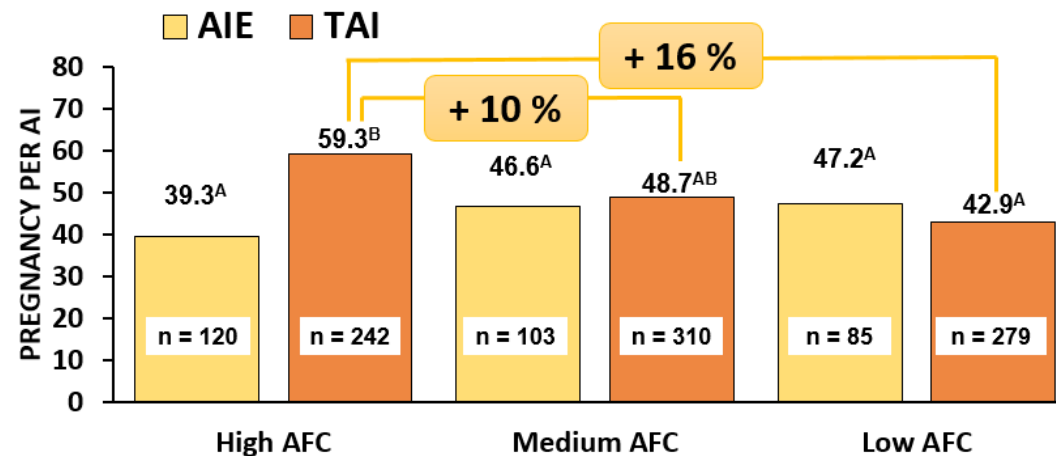
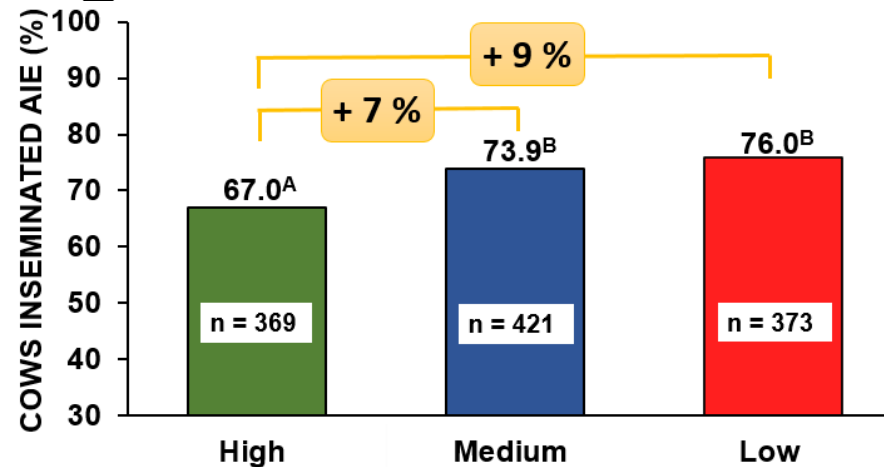
Milk	Proportion of cows that left herd	$P$ value
High	1.8%	$< 0.01$
Medium	3.6%	
Low	11.1%	



# Conclusions

Age at first calving affected reproductive performance for cows managed with a program that favored AIE:

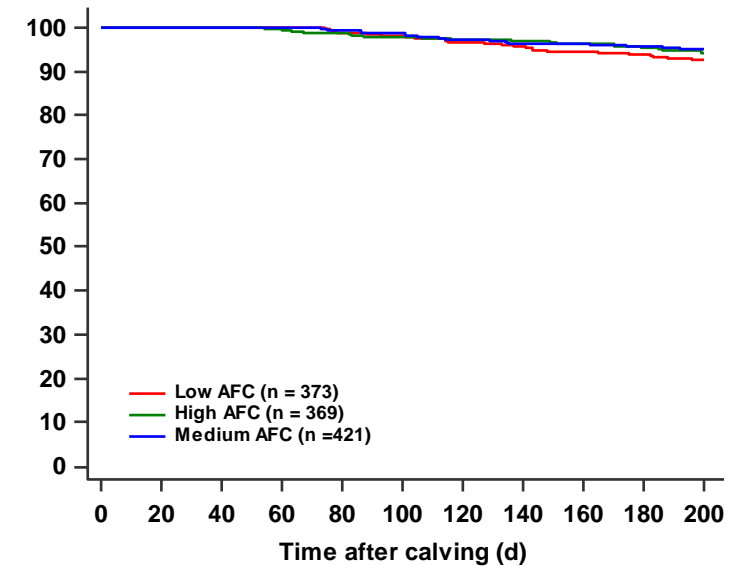
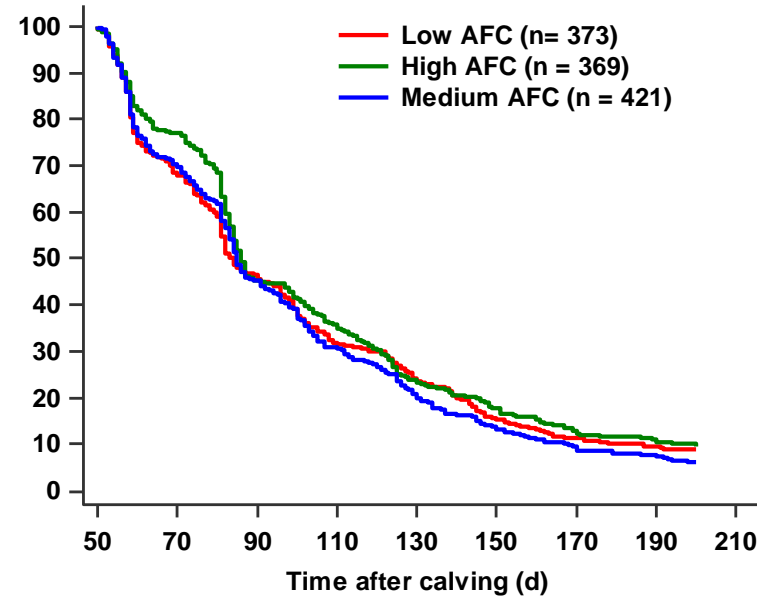
- ✓ Proportion of cows AIE
- ✓ Pregnancy per AI
- ✗ Time to pregnancy
- ✗ Herd exit dynamics



# Conclusions

Age at first calving affected reproductive performance for cows managed with a program that favored AIE:

- ✔ Proportion of cows AIE
- ✔ Pregnancy per AI
- ✘ Time to pregnancy
- ✘ Herd exit dynamics



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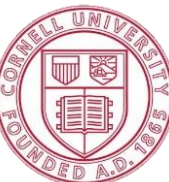
## Hypothesis

Age at first calving would affect the proportion of cows inseminated at detected estrus (AIE), pregnancy per AI (P/AI), time to pregnancy, proportion of cows pregnant during lactation, and herd exit dynamics

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## Research Objective

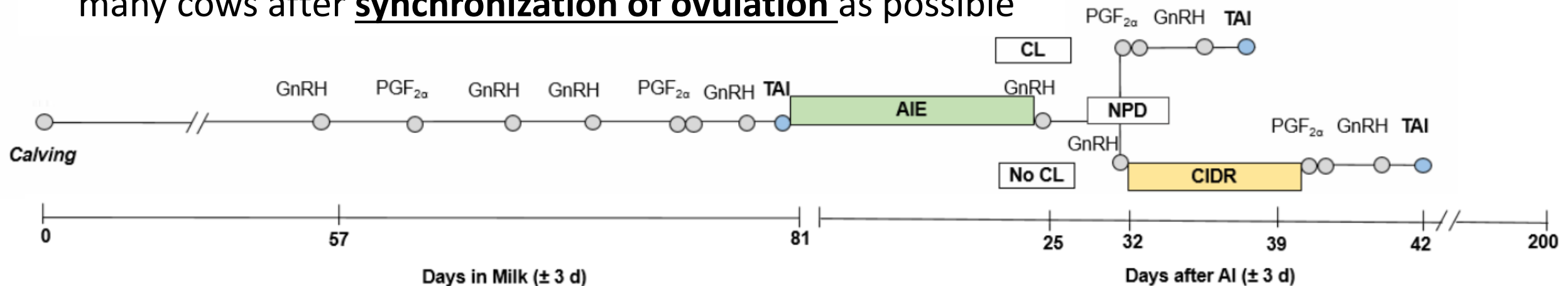
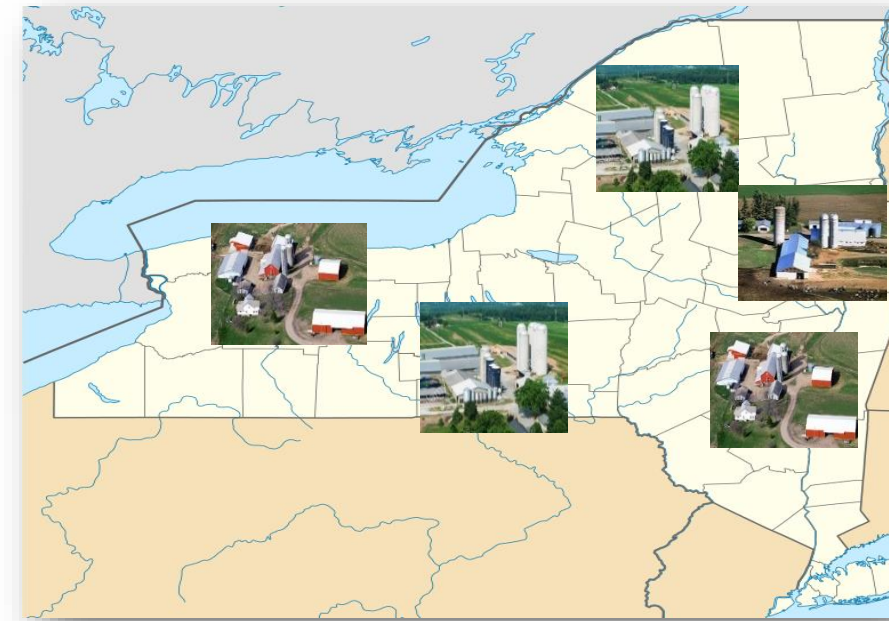
Evaluate the **association between AFC and reproductive performance and herd exit** of primiparous Holstein cows submitted to AI with a program that favored insemination at detected estrus or timed AI



# Research Design

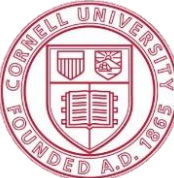
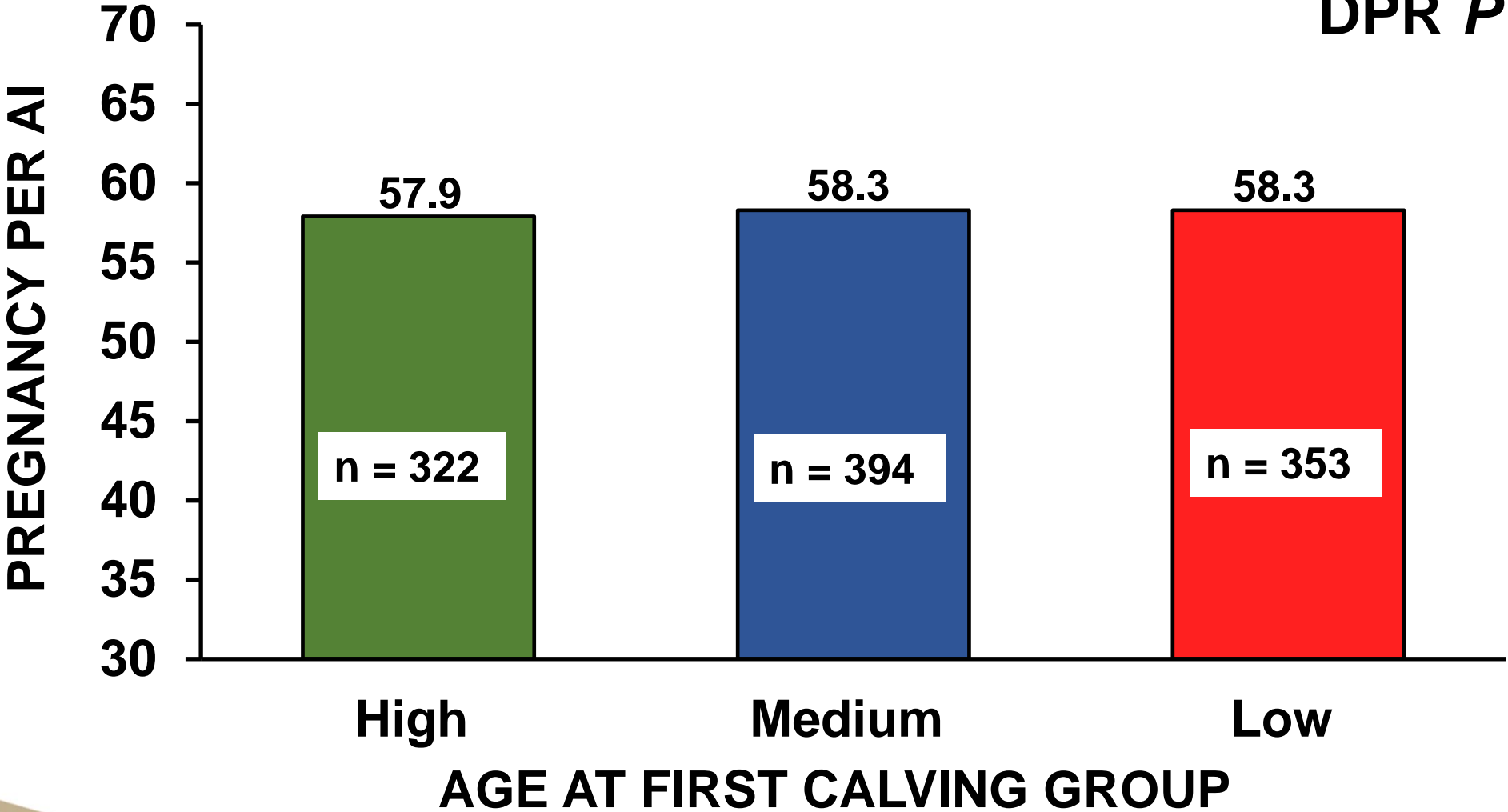
## Retrospective Cohort Study

- ✓ Primiparous Holstein lactating dairy cows from 5 commercial farms in NY (n = 1,072)
- ✓ Cows retrospectively grouped by AFC tertiles within farm (n; mean; range): **Low (n= 323; 21.5; 18.6-22.4)**  
**Medium (n= 394; 22.1; 21.3-23.3)**  
**High (n= 355, 23.5; 21.8-29.6)**
- ✓ Reproductive Management: designed to inseminate as many cows after synchronization of ovulation as possible

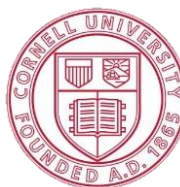
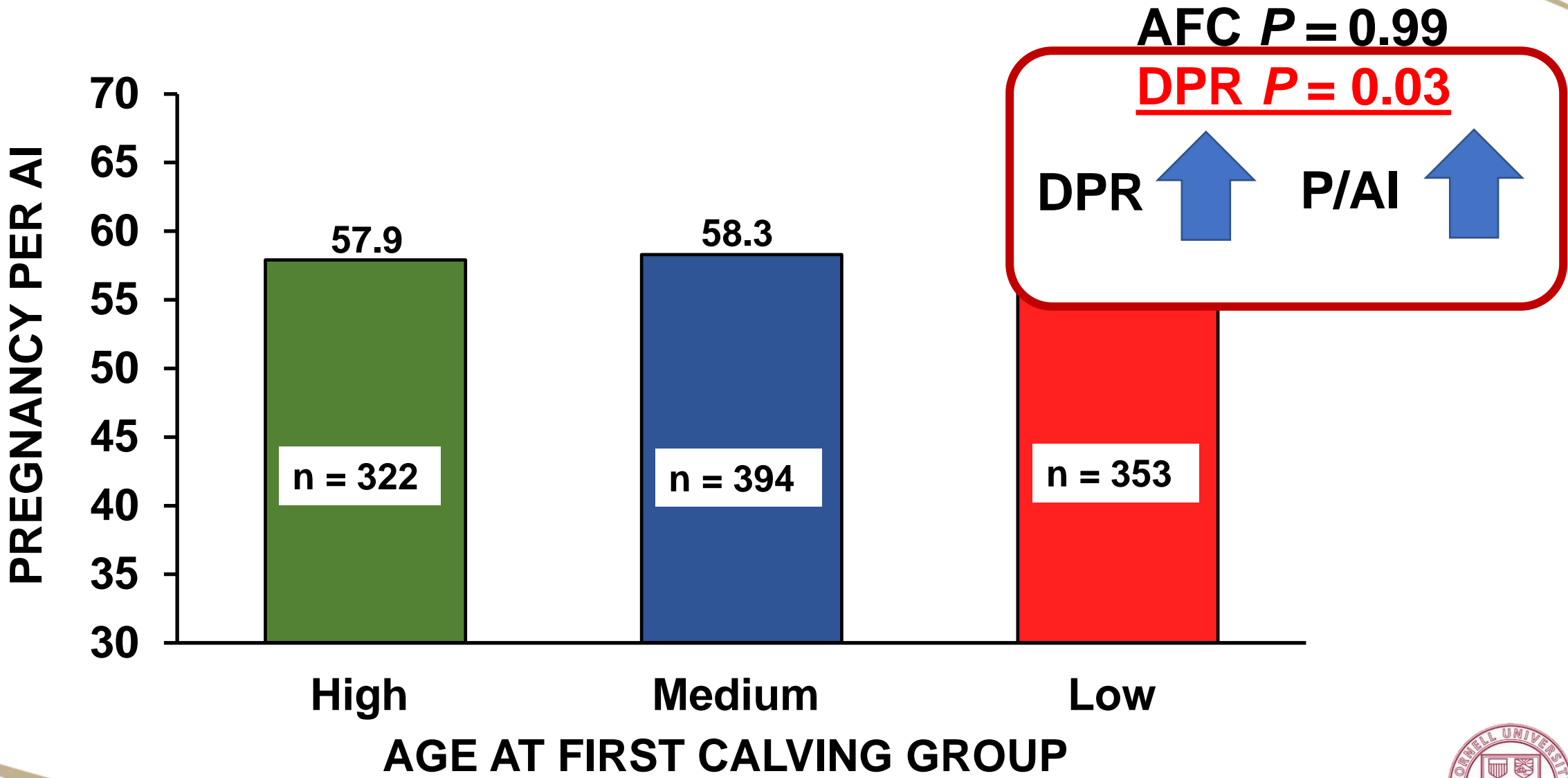


# Results- First Service P/AI

AFC  $P = 0.99$   
DPR  $P = 0.03$



# Results- First Service P/AI



# Results- Time to Pregnancy

**AFC P = 0.06**

**DPR P = 0.02**

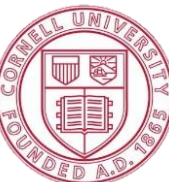
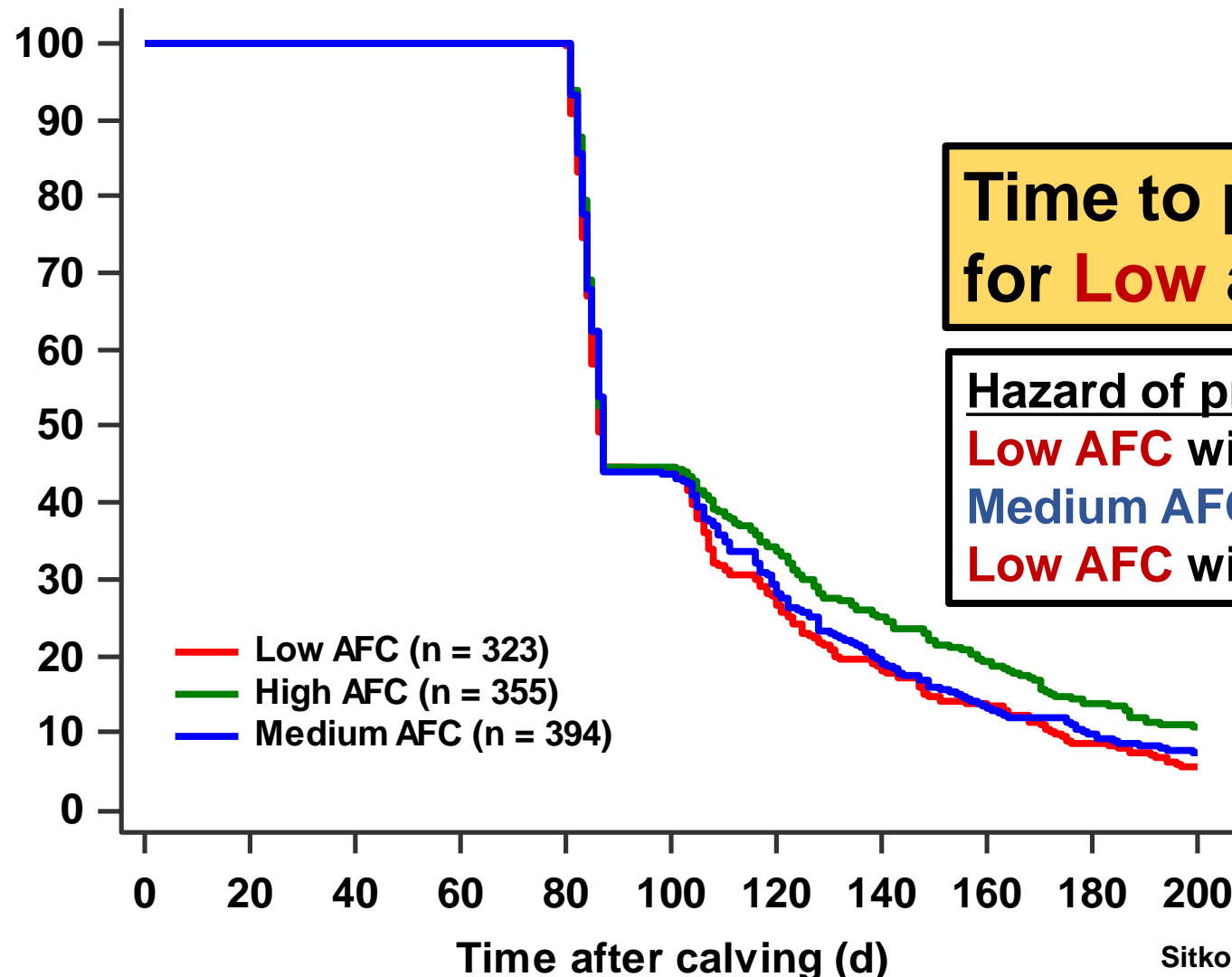
Time to pregnancy was decreased for **Low** and **Medium** AFC groups

Hazard of pregnancy

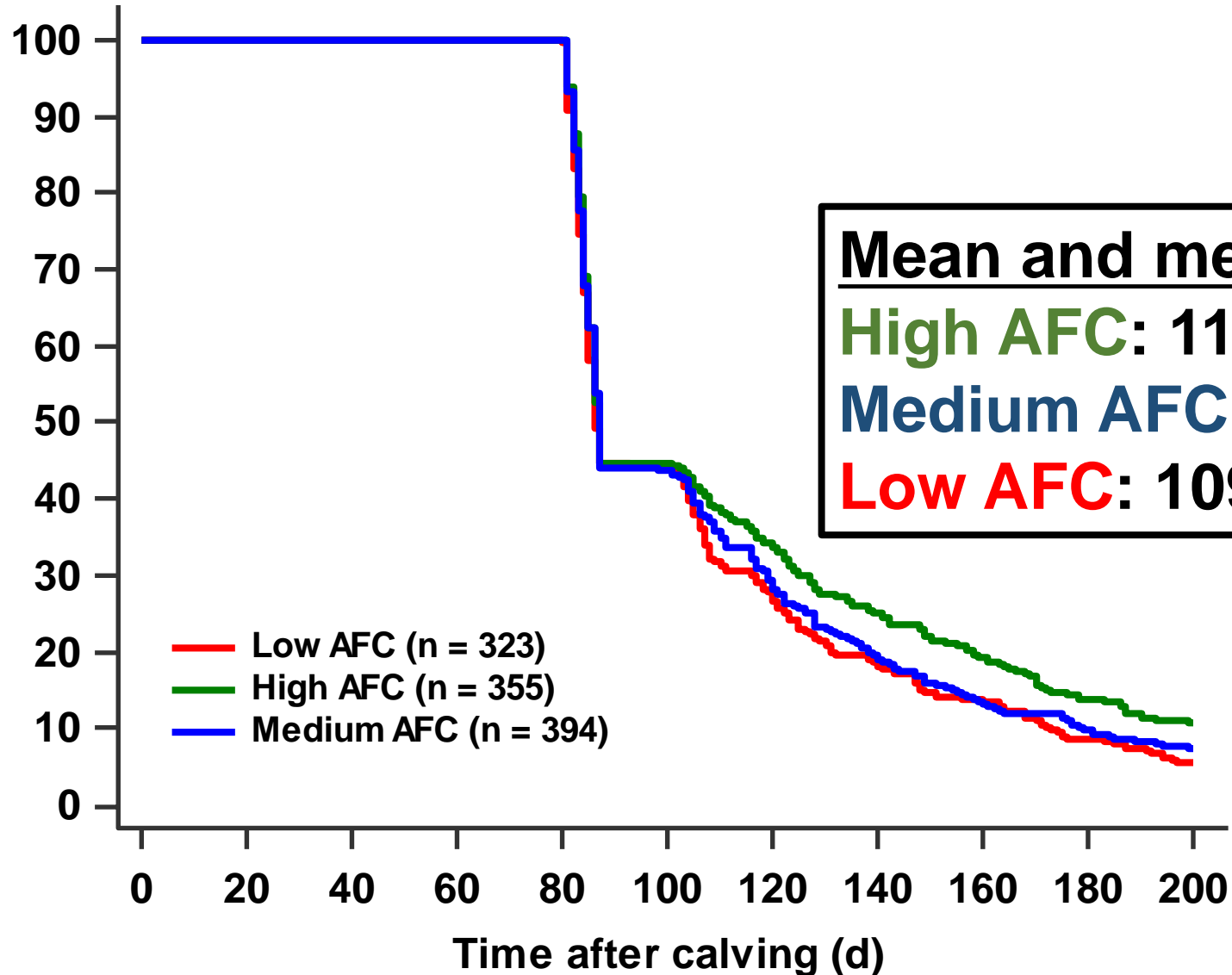
**Low AFC** with **High AFC** = 1.21, 95% CI:1.04-1.42

**Medium AFC** with **High AFC** = 1.12, 95% CI:1.01-1.25

**Low AFC** with **Medium AFC** = 1.01, 95% CI:0.91-1.12



# Results- Time to Pregnancy



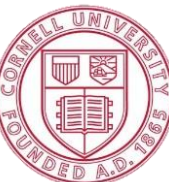
Mean and median days to pregnancy:

**High AFC: 114, 87**

**Medium AFC: 110, 87**

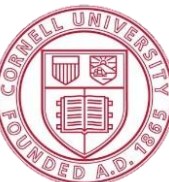
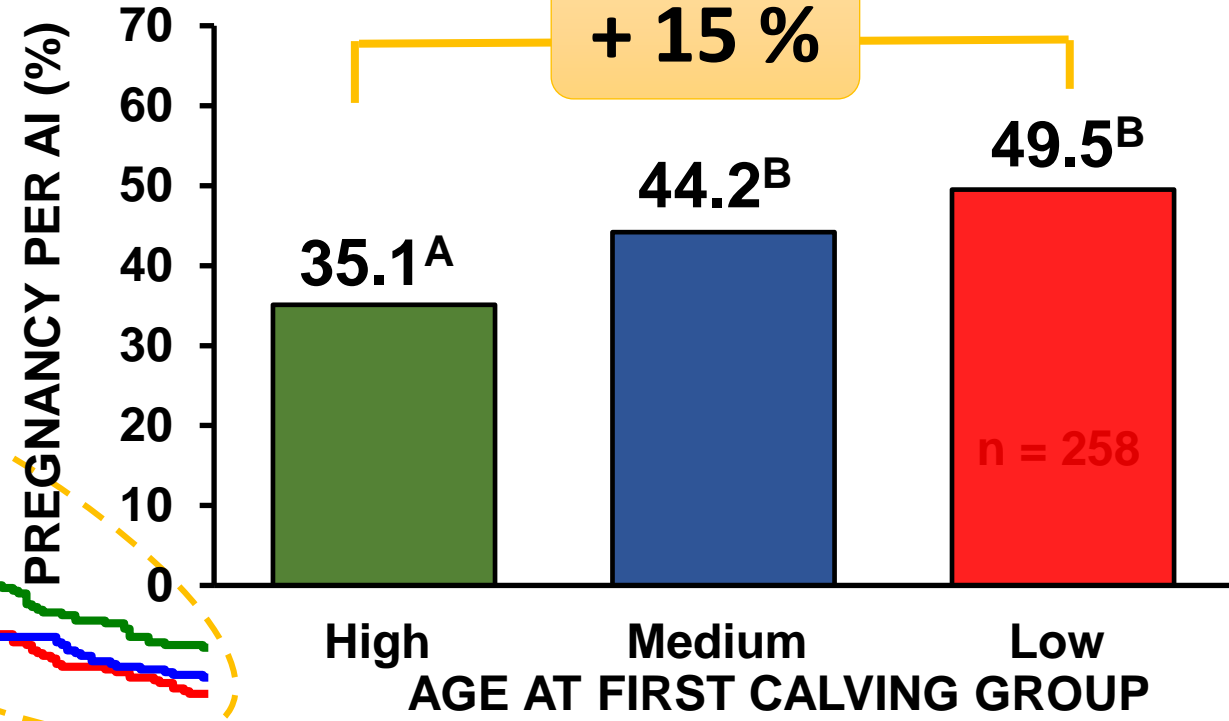
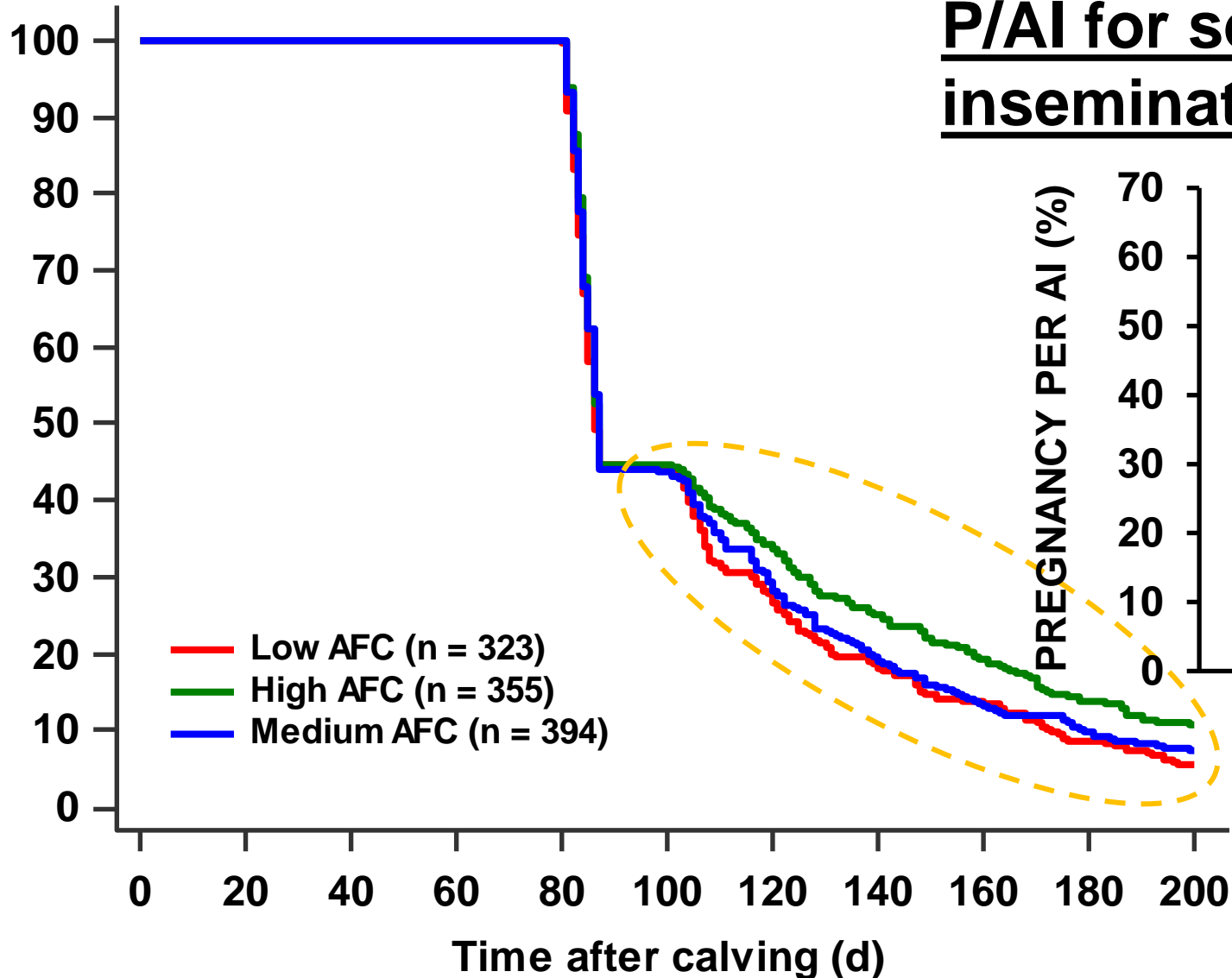
**Low AFC: 109, 86**

— Low AFC (n = 323)  
— High AFC (n = 355)  
— Medium AFC (n = 394)

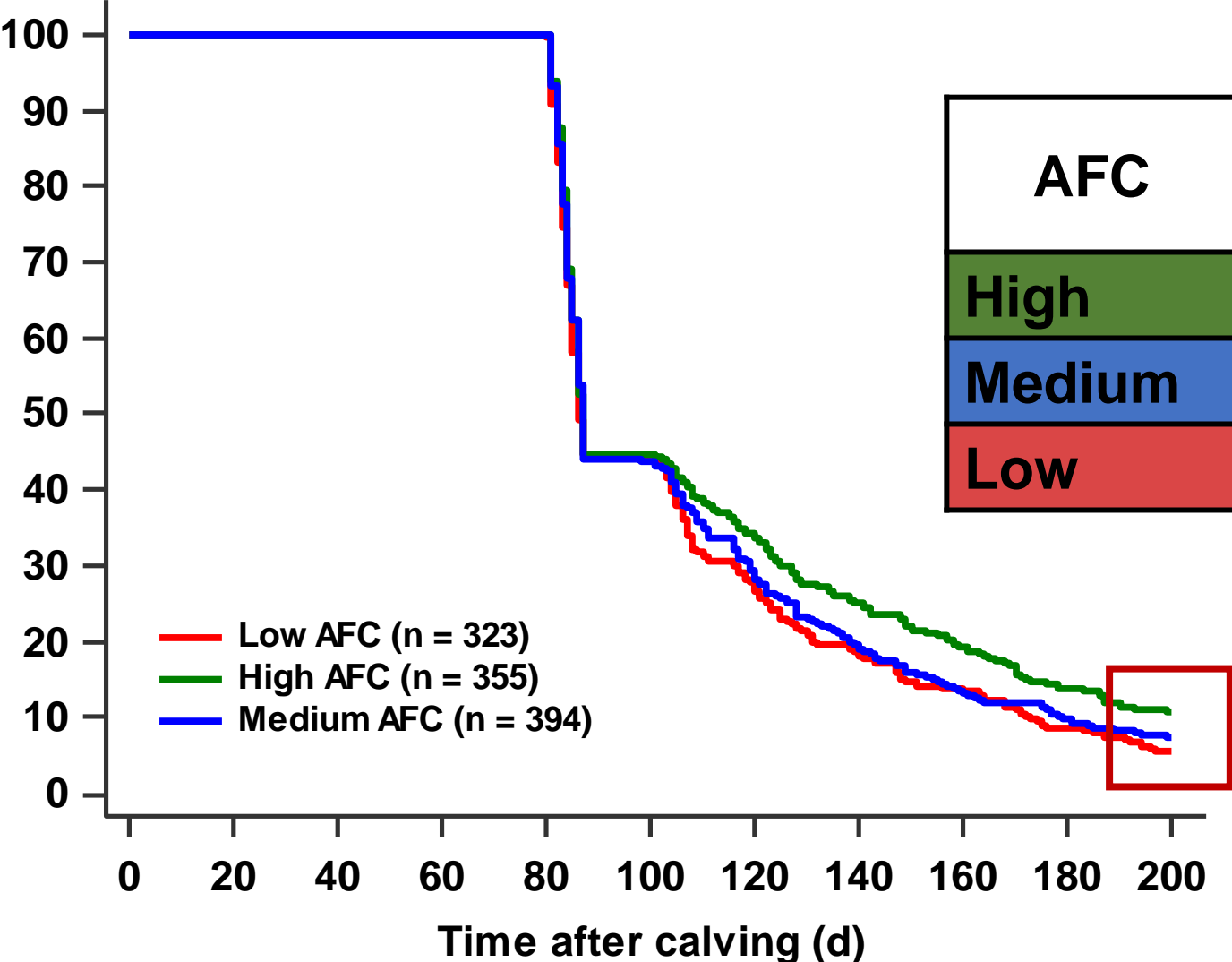


# Results- Time to Pregnancy

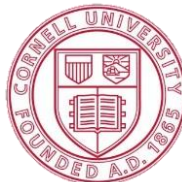
P/AI for second and subsequent inseminations **AFC P < 0.01**



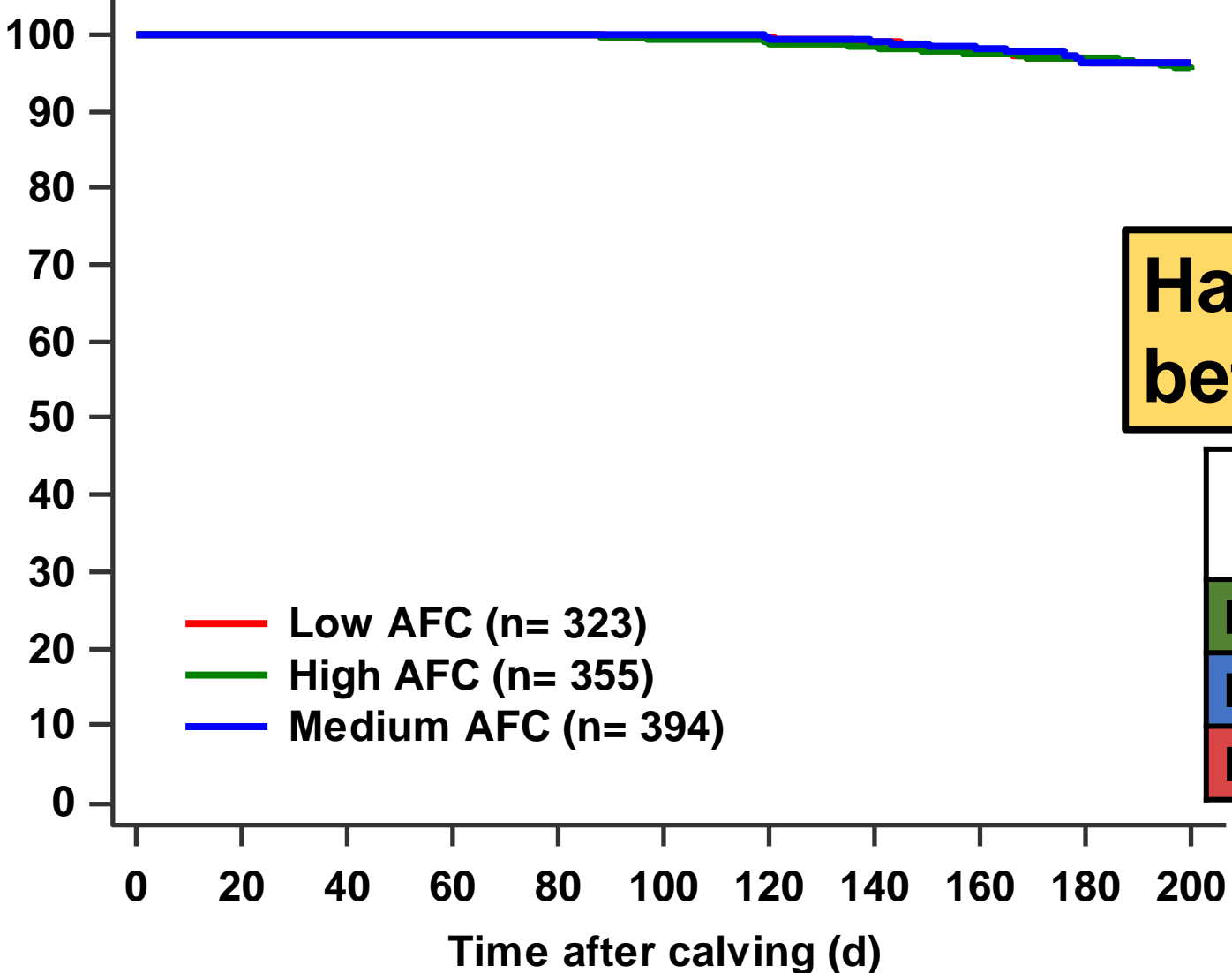
# Results- Proportion Cows Pregnant 200 DIM



AFC	Proportion pregnant by 200 days	P value
High	87.9% <sup>A</sup>	< 0.05
Medium	91.6% <sup>BA</sup>	
Low	93.5% <sup>B</sup>	



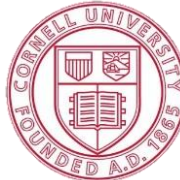
# Results- Herd Exit



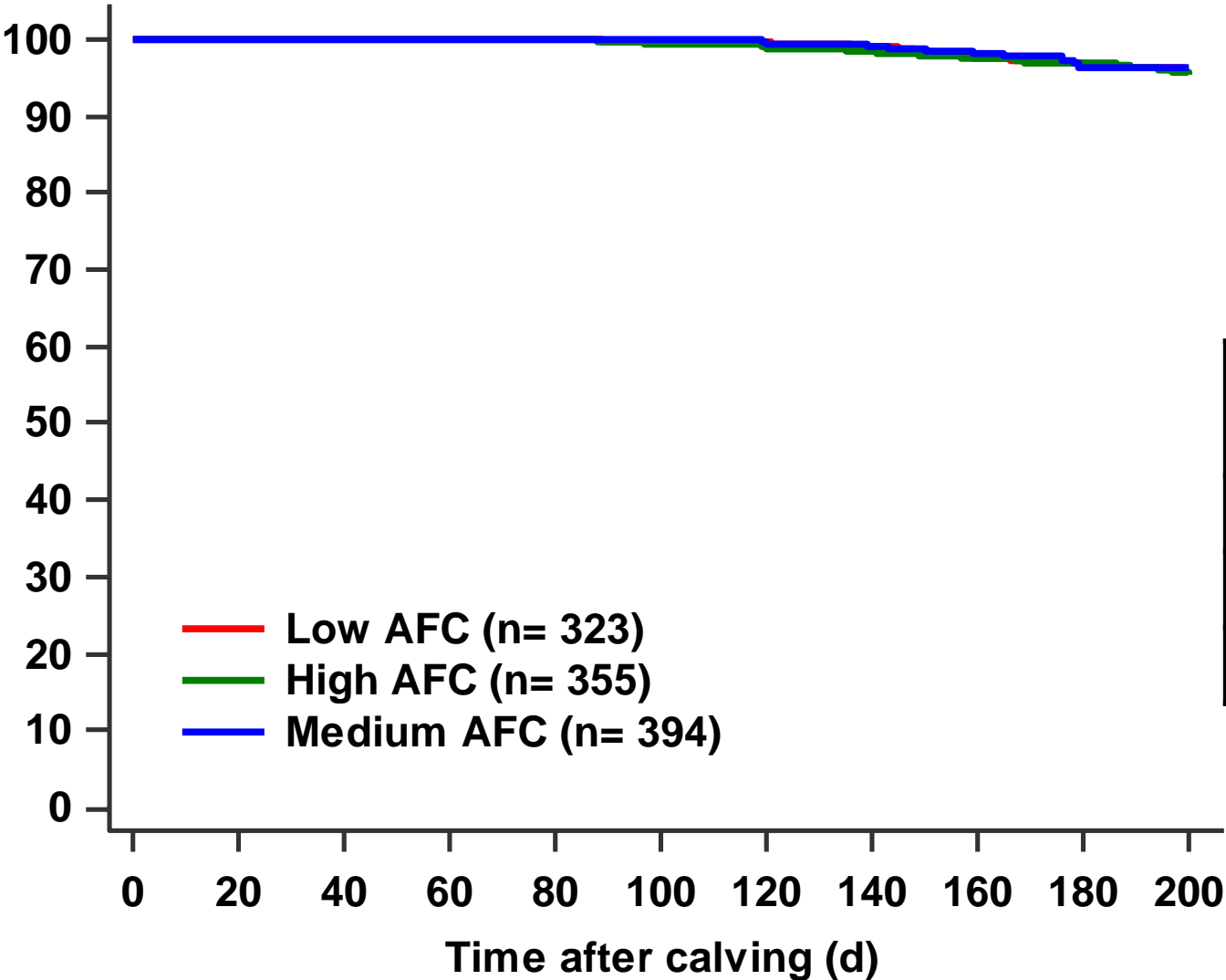
**AFC  $P = 0.69$**   
**Milk production  $P < 0.01$**

**Hazard of herd exit similar between AFC groups**

AFC	Proportion of cows that left herd	<i>P</i> value
High	1.2%	<b>0.69</b>
Medium	2.4%	
Low	1.1%	



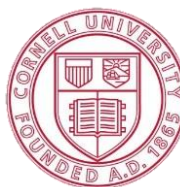
# Results- Herd Exit



AFC  $P = 0.69$

**Milk production  $P < 0.01$**   
 Milk ↓ Hazard ↑  
 herd exit

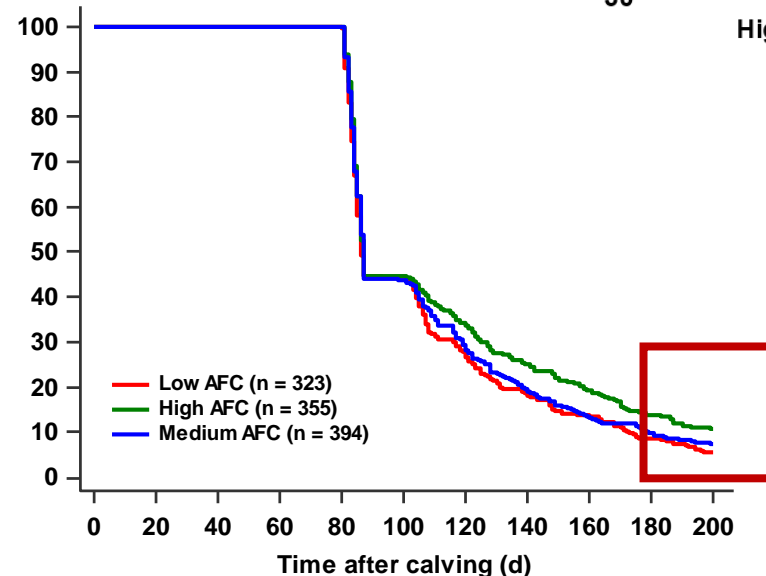
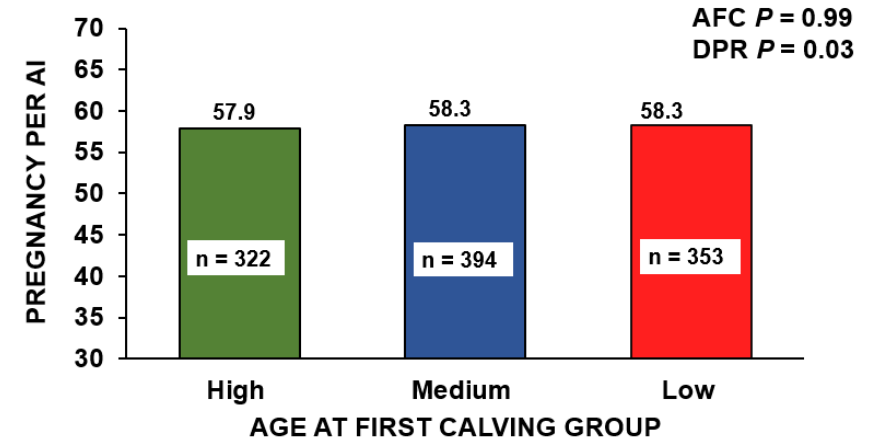
Milk	Proportion of cows that left herd	$P$ value
High	2.4%	$< 0.01$
Medium	2.6%	
Low	7.2%	



# Conclusions

Age at first calving affected reproductive performance for cows managed with a program that favored TAI:

- ❌ Pregnancy per AI
- ✅ Time to pregnancy
- ✅ Proportion pregnant by 200 DIM
- ❌ Herd exit dynamics



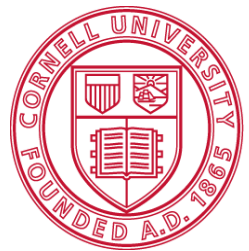
# Acknowledgements



**Giordano Lab**



**Participating farms and veterinarians**



**Cornell University**  
Department of Animal Science



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