The effect of reproductive performance on the herd value assessed by integrating a daily dynamic programming with a daily Markov chain model

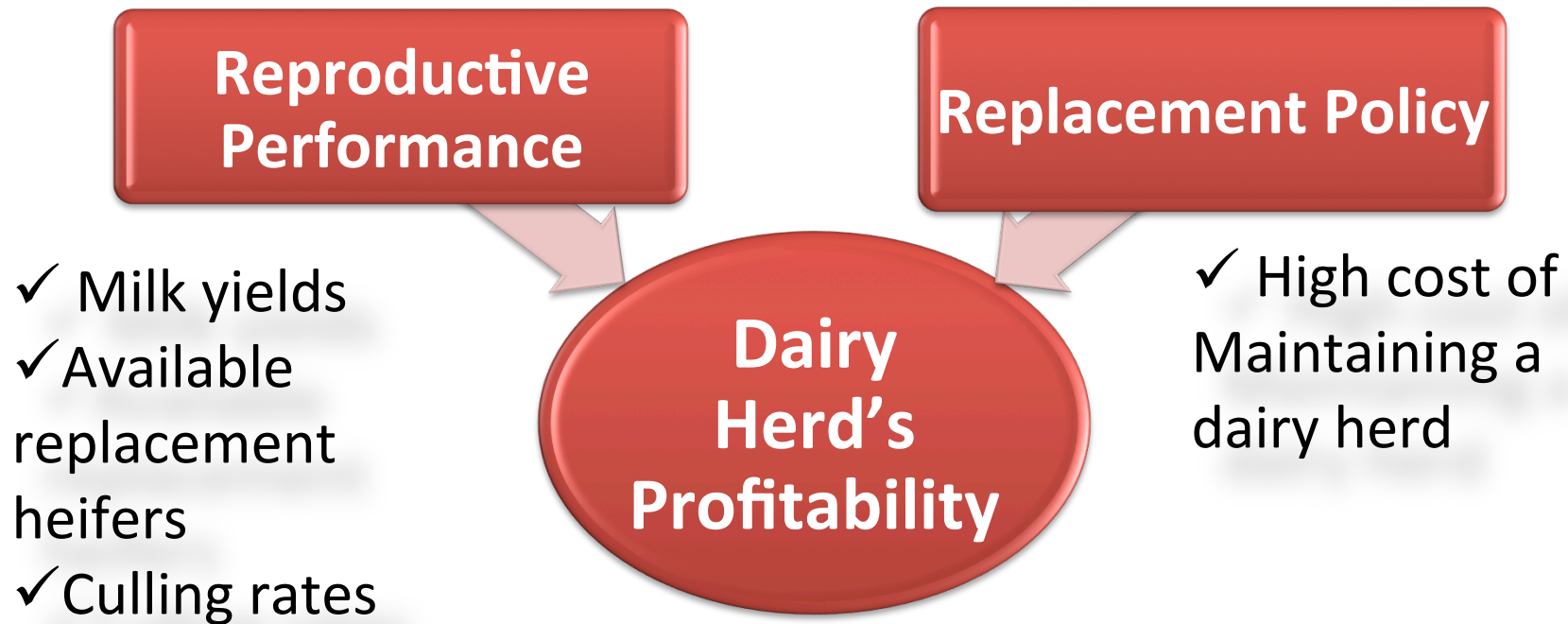Afshin Samia Kalantari

Victor E. Cabrera

Outline

➢ Introduction

  ✓ Background

  ✓ Objectives

➢ Material & Methods

  ✓ Daily Dynamic Programming model

  ✓ Daily Markov Chain

  ✓ 5 different Reproductive programs characteristics

➢ Results

➢ Conclusion

Introduction

Reproductive Performance

Replacement Policy

Dairy Herd's Profitability

- ✓ Milk yields
- ✓ Available replacement heifers
- ✓ Culling rates

- ✓ High cost of Maintaining a dairy herd

Objective

❑ **Determining the effect of reproductive performance on dairy cattle herd value**

DP
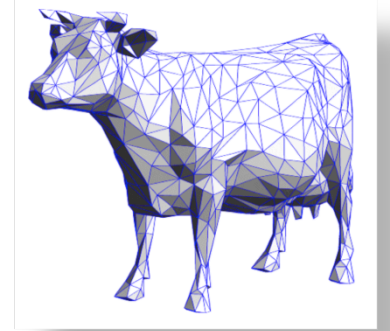- Developing a daily DP model

MC
- Combining with a Daily Markov chain model
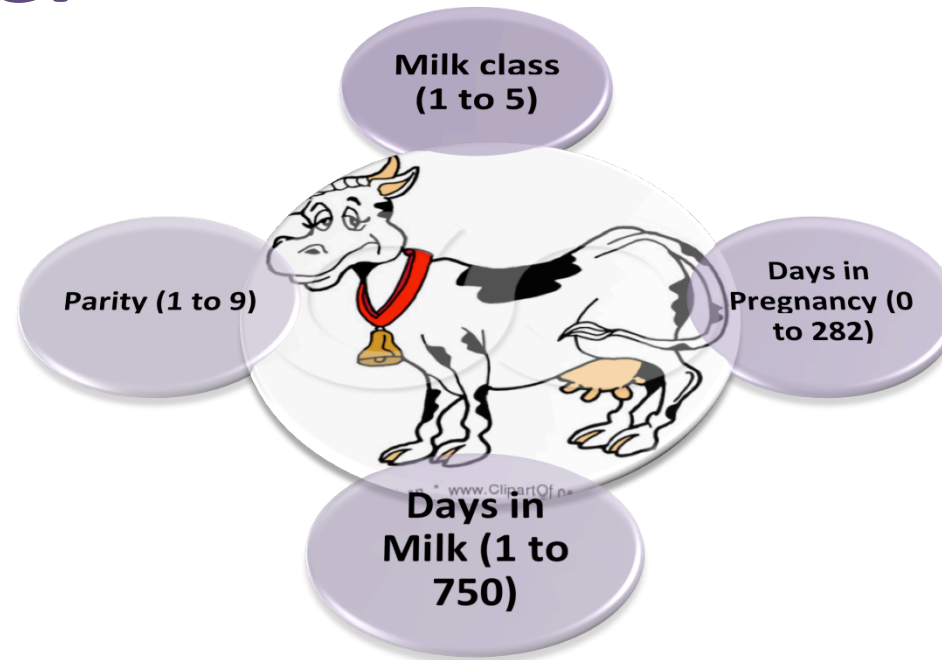
Herd value
- Compare different reproductive programs' herd values
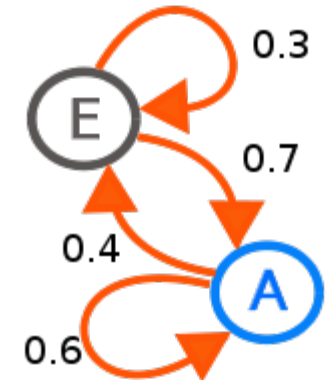
Daily DP model

- A technique that uses divide and conquer algorithm

- In this study value iteration method was used to find optimal replacement decisions with daily stage length

DP Model

- DP model ➡️ Retention Pay-Off (RPO)
- RPO = Expected profit from keeping the cow compared with immediate replacement

Daily Markov chain model

- Is a simulation method
- After optimizing with DP daily Markov chain was used to simulate the herd demographics

- This model find the structure or proportion of cows at steady state for cow states

Herd Value

- was defined as the herd's weighted average RPO

- $Herd\ Value=\sum$ ... $\sum d=1\uparrow750$ ... $\sum p=0\uparrow282$ ...
$(p\downarrow_{d,p}\times$ ... $_{d,p})$

Reproductive Programs' Effect (From MC)

Replacement Policy Effect (From DP)

Herd Value
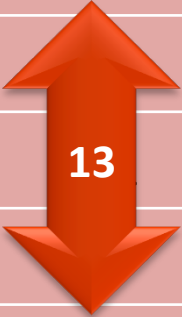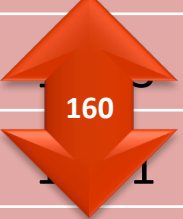
Reproductive programs chars

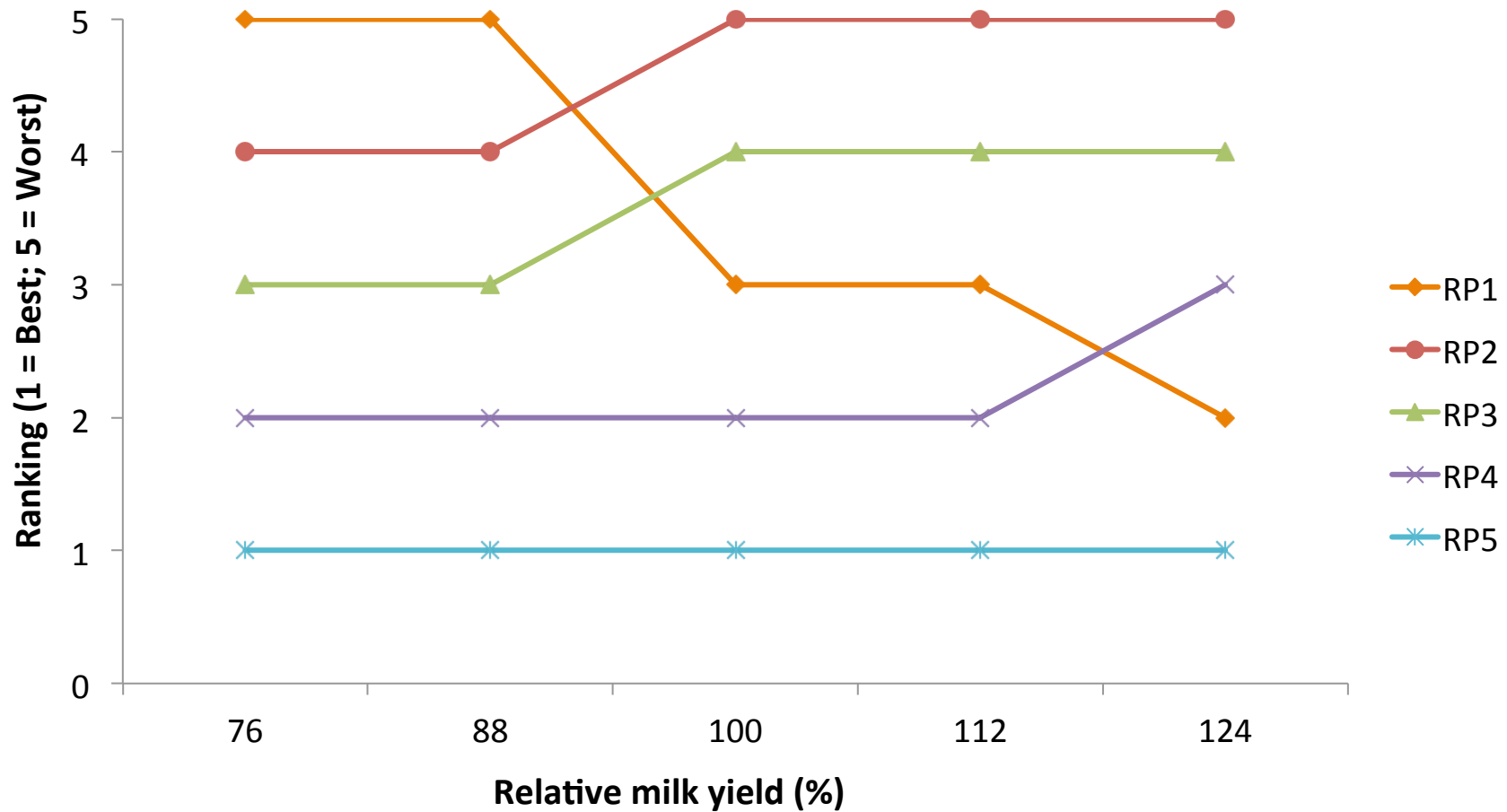| Repro Program	First AI			Second and subsequent AI			21dPR(%)
	ED before 1st TAI	CR ED before 1st TAI	CR TAI	ED before TAI	CR ED before TAI	CR TAI	
RP1	-	-	42	-	-	30	**17**
RP2	70	25	32	70	25	28	**14**
RP3	50	30	36	50	30	30	**16**
RP4	30	35	40	30	35	30	**18**
RP5	80	35	30	80	35	28	**20**

* A subset of reproductive programs studied in Giordano et al. (2012)

Results

- Herd values (US$) for five repro programs across five milk classes

Repro Program	21 d PR (%)	Relative milk yield to average lactation curve (%)				
		76	88	100	112	124
RP1	17	156	374	769	1,224	1,745
RP2	14		376	729	1,129	1,593
RP3	16	13	385		1,190	160
RP4	18		395	77	1,234	
RP5	20	169	410	806	1,248	1,753

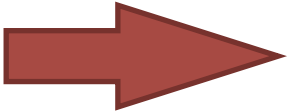# Ranking changes of 5 repro programs across 5 milk classes
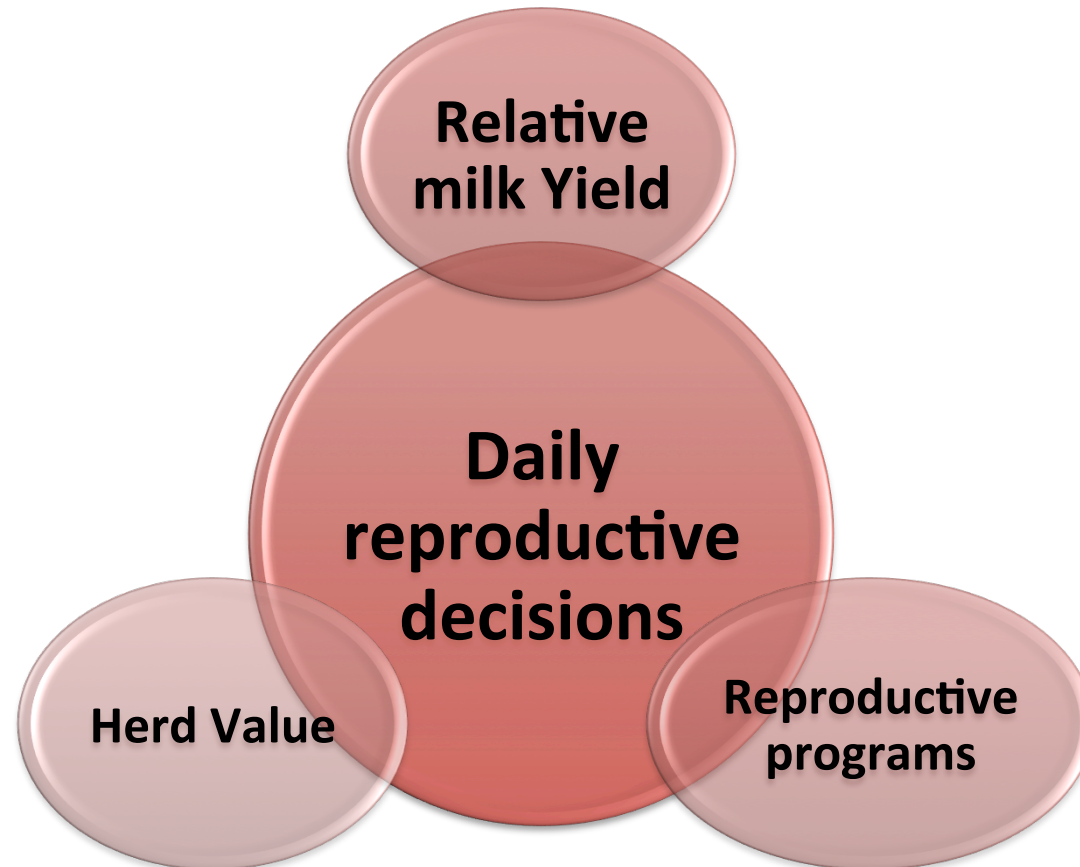
Source of difference btw repro programs
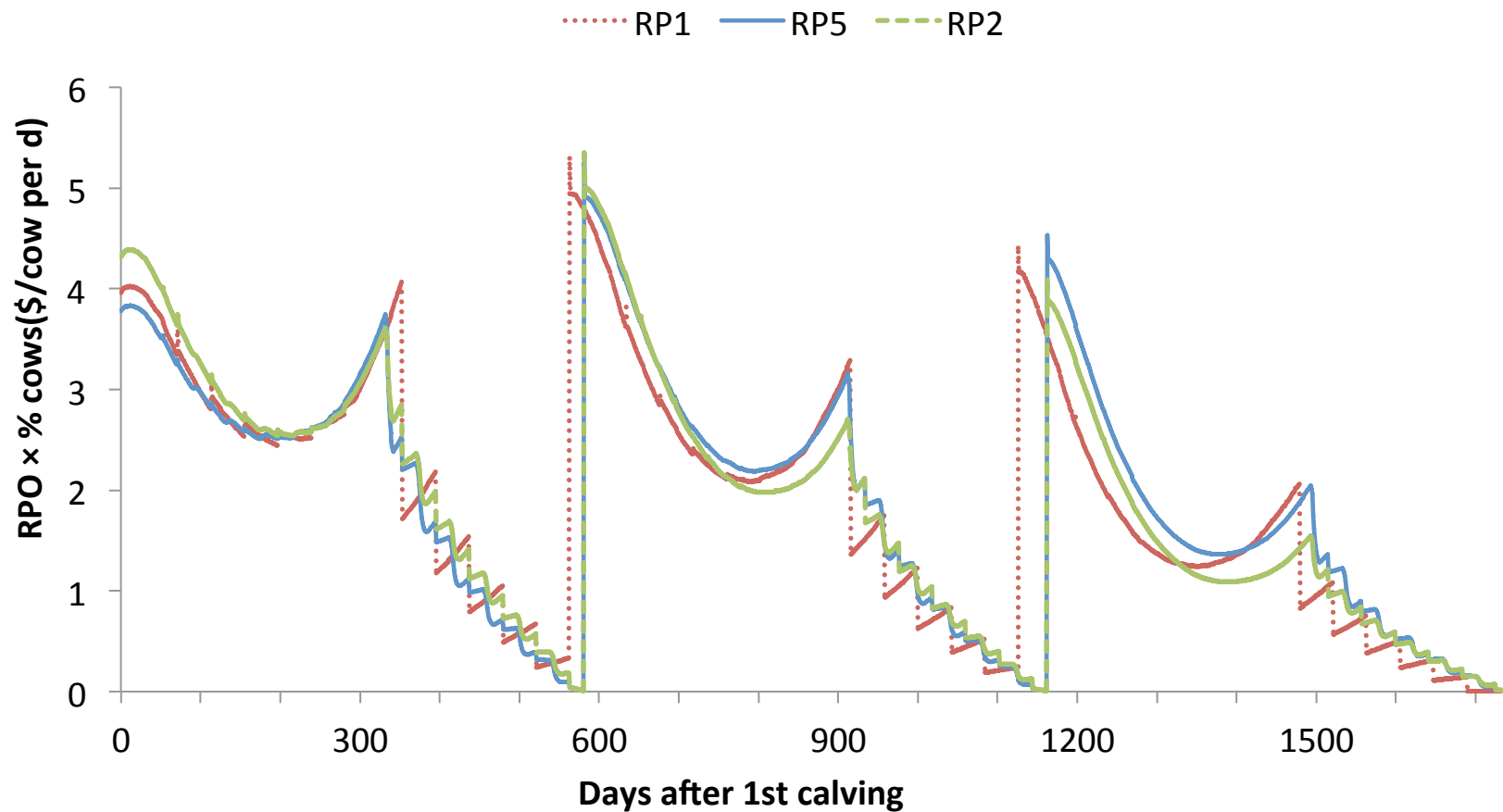
Conclusion

- Positive relationship between Reproductive performance and herd value

- There could be an opportunity to adjust the reproductive programs according to milk class

- daily decisions of assigning cows to different reproductive management groups based on their RPO **Improving a herd value**
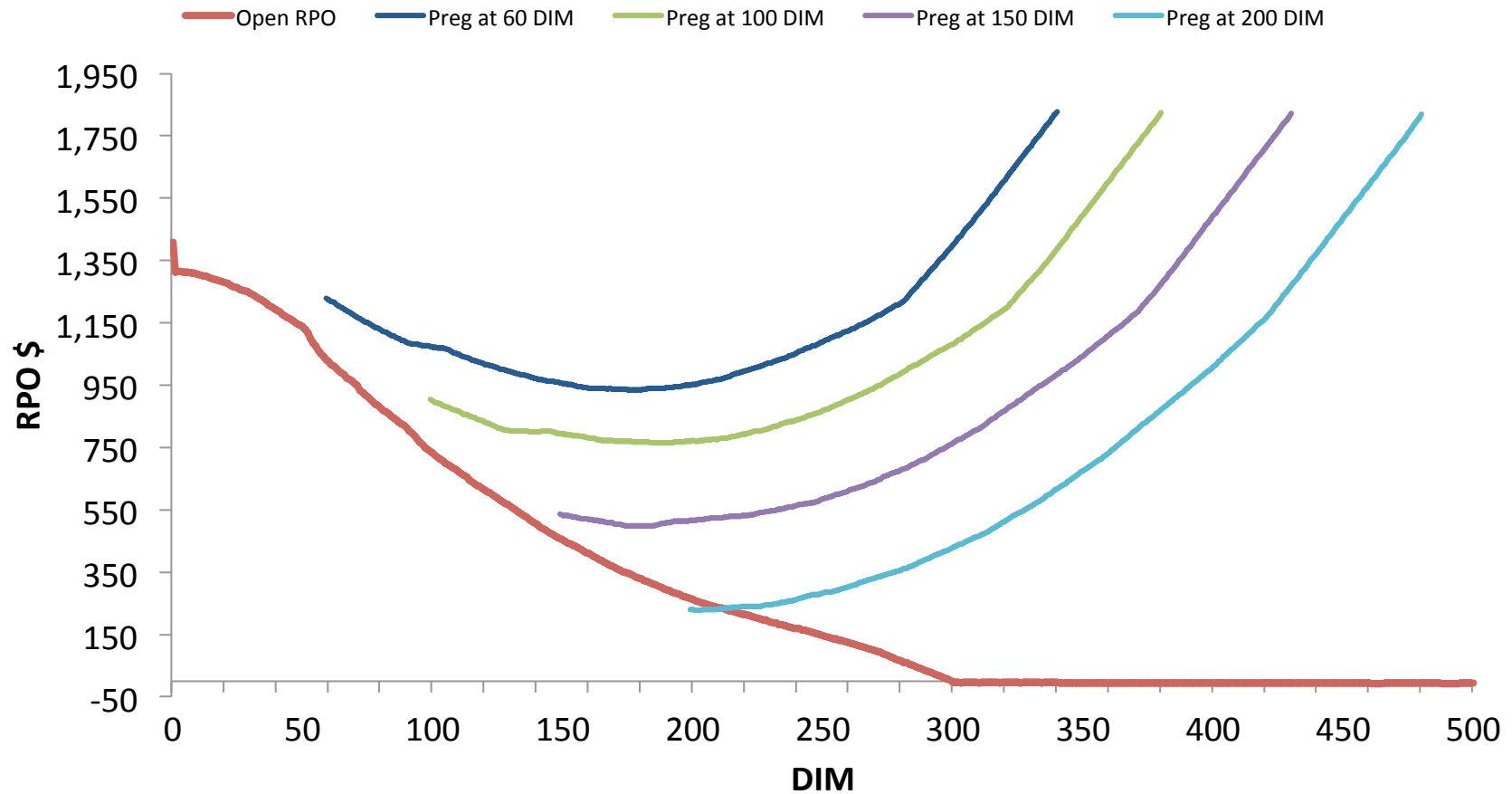
Conclusion...

Thank you!

RPO for different DIM at pregnancy

Changes in RPO for pregnancy at 120 DIM