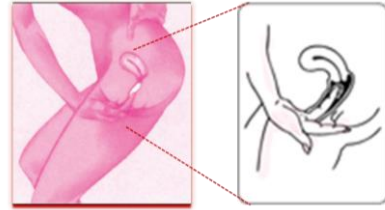
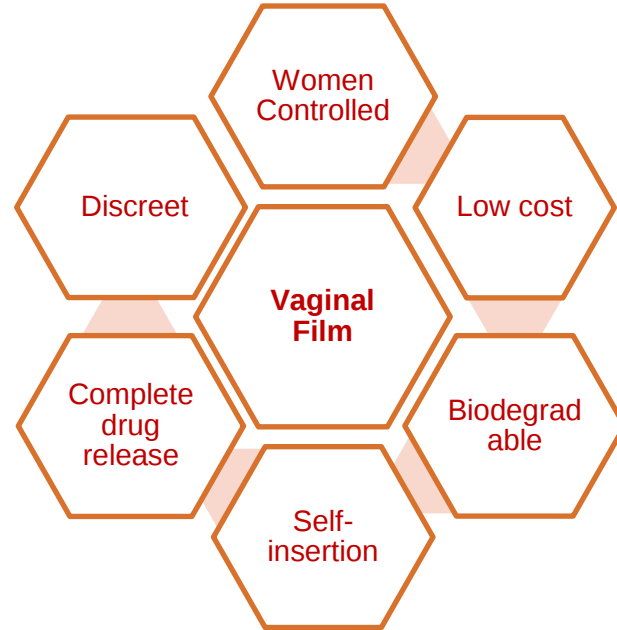
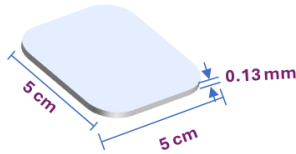


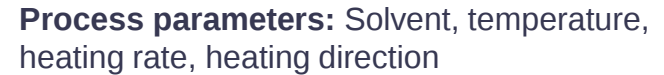
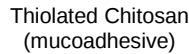
Translating vaginal films from bench to clinic: Interplay between user preferences and drug delivery considerations

Sravan Kumar Patel, MS, PhD
University of Pittsburgh
Magee-Womens Research Institute
July 15, 2025

What is a Film & How it Works?

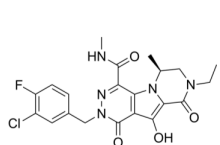
- Thin & flexible continuous matrix/sheet that carries drugs
- 50-200 μm
- <1 g



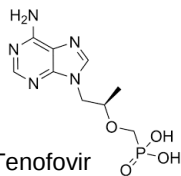


Progress toward vaginal film development & translation

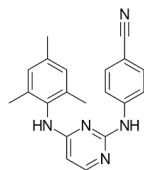
Payloads



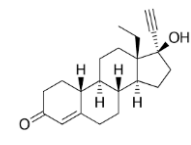
MK-2048



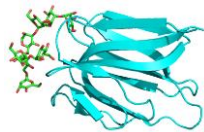
Tenofovir



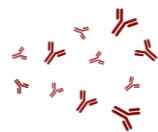
Dapivirine



Levonorgestrel



Griffithsin



mAb (HCA)

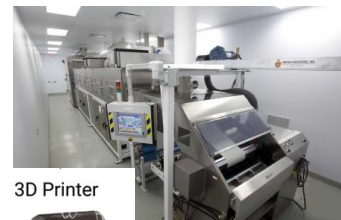
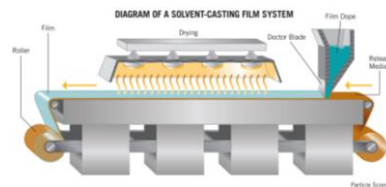


Nanoparticles

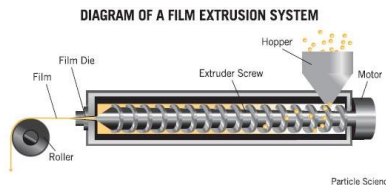


L. crispatus

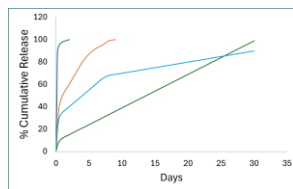
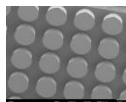
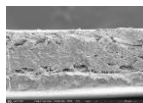
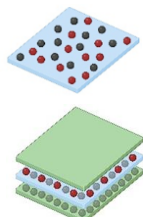
Manufacturing/scale-up



3D Printer

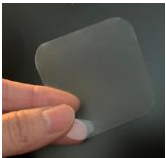


Designs



Translation





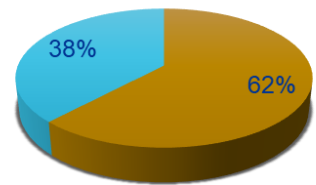
Vaginal films for HIV Pre-exposure prophylaxis (PrEP)

HIV and Pre-Exposure Prophylaxis

**Living with HIV
39 M**

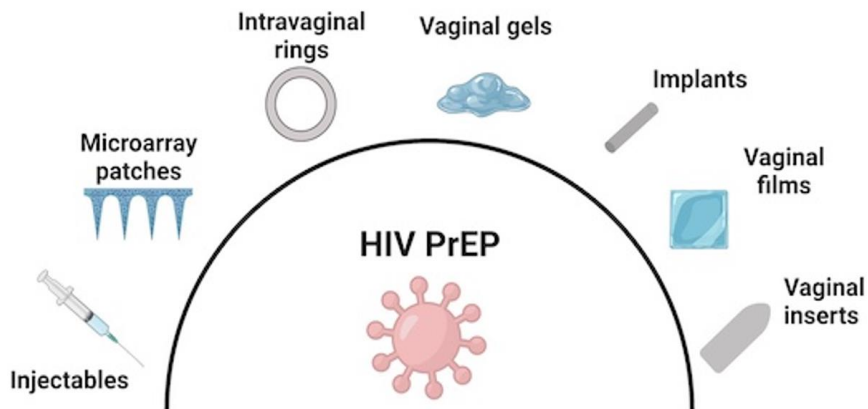
**New infections
1.3M**

(3x UN target for 2025)



■ Women and Girls ■ Other

Pre-Exposure Prophylaxis is the Key!



To achieve extended usability

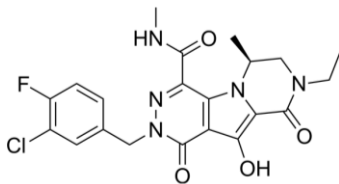


Mucoadhesion



Sustained drug release

MK-2048 weekly film

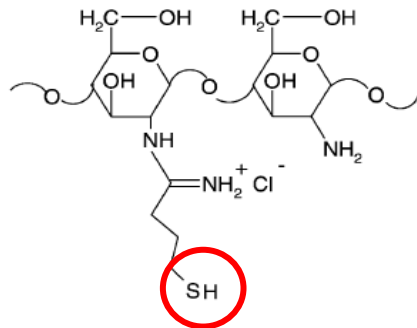


MK-2048

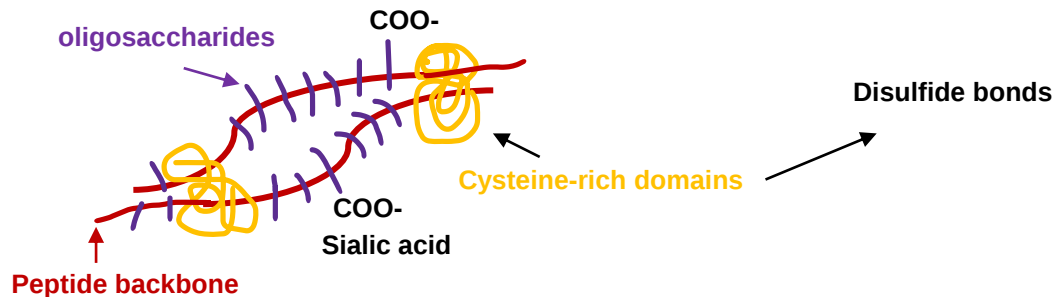
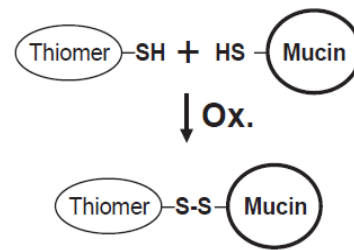
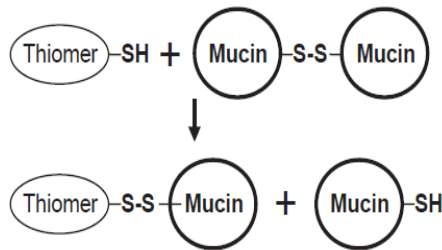
Integrase strand-transfer inhibitor

Goal: *Develop a vaginal film incorporating MK-2048 that can provide drug levels for one-week*

Imparting mucoadhesion



Thiolated chitosan

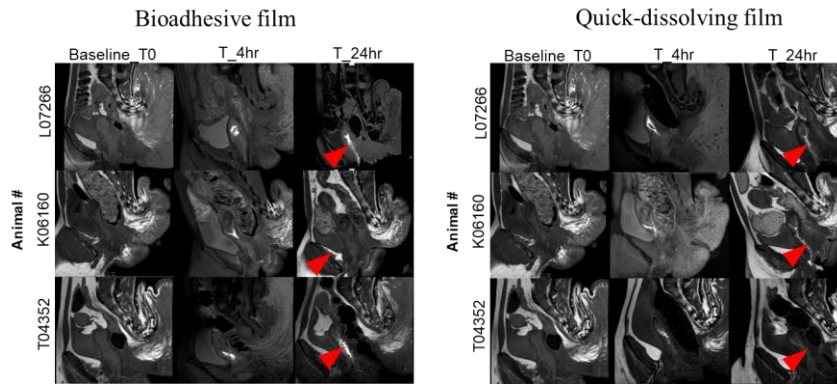


Andreas et, al. Advanced drug delivery review, 57 (2005) 1569– 1582

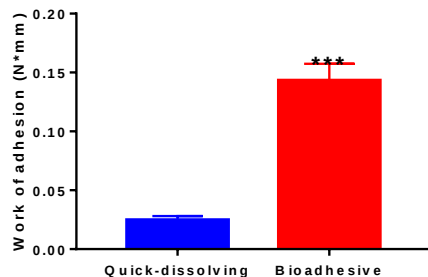
Imparting mucoadhesion to the film

Component	Quick-dissolve	Bioadhesive
PVA	✓	✓
HPMC E5	✓	✓
PEG 8000	✓	✓
Glycerin	✓	✓
Propylene glycol	✓	✓
Sodium starch glycolate	✓	X
Thiolated chitosan	X	✓
Drug	✓	✓

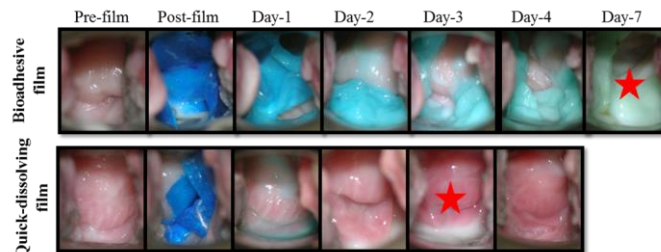
Contrast MRI (Gd incorporated films) shows longer retention



Mucoadhesion (porcine tissue)



Colposcopy (blue-dyed films) shows longer retention



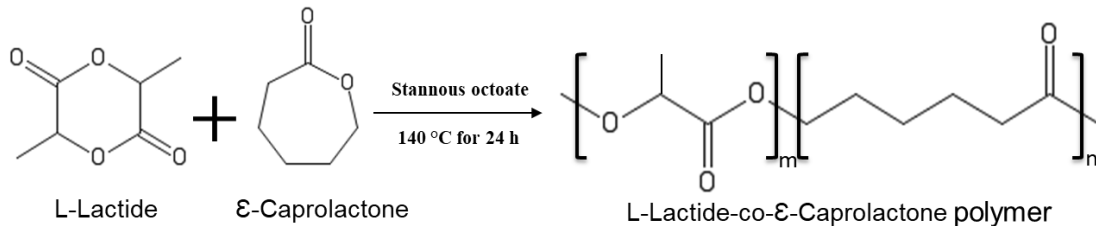
Pharmaceutics 2020, 12(1), 1

Incorporating sustained release

Polylactide-co-caprolactone



Biodegradable Elasticity/rigidity Film former



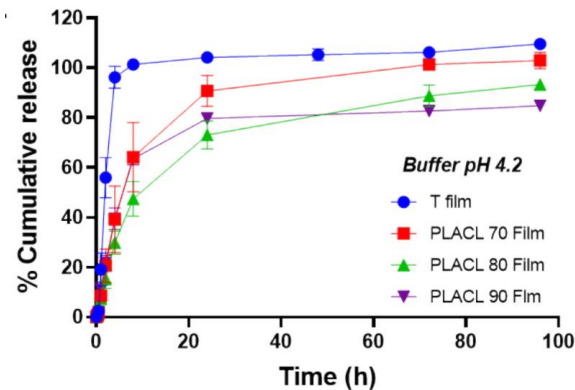
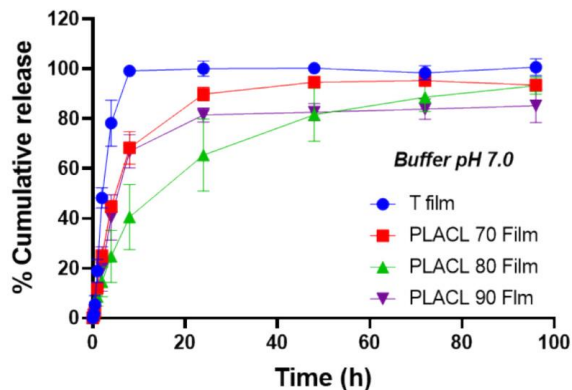
Polymer	Monomer feeding ratio (LA/CL)	M_n (kDa)	M_w (kDa)	M_w/M_n	Actual ratio of LA/CL	T_g ($^{\circ}\text{C}$)
PLACL 90	90:10	13.8	22.9	1.66	90:10	36.86
PLACL 80	80:20	12.3	19.8	1.61	81:19	27.75
PLACL 70	70:30	16.8	26.7	1.59	65:35	16.57

→ PLACL+PVA base film

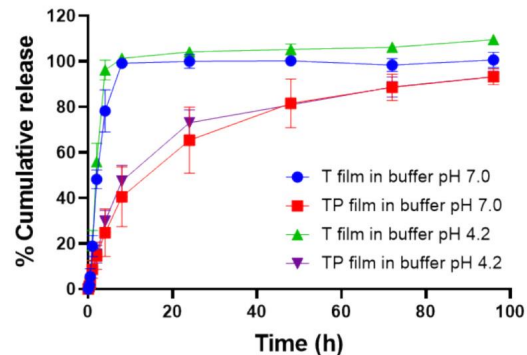
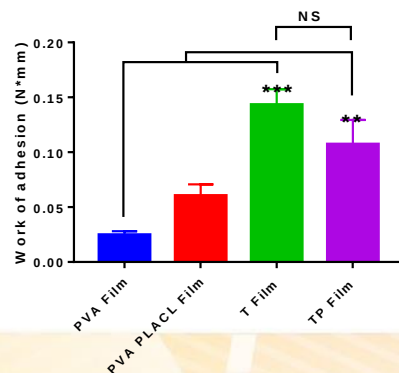
→ PLACL+Thiomer+PVA base film

J Control Release. 2025 379:696-707

PLACL films release MK-2048 in a sustained fashion



Thiomer+PLACL80 (TP) films are mucoadhesive and maintain sustained drug release



J Control Release. 2025 379:696-707



PHILADELPHIA, PA
JULY 13-18, 2025

**NEXT-GENERATION
DELIVERY INNOVATIONS**

In vivo evaluation in pigtail macaques



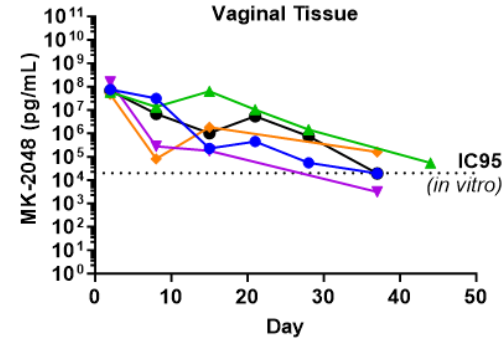
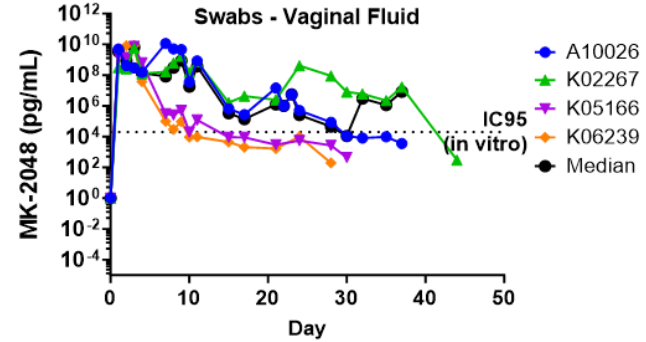
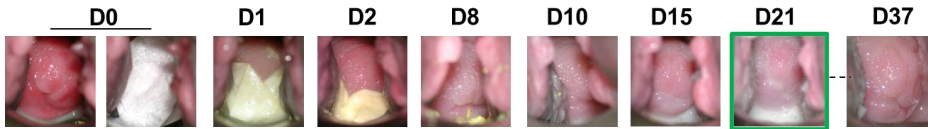
Female pigtail macaques



Films inserted once on day 0



Samples: plasma, tissue



J Control Release. 2025 379:696-707

Translating ER vaginal films to the clinic

Drug delivery features

Mucoadhesion

Sustained Release

In vitro tox/safety

Preclinical PK/safety

Are these sufficient?



Acceptability features

Geometry: Size, shape, thickness

Flexibility

Insertion success

Cost & scalability

Rapid translation to the clinic

User-feedback is central to film design

PAS-II/FACE/
QUATRO/FAME

Film acceptability
(US & Africa)

FLAG

Size & tactile
properties (Pittsburgh)

FAME-101/103B

Insertion success &
instructions (Pittsburgh)

MATRIX-002

Usability/acceptability
(US, South Africa,
Kenya, Zimbabwe)

Design consultations & Participatory Engagements



Packaging &
de-medicalization

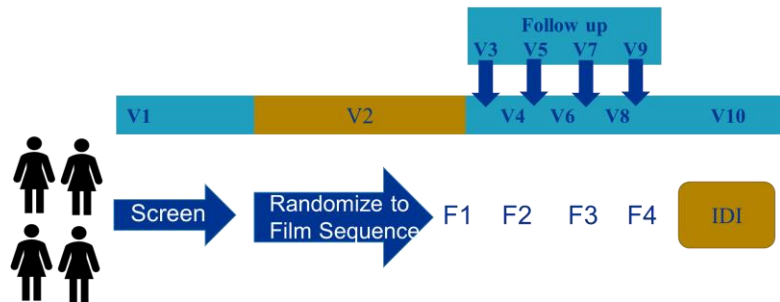


Stakeholder Engagements

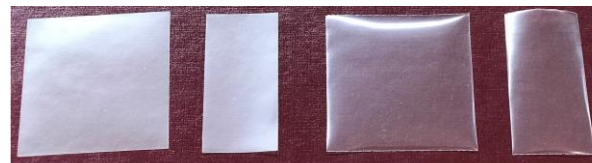
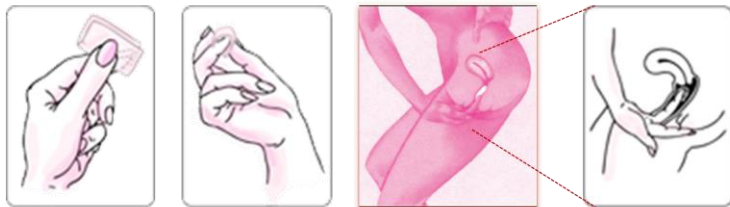


Film size & tactile properties – FLAG study

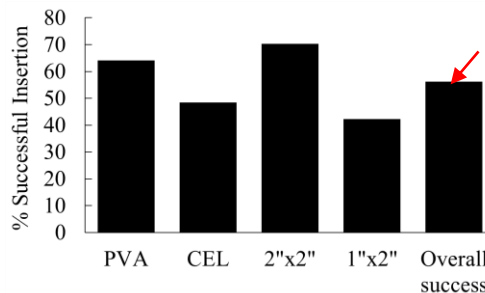
Trial Design (N=32 pre-menopausal women)



Self-administration of film, followed by clinician observation and assistance



2"x2" CEL 1"x2" CEL 2"x2" PVA 1"x2" PVA



Event	Number
Vaginal Discharge	7
Vaginal/vulvar Stickiness	7 (all PVA)
Vaginal Itching	3
Vaginal Candidiasis	2
Vaginal Dryness	3
Leakage	3
Vaginal Odor	1

- Film size and base polymer (tactile properties) affect the success of vaginal insertion, which could ultimately impact acceptability.
- Insertion success increases with use experience.
- A large size film with reduced stickiness is preferred by women.

Learnings from Stakeholder meetings & design consultations

Likes: discreet, self-administered, low cost, no pill burden

Questions/concerns: Impact of menses/sex, side effects, time to protection, square corners

[After immersing the product in water] “it immediately becomes soft, it is not hard anymore, but I think many women would **prefer** something **without sharp edges and not square.**”

-MAA, AYP Liaison Officer, LVCT Health, MOSAIC
NextGen Squad member, Kenya

“[The film] was easy [to insert]. So, once you put it in there, then if you remove the finger it will stick in there...With the film actually **my partner couldn't feel if there is something in there.**”

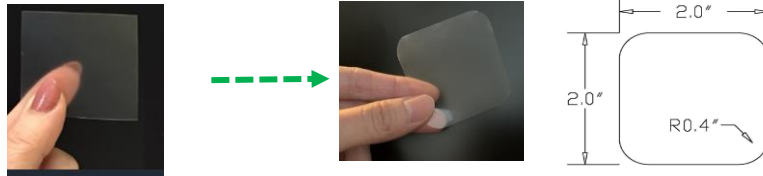
NM, former QUATRO study participant, Zimbabwe

“How can we expect to put something **square in a round hole?**”

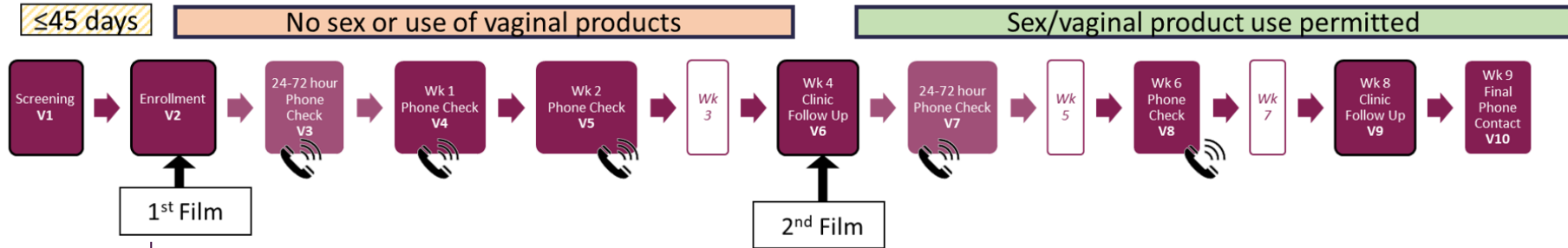
-Yvette Raphael, Executive Director, Advocates for the
Prevention of HIV in Africa (APHA), South Africa

Square vs. rounded corners – MATRIX-002

Placebo films with extended release composition



- Trial to assess **acceptability**, **usability** and **safety** of two placebo prototype vaginal films which differ in shape
- 100 participants (18-45 y/o) and up to 30 sexual partners



Square vs. rounded corners – MATRIX-002

Preference for film shape

Film shape	Month 1	Month 2
	Mean (range) N=84	Mean (range) N=75
Film A	8.0 (4-10)	9.0 (5-10)
Film B	8.9 (3-10)	8.8 (4-10)

Rating scale: 1-10, 10=high

Slightly higher preference for curved edge film

100% self-insertion success

	Month 1 N	Month 2 N
Films inserted	93	81
Inserted on 1 st attempt	90	80
Insertion required 2 or more attempts and/or assistance	3	1

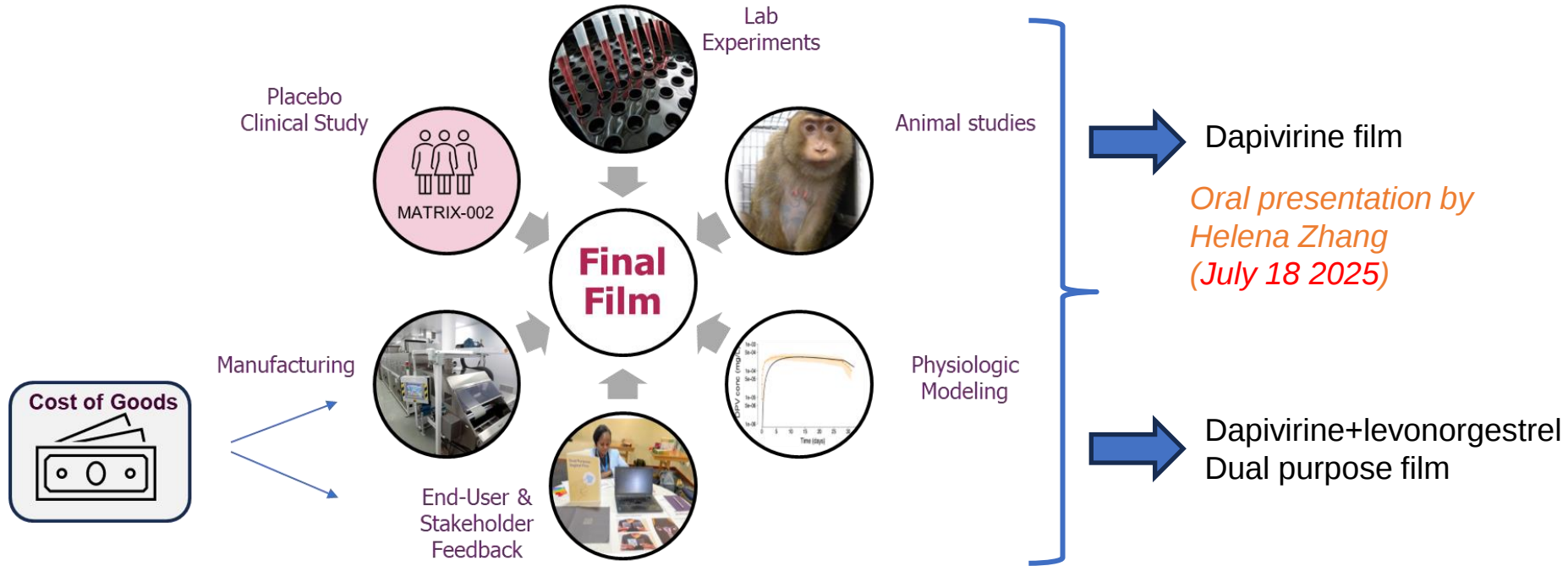
No significant adverse events



No impact on sex
Some reported improvement in pleasure

*“We tried having sex. I didn’t experience any irritation, or I didn’t feel that there was something in there, you understand? Things like that. So, **it was a normal thing**, you see.”*

One-month film development



Challenges

Scale-up



Scale: 0.2 kg
50 units



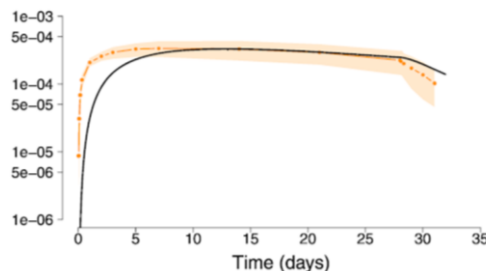
Scale: 20 kg
10,000 units



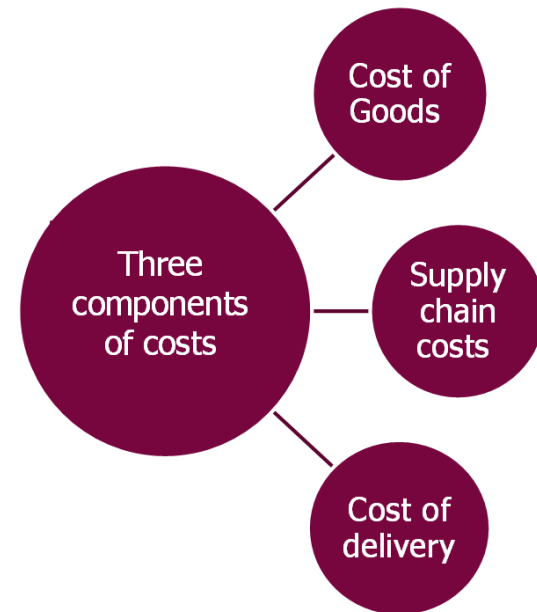
Translatability of preclinical models



PBPK models

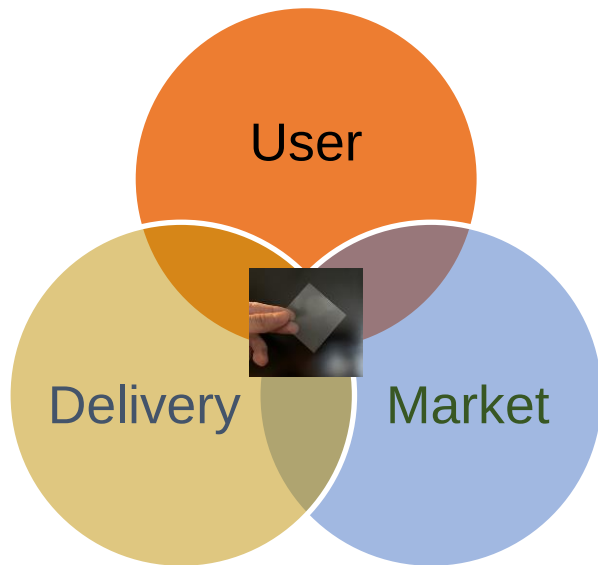


Costs



Summary

- Film matrix is tunable - mucoadhesion and sustained release
- User-centered approach informs film development & film attributes



Acknowledgements

Lisa Rohan

Jing Li
Junmei Zhang
Lin Wang
He Zhang
Sandeep Urandur
Phil Graebing
Hrushika Agashe
Galit Regev
Sheila Grab

MWRI/U Pittsburgh

Sharon Hillier
Katherine Bunge
Ingrid Macio
May Beamer
Urvi Parikh
Cory Shetler

University of Washington

Dorothy Patton
Yvonne Cosgrove-Sweeney

University of Colorado

Peter Anderson
Lane Bushman

Johns Hopkins University

Craig Hendrix
Mark Marzinke

CONRAD

Gustavo Doncel
Meredith Clark

Benefit Coatings

Craig Berry
Adam Berry

IPM/Population Council

Brid Devlin
Jeremy Nuttall

MATRIX-002 Protocol Chairs

Alexandra Minnis
Nyaradzo M. Mgodhi



Thank you

patels10@mwri.magee.edu