

Validation of a Penile Prosthetics Placement Simulation Platform for Surgical Training: a Comparative Study with Cadavers

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MEDICINE *of* THE HIGHEST ORDER



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Disclosures

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Intuitive – Grant

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Coloplast Consultant and Educator

Introduction

Surgical training constraints

- Work-hour mandates
- Shorter training programs
- Availability of expert surgical educators

Acquisition of prosthetic surgical skills

Cadaver simulation training

Need for penile simulation models

- Improve penile prosthetic surgery training

Lentz et al, Sex Med 2018
Oberlin et al, J Urol 2015
Onyeji et al, J Urol 2017

Objective

Full-immersion penile simulation models for prosthetic surgery

- Residents, fellows, and low volume penile prosthetic surgeons
- Procedural knowledge and confidence with placement of a penile prosthesis

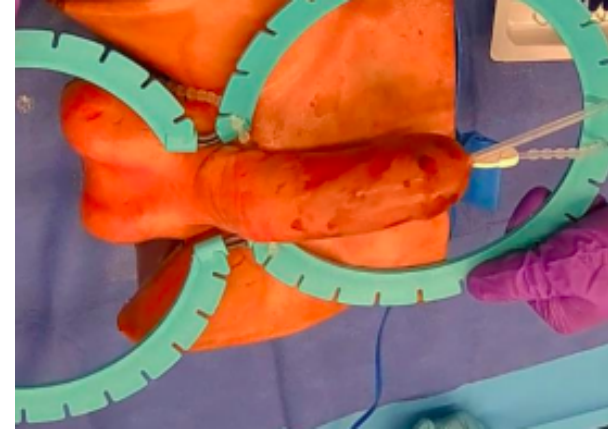
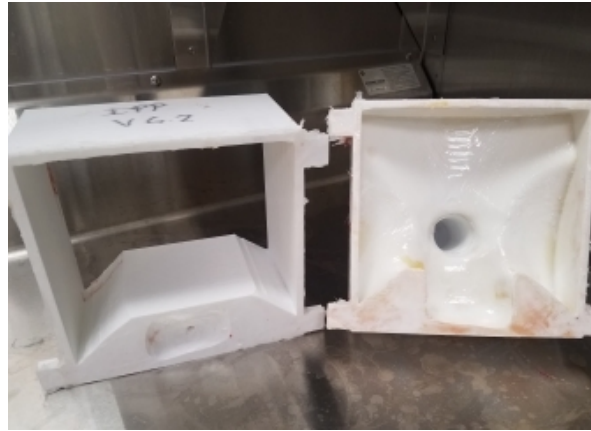
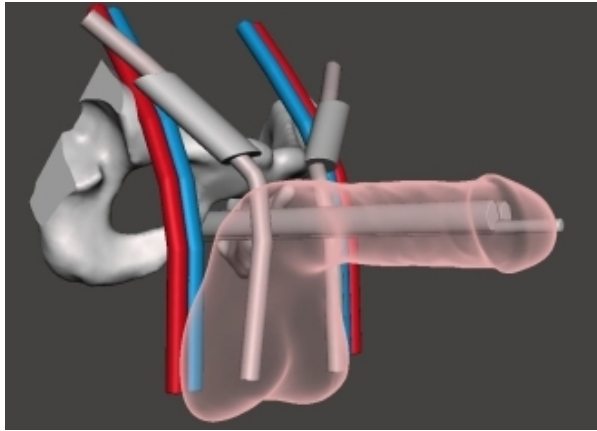
Penile models

- High-fidelity
- Non-biohazardous
- Cost-effective

Anatomical Male Pelvic Model

Computer-aided design (CAD) replicating pelvic anatomy

3D printed negative casts filled with Polyvinyl alcohol (PVA) to create hydrogel model



Methods

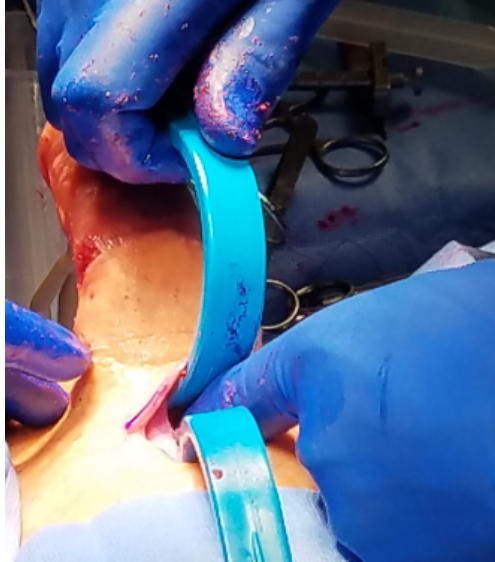
Combined Cadaver and Hydrogel Model Event

- Residents and low volume penile prosthesis surgeons (n=9)
- 3-Piece penile prosthesis placement (IPP) under the supervision of high-volume penile prosthesis implanters (n=3)
- Post-Simulation Questionnaires
 - Assessment of hydrogel model simulation construct to cadaver model
 - Operative experience
 - Educational effectiveness

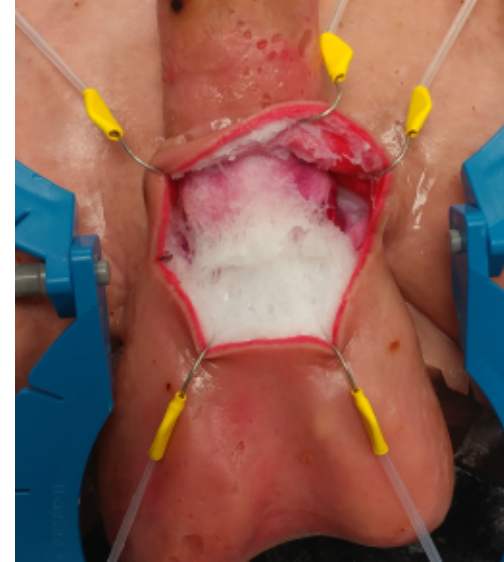


Incision and Exposure

Suprapubic

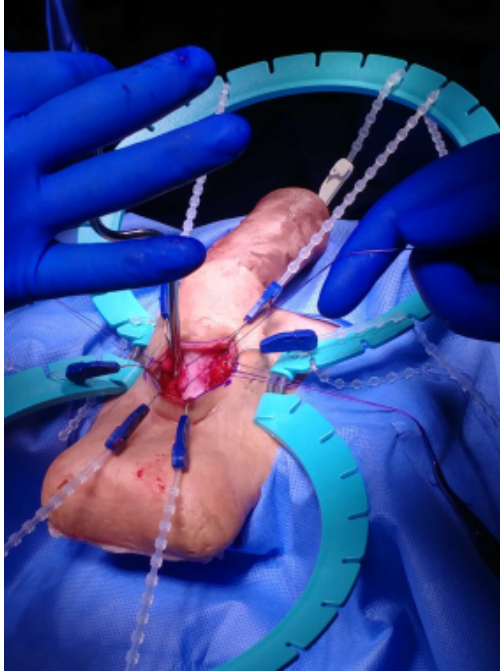


Penoscrotal

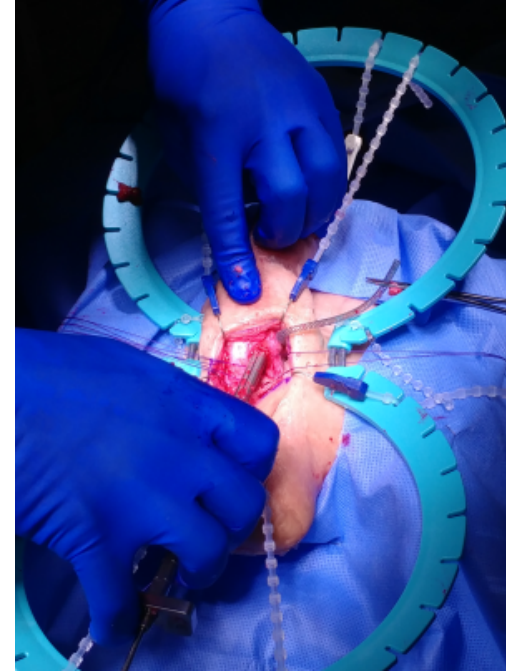


Dilation

Proximal Dilation

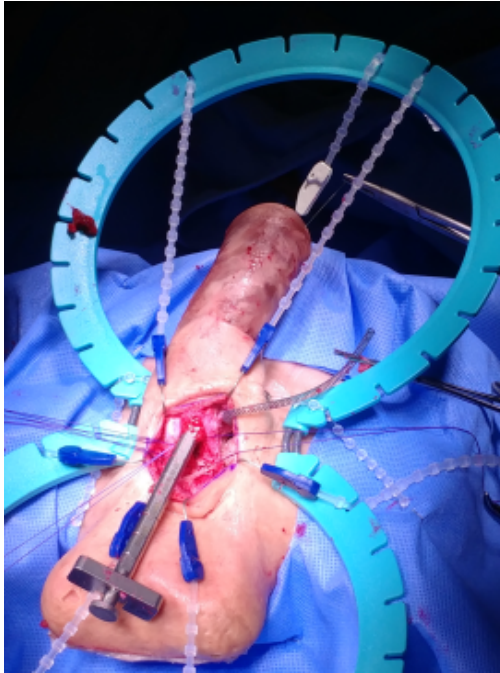


Distal Dilation

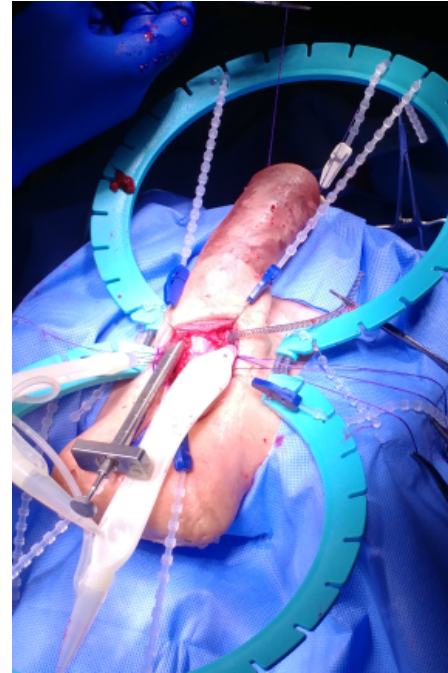


Corporal Measurement

Distal and Proximal

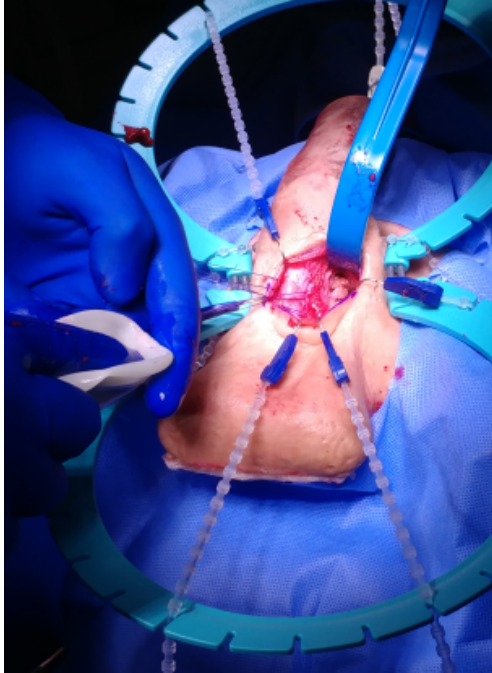


Modifiable Metrics

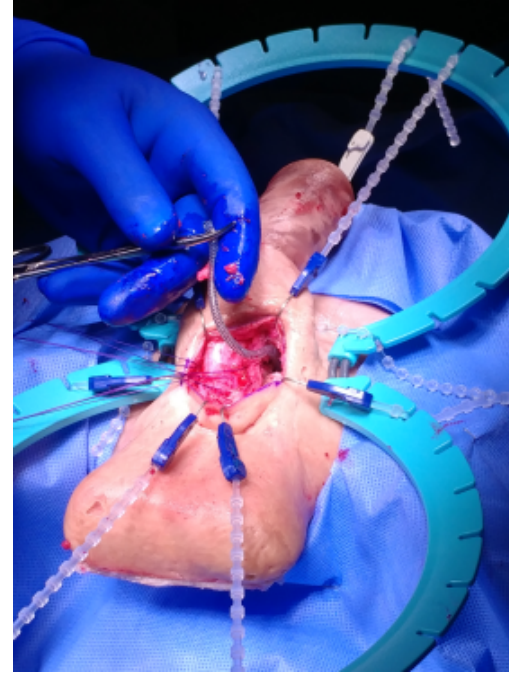


Reservoir Placement

Inguinal or Ectopic

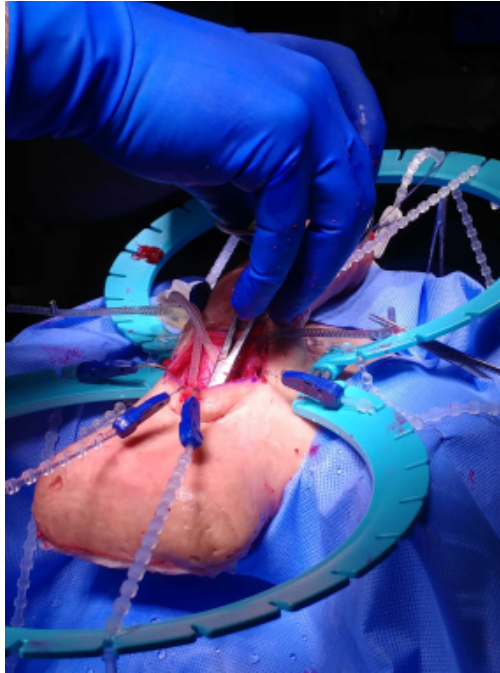


Retroperic Space

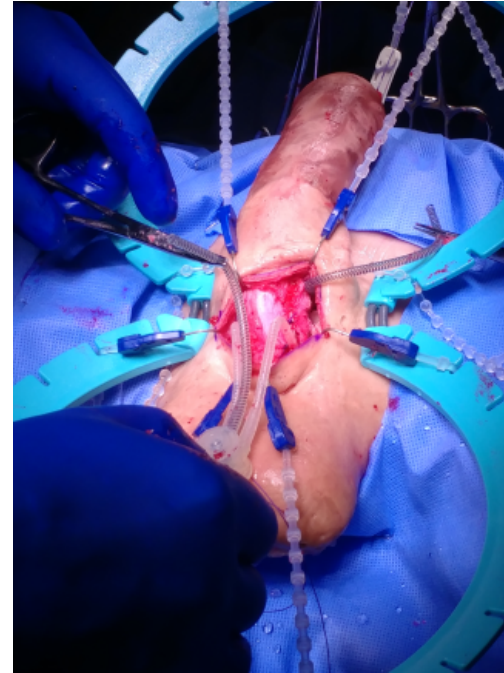


Pump Placement

Pouch
Development

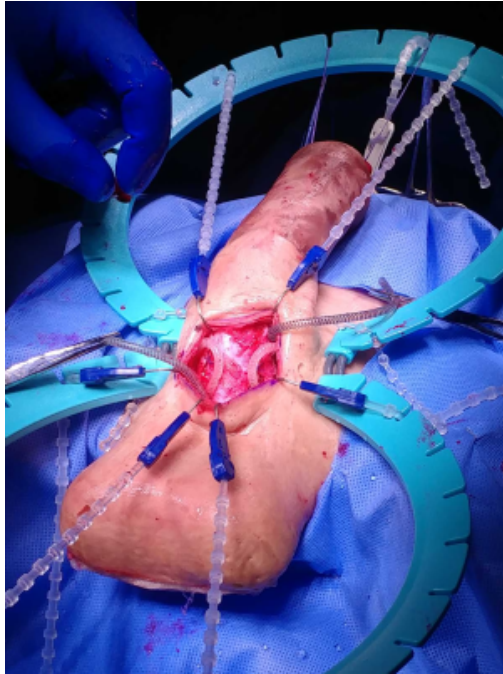


Pump Action



Connection and Closure

Connections

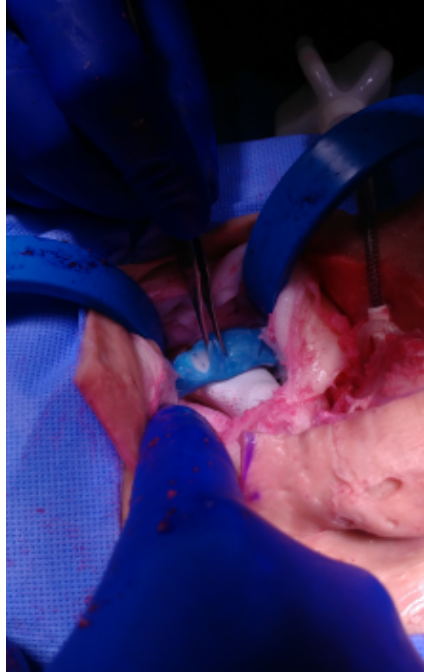


Skin Closure

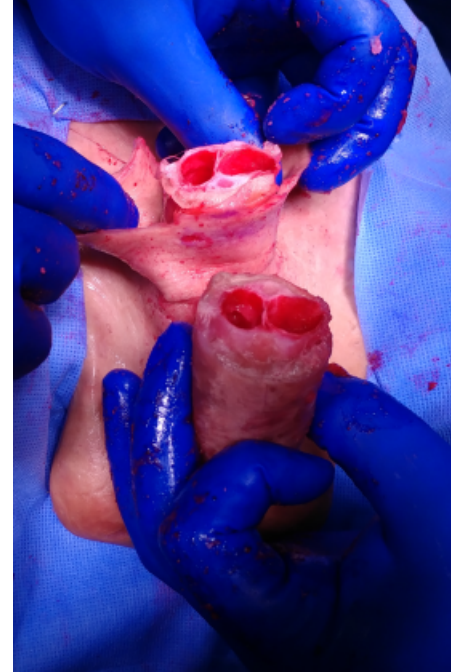


Error Recognition

Iliac Vessel
Assessment

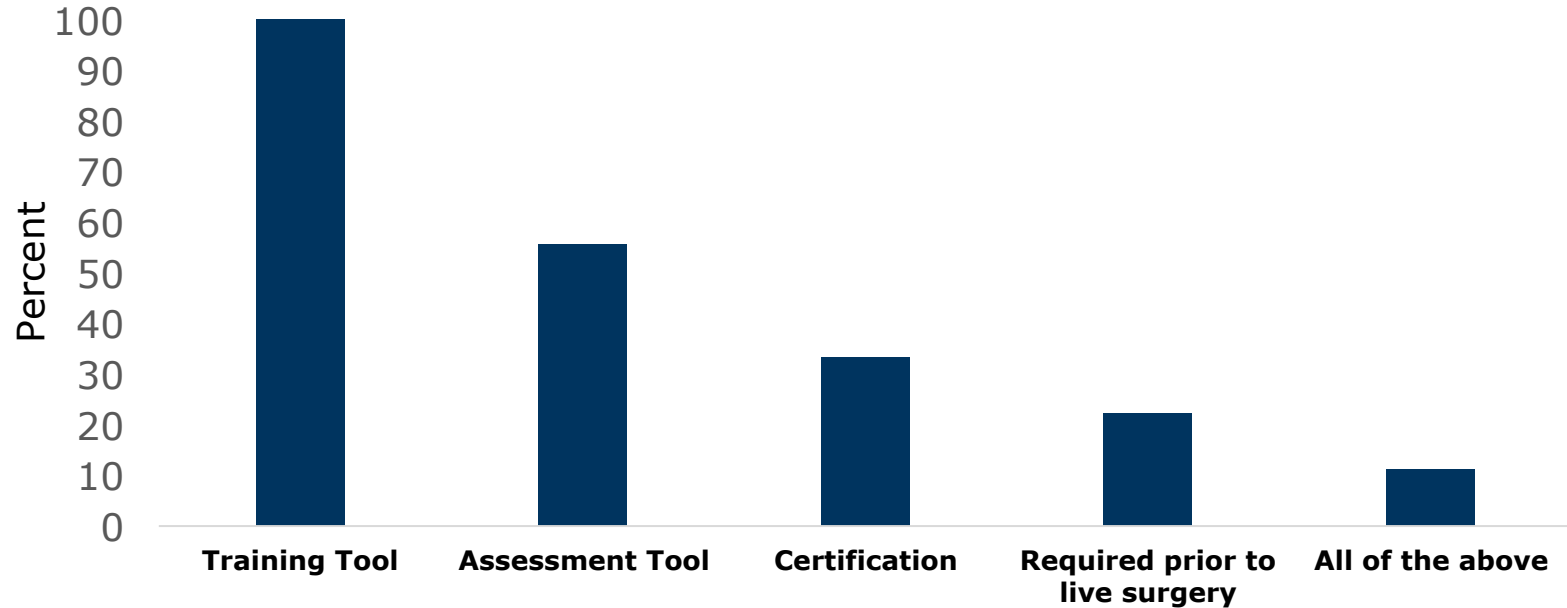


Corporal
Perforation

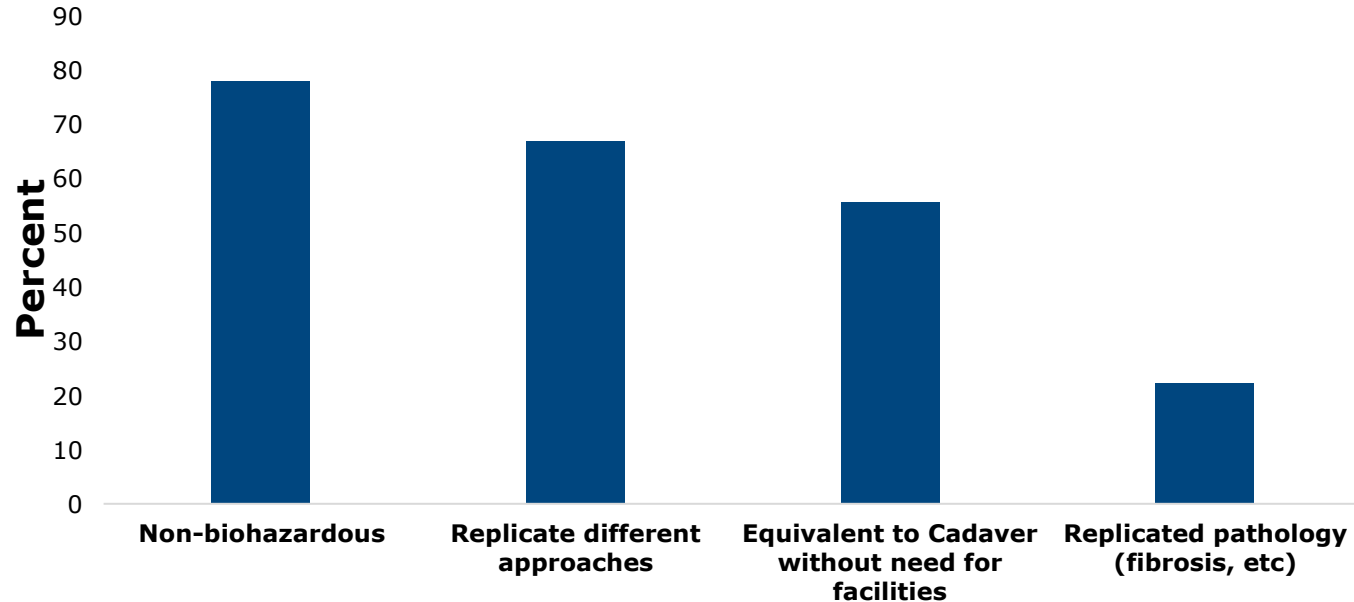


Task	Realistic Response Processes (%)
Skin Incision	77.78
Retraction	88.89
Corporal Dissection	55.56
Corporal Sutures	77.78
Corporotomy	88.89
Corporal Dilation (Proximal)	77.78
Corporal Dilation (Distal)	88.89
Prosthetic Measurement	77.78
Reservoir Placement	88.89
Prosthetic Placement	66.67
Pump Placement	22.22
Corporal Closure	66.67
Skin Closure	44.44

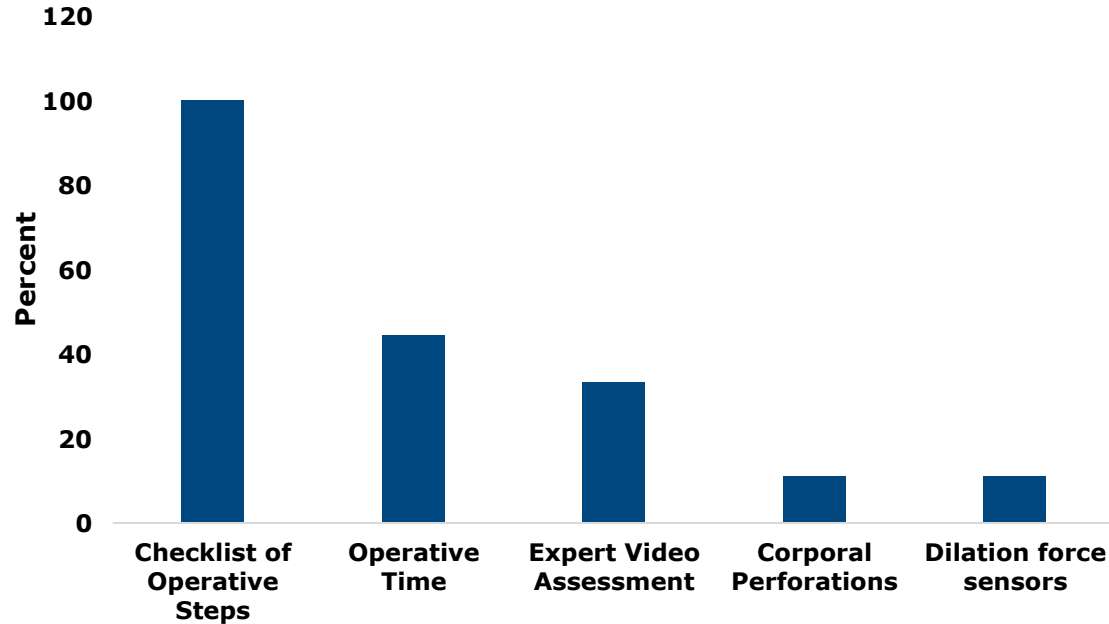
Simulation Construct Utility



Simulation Construct Utility

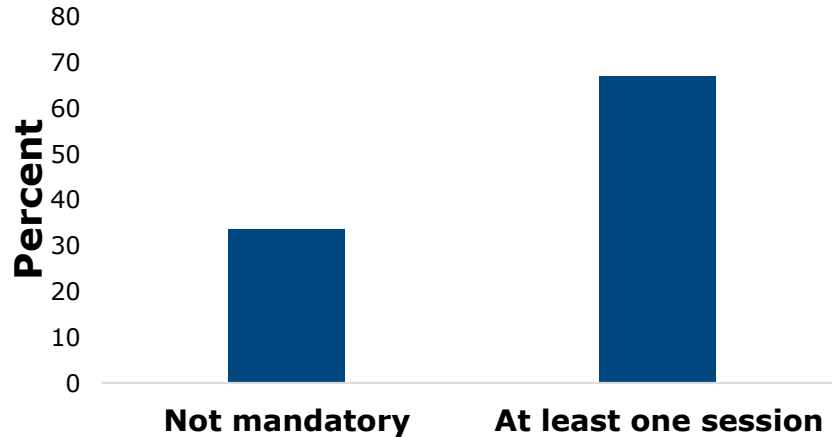


Requested Assessment Areas

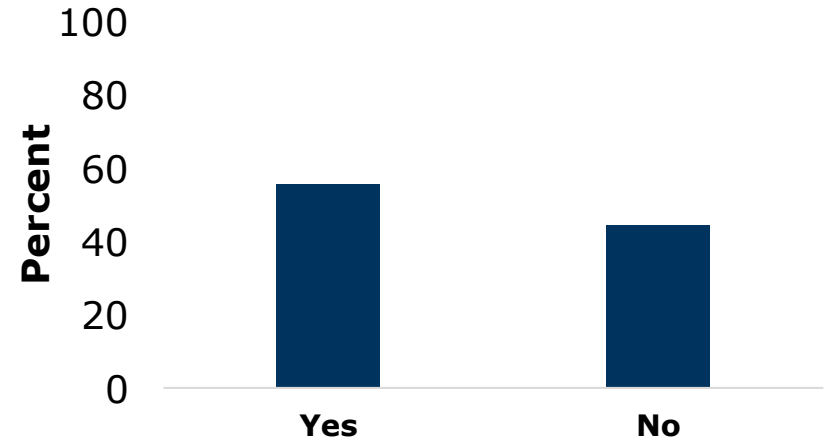


Simulation Implementation

Should the Hydrogel Model be Mandatory?



Can The Model Discriminate Skill Level?



Task Hierarchy

Rank	Expert (n=3)	Novice (N=9)
1	Corporal dilation	Corporal Exposure
2	Reservoir placement	Corporal Dilation
3	Corporal exposure	Reservoir Placement
4	IPP measurement	IPP Placement
5	IPP placement	IPP Measurement
6	Pump insertion	Corporal Closure
7	Corporal closure	Pump Insertion

Model Advantage Highlights

Cost-Effective

- Clinic
- Shipping
- Research
- Education

Future Improvements

- Tissue Texture
- Bleeding

Advantage	Participant Rating
Non-biohazardous	83.3%
Potential to Replace Cadavers	66.7%
Average Simulations Prior to Live Surgery	3.3x

Conclusion

Penile Prosthesis Simulation Model Construct

- Full-Immersion
- Non-Biohazardous
- Offers comprehensive full-task training
- Cost-effective and may improve patient safety by increasing surgical training exposure

Further comparison to cadaver simulation training will be needed for this novel simulation platform

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Thank You



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Simulation Innovation Lab
Create. Rehearse. Operate.

References

- **Lentz AC, Rodríguez D, Davis LG, Apoj M, Kerfoot BP, Perito P, Henry G, Jones L, Carrion R, Mulcahy JJ, Munarriz R. Simulation Training in Penile Implant Surgery: Assessment of Surgical Confidence and Knowledge With Cadaveric Laboratory Training. Sex Med. 2018 Dec;6(4):332-338.**
- **Oberlin DT, Matulewicz RS, Bachrach L, Hofer MD, Brannigan RE, Flury SC. National practice patterns of treatment of erectile dysfunction with penile prosthesis implantation. J Urol. 2015 Jun;193(6):2040-4.**
- **Onyeji IC, Sui W, Pagano MJ, Weinberg AC, James MB, Theofanides MC, Stember DS, Anderson CB, Stahl PJ. Impact of Surgeon Case Volume on Reoperation Rates after Inflatable Penile Prosthesis Surgery. J Urol. 2017 Jan;197(1):223-229.**