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ORIGINAL ARTICLE

Resident education in urogynecologic procedures through stepwise simulation: puerperium to prolapse

Nicole Wood,[a,*,†] Cecile A. Ferrando,[a,b] Vicki Reed[a] and Erin Higgins[a]

[a]*Women's Health Institute, Department of OBGYN, Cleveland Clinic Foundation, 9500 Euclid Ave, Cleveland, OH, 44195, USA;*
[b]*Women's Health Institute, Department of FPMRS, Cleveland Clinic Foundation, 9500 Euclid Ave, Cleveland, OH, 44195, USA*

**Corresponding author at: 85 Seymour St, Suite 525, Hartford, CT 06106, USA. Email: nicolejw1008@gmail.com*
[†]*Present address: Department of Urogynecology, Hartford Hospital, 85 Seymour St, Suite 525, Hartford, CT 06106, USA*

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Abstract

Background: Studies suggest that at the time of graduation most obstetrics and gynecology (OBGYN) residents cannot independently perform all Council on Resident Education in Obstetrics and Gynecology (CREOG)-recommended urogynecologic procedures. Lack of confidence in these procedures may be combatted with the use of simulation in education. This study aimed to describe and evaluate the success of a novel stepwise urogynecologic simulation pilot program developed to promote resident procedural confidence. **Methods:** A novel urogynecology simulation curriculum was developed, with an aim to maximize resident investment in urogynecologic procedures and promote diversity of learning through the incorporation of interprofessional instructors. The simulation was built to follow a single patient via stepwise stations through urogynecologic procedures they might encounter in a lifetime. Participants (post-graduate year [PGY] 1–4 OBGYN residents) completed a survey prior to and following the conclusion of the simulation. **Results:** Study participants included seven junior residents (70%; PGY1: $n = 4$, PGY2: $n = 3$) and three senior residents (30%; PGY3: $n = 1$, PGY4: $n = 2$). Statistically significant improvements were noted in resident confidence in performing the included procedures ($P = 0.018$), confidence in counseling about the procedures ($P = 0.001$), confidence in recognizing complications ($P = 0.0007$), preparedness in performing the procedures ($P = 0.001$), and likelihood they will perform the procedures in practice ($P = 0.029$). **Conclusions:** This simulation curriculum encouraged improved confidence and technical competency in urogynecologic procedures in OBGYN residents through skills development in a comprehensive simulation. We hope this intervention may be widely implemented to bolster urogynecologic education.

Keywords: *simulation; resident education; urogynecology; medical education; gynecologic education*

Introduction

Urogynecologic subspecialty patient care and surgical training is a smaller, but no less essential, component of general obstetrics and gynecology (OBGYN) residency training. National surveys of OBGYN residents and program directors suggest that there is a general gap in urogynecology resident education in most OBGYN residency programs. A national cross-sectional sample of third and fourth year OBGYN residents in the USA in 2007 reported that nearly half of surveyed residents were not satisfied with their urogynecology education.[1] While recently graduated OBGYN generalists felt comfortable counseling patients on prolapse and urinary incontinence,[2] they only felt comfortable performing a small number of urogynecologic procedures following graduation, including cystoscopy, anterior and posterior repairs, and McCall's culdoplasty.[1] In the same year, program directors reported that graduating residents could independently perform only four out of ten Council on Resident Education in Obstetrics and Gynecology (CREOG)- and American Urogynecologic Society (AUGS)-recommended urogynecologic procedures.[3] A more recent study of graduating resident case numbers reported a 26% decrease in incontinence and pelvic floor procedures from 2013 to 2019.[4] Calls have also been made to improve resident experience in outpatient urogynecologic tasks such as pessary fitting.[5,6]

Simulation has been shown across numerous specialties to improve resident surgical performance and confidence in

performing simulated procedures.[7] This holds true in urogynecologic procedures. Simulations addressing mid-urethral slings, in particular, have been shown to improve resident operative time, comfort, and preparation in performing the procedure.[8,9] Resident lack of confidence in performing urogynecologic procedures following graduation may be combatted with the increased use of simulation in urogynecologic education, particularly in those programs that do not have regular resident exposure to subspecialty urogynecologic fellows and staff surgeons.

To our knowledge, no previous published simulation curriculum has addressed several essential aspects of urogynecologic care using an interdisciplinary, interprofessional team of instructors for comprehensive resident urogynecologic education. Therefore, the primary objective of this study was to further add to the body of evidence surrounding resident simulation in urogynecology by describing and evaluating the success of a novel stepwise urogynecologic simulation pilot program in improving resident confidence in performing urogynecologic procedures. We hypothesized that implementation of this pilot program would lead to statistically significant increases in resident-reported scores of confidence in performing the included urogynecologic procedures.

Materials and methods

This was an Institutional Review Board (IRB)-approved (IRB# 22-1065) cross-sectional study surveying OBGYN resident physicians at a single institution who participated in a comprehensive interprofessional urogynecologic simulation. Data were collected via digital survey of residents who were active participants in the simulation.

A novel urogynecology simulation curriculum was developed, with the aim of maximizing resident investment in urogynecologic procedures and promoting diversity of learning through the incorporation of interprofessional instructors. Instructors included: generalist OBGYN physicians, urogynecology nurse practitioners, pelvic floor physical therapists, urogynecology fellows, and urogynecology staff physicians. The simulation was built to follow a single patient via vignettes through stepwise stations of urogynecologic procedures they might encounter in a lifetime, as follows: obstetric anal sphincter injury (OASIS) repair (previously described in the ACOG Obstetric Laceration Repair Simulation Module),[10] pelvic floor physical therapy (PFPT), mid-urethral sling (MUS) placement on a cadaver model, pessary placement and fitting, apical suspension/sacrocolpopexy on a box trainer model (previously described in Tunitsky-Bitton et al.),[11] and cystoscopy with stent placement on a bladder model. Vignettes and suggested materials for each station are outlined in Table 1, with examples of some individual stations shown in Fig. 1. No materials were specifically purchased for this simulation, and adaptations were made based on materials already in use by the department for other educational interventions. The simulation was preceded by a pre-brief and didactic session, and followed by a debrief. Additionally, each station incorporated a mini-didactic or brief overview of the topic prior to completion of the task. The general flow of the simulation is represented in Fig. 2. All stations were located in the same room in a simulation facility, allowing for ease of travel between stations. Residents rotated through each station in small groups, with a maximum of three residents in each group. Resident groups were allotted 20 min at each station. At each station, residents were oriented by the preceptor to the station and vignette, the required anatomy, and the materials, after which each resident was led step-by-step through the relevant procedure. The session began with a 30-min pre-brief to review the format of the simulation and basic information, and it ended with a 30-min debrief to review and reflect upon the skills learned. The total simulation time was 3 h.

Participants were OBGYN resident physicians in an accredited OBGYN residency program who were available to be physically present for the simulation and free of clinical responsibilities at that time. All levels of training (post-graduate year (PGY) 1–4) were invited to participate as part of their weekly didactics, and those who were able to be present were recruited for the study immediately prior to the simulation at the simulation site. In this OBGYN residency program, urogynecology training mainly takes place during the second half of the PGY2 year and the first half of the PGY3 year; therefore, some participants had no previous urogynecology education. Participants were included if they agreed to participate in the intervention, and additionally agreed to participate in a survey prior to and following the intervention. Participants were excluded from the study portion of the intervention if they declined to fill out the study survey. Participants were provided with an information sheet detailing the study prior to participation. Participants were not compensated for their participation.

A survey was developed within Research Electronic Data Capture (REDCap) consisting of approximately 40 questions, which was disseminated to all participants immediately prior to and immediately following the simulation via a web link. Survey questions were written in 10-centimeter Visual Analog Scale (VAS) format, which was modeled after a similar VAS-based questionnaire previously used in a study by Oliphant et al. regarding simulation for resident education on mid-urethral sling placement.[9] The questions

Table 1. Description of simulation stations

Station	Vignette	Staff	Materials
OASIS repair	A 35 year old G1P0 at 39w 2d gestation presents for admission for risk-reducing induction of labor, resulting in a 36 h induction and 4 h of pushing followed by a forceps-assisted delivery for maternal exhaustion. The patient experienced a 4th degree perineal laceration, and you have been called to the room to assist in the repair.	OBGYN attending physician (>10 years' experience), urogynecology fellow	• OASIS repair model (Limbs and Things Sultan Anal Sphincter Trainer used for this simulation). • Instruments: scalpel, needle driver, forceps, suture scissors. • Suture: 3-0 polyglactin 910 CT, 2-0 polyglactin 910 CT, 4-0 polyglactin 910 SH.
PFPT	Our patient is now 4 months post-partum. Her perineal laceration healed well, however she has persistently reported SUI following delivery that has not resolved during her post-partum course, as well as infrequent incontinence of gas. She was evaluated at the post-partum care clinic and referred for pelvic floor physical therapy to address these symptoms.	Pelvic floor physical therapist (>5 years' experience)	• Pelvic floor musculature model (Evotech Scientific used for this simulation). • Vaginal dilator/wand set (Intimate Rose used for this simulation). • EMG System stimulator (Pathway STM-10 used for this simulation).
MUS placement	Our patient experienced some mild improvement in urinary incontinence following pelvic floor physical therapy, however her SUI did not completely resolve, and is frequent enough that she wears a pad daily. She discussed these symptoms with her urogynecologist, and made a decision to defer further intervention until she had completed childbearing. Our patient now re-presents as a 38 year old G2P2, 1 year following an elective cesarean delivery of her second child. She has decided that she has completed childbearing, and would like to discuss further management of her SUI. She continues to experience leakage daily with laugh/cough/sneeze. Upon exam, you note Stage I apical prolapse, and a positive cough stress test. Her urinalysis is negative and her post-void residual is zero. After a discussion of management options, you agree to proceed with placement of a retropubic mid-urethral sling.	Urogynecology attending physician (>2 years' experience), urogynecology fellow	• Cadaver with female pelvic anatomy. • Retropubic mid-urethral sling (Boston Scientific mid-urethral sling used for this simulation). • Instruments: scalpel, curved Mayo scissors, Kelly forceps, Metzenbaum scissors, smooth forceps. • Suture: 2-0 polyglactin 910 SH.
Pessary fitting and placement	A 65 year old G2P2 with a history of SUI, re-presents to your clinic for bulge symptoms. You previously cared for her a number of years ago for SUI symptoms, and performed a MUS procedure. Patient recovered well from her procedure and has had no further SUI symptoms. She now complains of increasing vaginal bulge and pelvic pressure symptoms which have worsened over the last few years. She feels and has to reduce a vaginal bulge at least once per week, and it is becoming irritating and uncomfortable for her. You note Stage III apical prolapse on her POP-Q exam. You discuss treatment options, and she would currently like to avoid further surgical procedures. She elects for pessary fitting.	Urogynecology nurse practitioner (>5 years' experience)	• Pessary fitting kit (Cooper Surgical used for this simulation). • Pelvic training model (Limbs and Things Clinical Female Pelvic Trainer used for this simulation). • Lubricant.
Sacro-colpopexy	Our patient re-presents two years later as a 67 year old G2P2 with a history of SUI and stage III prolapse, currently using a size 4 ring with support pessary for treatment. She is doing well with the pessary and is taking it out to clean it every few months at home. She is becoming tired of caring for the pessary and would like to discuss surgical options to address her prolapse. After addressing options for surgical correction of prolapse, she elects to proceed with laparoscopic supracervical hysterectomy with sacrocolpopexy.	Urogynecology attending physician (>5 years' experience), urogynecology fellow	• Materials as previously published by Tunitsky-Bitton et al.[11]
Cystoscopy and ureteral stent placement	Following your apical suspension procedure, you perform a cystoscopy to ensure that no bladder injury occurred during the procedure. You notice a strong jet from the left ureter, but no efflux from the right ureter, despite IV-fluid bolus and fluorescein. You decide to proceed with ureteral stenting to ensure patency.	Urogynecology fellow ×2	• Cystoscopy bladder model (Boston Scientific Kidneys, Ureter and Bladder (KUB) Model used for this simulation). • Normal saline distension fluid. • 30 degree and 70 degree 21-French cystoscope with camera and cystoscopy video tower. • Ureteral stents.

CT: circle taper needle; EMG: electromyography; G: gravidity; MUS: mid-urethral sling; OASIS: obstetric anal sphincter injury; P: parity; PFPT: pelvic floor physical therapy; SH: small half circle needle; SUI: stress urinary incontinence.

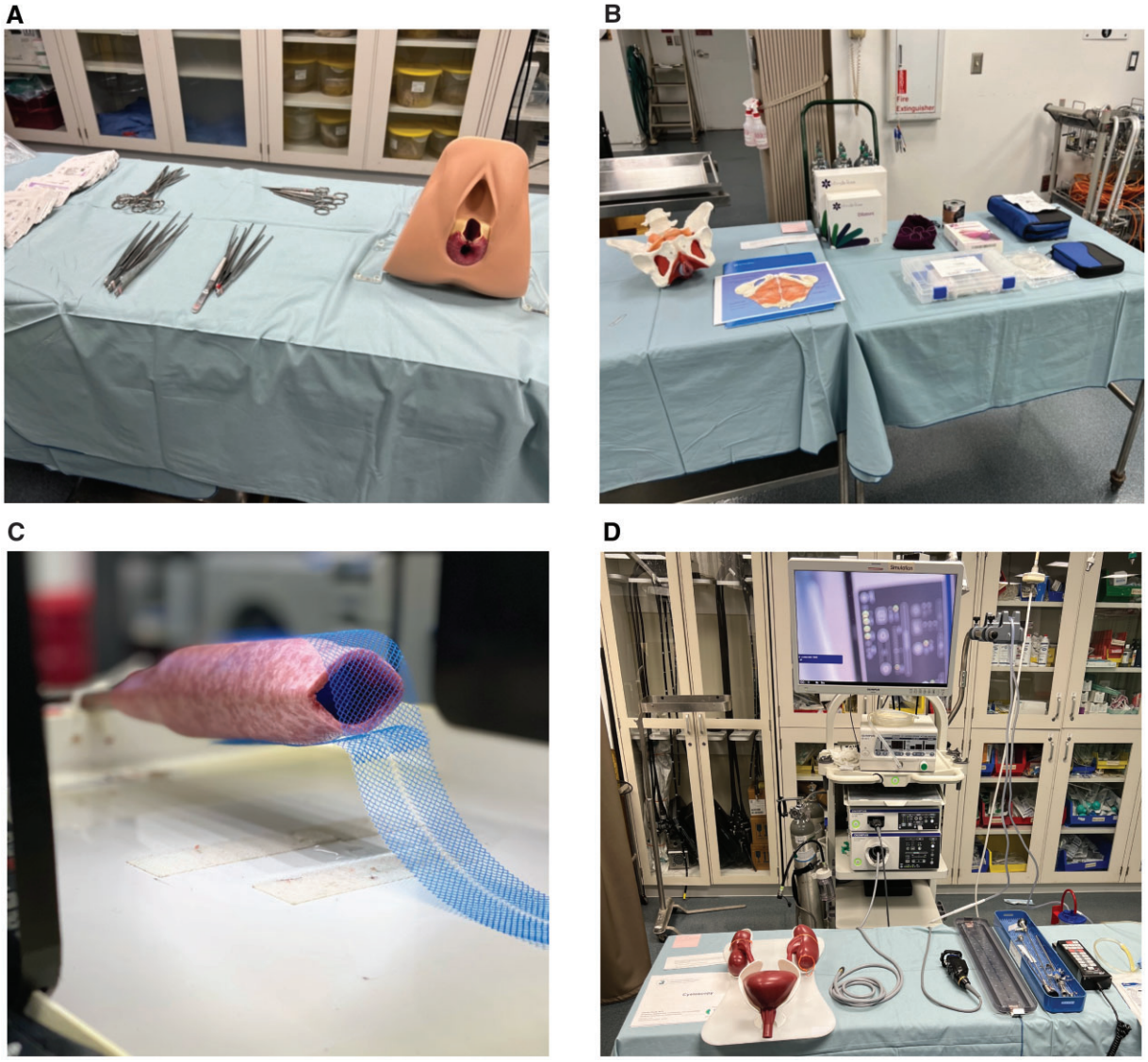

Figure 1. Simulation station setup examples. (A) OASIS repair; (B) pelvic floor physical therapy; (C) sacrocolpopexy model station[7]; (D) cystoscopy and ureteral stent placement.

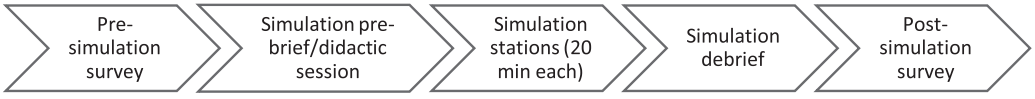

Figure 2. Simulation flow diagram.

evaluated each separate station in the simulation, as well as the simulation as a whole. Questionnaires were anonymous and de-identified.

Data were collected using the REDCap tool. Approximately normally distributed continuous measures were summarized using mean ± standard deviation (SD) and compared using two-sample *t*-tests. Categorical factors were summarized using frequencies (*n*) and percentages (%), and were compared using Pearson's chi-square tests or Fisher's exact tests. Multiple-group comparisons were performed using ANOVA tests. Tests were two-sided and considered significant at

$P < 0.05$. All data were analyzed using JMP 14.0 (SAS Institute Inc, Cary, NC).

Results

A total of 14 residents participated in the simulation curriculum, 10 of whom agreed to participate in the study (71.0% response rate). Of those residents, 10 residents (100.0%) completed the pre-intervention survey and seven (70.0%) completed the post-intervention survey. Study participants included seven junior residents (70%; PGY1: $n = 4$, PGY2: $n = 3$) and three senior residents (30%; PGY3: $n = 1$, PGY4: $n = 2$); 70.0% of all participants had not previously participated in a urogynecology rotation.

Table 2 outlines the differences in mean VAS scores pre- and post-intervention for all questions individualized to each station. Statistically significant increases in VAS scores were noted for all general simulation questions for the residency cohort as a whole (Q1.1 pre- 2.7 ± 2.95 vs. post- 5.86 ± 1.21, $P = 0.018$; Q1.2 pre- 2.4 ± 2.46 vs. post- 6.57 ± 1.51, $P = 0.001$; Q1.3 pre- 2.22 ± 2.17 vs. post- 6.57 ± 1.72, $P < 0.001$; Q1.4 pre- 2.11 ± 2.42 vs. post- 6.43 ± 1.51, $P = 0.001$; Q1.5 pre- 2.37 ± 2.50 vs. post- 5.43 ± 2.29, $P = 0.029$). Statistically significant increases in confidence in knowledge, performance of procedures, and recognition of complications as well as degree of preparation with training were noted in six out of seven included individual procedures (Table 2). No differences for each procedure were noted in the degree of likelihood that residents would perform procedures in practice prior to and following the intervention in five of seven included procedures. Exceptions to this were: Q1.5 "Degree of likelihood that you will perform all CREOG-recommended urogynecologic procedures in practice" (pre- 2.37 ± 2.50 vs. post- 5.43 ± 2.29, $P = 0.029$) and Q7.6 "Degree of likelihood that you will perform a cystoscopy and ureteral stent placement in practice (if you were to pursue generalist practice)" (pre- 4.0 ± 2.89 vs. post- 7.57 ± 1.61, $P < 0.001$), where resident views on likelihood of performing these procedures did not change.

Prior to the intervention, a significant difference was found in between PGY levels for four of five questions regarding confidence and preparedness in performing all CREOG-recommended urogynecologic procedures (Fig. 3), with junior residents reporting significantly lower VAS scores (Q1.1 $P = 0.021$; Q1.2 $P = 0.048$; Q1.3 $P = 0.046$, Q1.4 $P = 0.039$). Notably, Q1.5, regarding the likelihood of performing all CREOG-recommended procedures in practice, was an exception with no difference in responses (Q1.5 $P = 0.07$). In contrast, in the post-intervention survey (Fig. 4), the VAS score gaps closed, and response differences between PGY class for all questions were non-significant (Q1.1 $P = 0.061$; Q1.2 $P = 0.53$; Q1.3 $P = 0.24$, Q1.4 $P = 0.34$; Q1.5: $P = 0.61$) (Fig. 4).

Discussion

This study aimed to evaluate the success of a newly developed urogynecology simulation curriculum. The intervention increased resident confidence in knowledge and performance of the included procedures. Interestingly, this intervention did not change resident perceptions of likelihood to perform specific included procedures in future generalist practice.

This study found gaps in residents' perceptions of their performance, counseling, and preparedness in urogynecology procedures between PGY years, and those gaps closed following implementation of the simulation curriculum. Additionally, it found improvements in these elements in the general simulation and by each task following the intervention in the cohort as a whole. Previous studies investigating periodic, structured, or case-based curricula covering urogynecology or general OBGYN topics have shown improvements in resident knowledge and satisfaction with their education;[12–14] however, these curricula did not include simulation. Simulation curricula targeting a specific urogynecologic procedure, such as mid-urethral sling placement, have also shown improvement in resident confidence, operative time, and skill with these procedures.[8,9] However, it is important to recognize the limitations of simulation for trainees or low volume surgeons in real world surgical outcomes, and how this may play into the Dunning–Kruger effect, wherein those individuals with little expertise in a task overestimate their ability.[15] Additionally, it must be considered that the small participant sample size of this study and smaller post-intervention response group may indicate an over-estimation of the change in confidence.

Our study interestingly found that residents did not change their opinion regarding which, if any, urogynecology procedures they would feel comfortable performing in generalist practice following the intervention. This may suggest resident awareness of practice and referral patterns in their region, given decreasing case number trends prior to graduation and in generalist practice nationally.[1,2] When reviewing Accreditation Counsel for Graduate Medical Education (ACGME)-based procedural volume recommendations, 15 vaginal hysterectomies, 10 cystoscopies, and 25 incontinence and pelvic floor procedures are currently required for graduation from OBGYN residency.[16] National surveys of graduating residents have noted that graduating case numbers have been decreasing with 26% and 19%

Table 2. Pre- vs. post-intervention visual analog scale scores

Question	Pre-simulation ($N = 10$)	Post-simulation ($N = 7$)	*P*-value
General simulation			
Q1.1: Confidence in performing all CREOG-recommended urogynecologic procedures independently	2.7 ± 2.95	5.86 ± 1.21	0.018*
Q1.2: Confidence in counseling patients regarding all CREOG-recommended urogynecologic procedures	2.4 ± 2.46	6.57 ± 1.51	0.001*
Q1.3: Confidence in the ability to recognize a complication of urogynecologic procedures	2.22 ± 2.17	6.57 ± 1.72	<0.001*
Q1.4: Degree that residency training to this point has prepared you as a trainee to perform all CREOG-recommended urogynecologic procedures	2.11 ± 2.42	6.43 ± 1.51	0.001*
Q1.5: Degree of likelihood that you will perform all CREOG-recommended urogynecologic procedures in practice (if you were to pursue generalist practice)	2.37 ± 2.50	5.43 ± 2.29	0.029*
Obstetric anal sphincter injury (OASIS) repair			
Q2.1: Confidence in performing an OASIS repair independently	3.23 ± 3.29	6.28 ± 1.79	0.037*
Q2.2: Confidence in knowledge of the steps of OASIS repair	4.14 ± 3.21	8.14 ± 1.68	0.006*
Q2.3: Confidence in the anatomy of the perineum	4.78 ± 2.33	7.14 ± 1.35	0.024*
Q2.4: Confidence in the ability to recognize a complication in OASIS repair	3.36 ± 2.76	6.0 ± 2.0	0.037*
Q2.5: Degree that surgical training to this point has prepared you as a trainee to perform an OASIS repair	4.14 ± 3.23	6.86 ± 1.46	0.049*
Q2.6: Degree of likelihood that you will perform an OASIS repair in practice (if you were to pursue generalist practice)	7.0 ± 2.72	7.71 ± 1.89	0.54
Pelvic floor physical therapy (PFPT)			
Q3.1: Confidence in describing PFPT to a patient accurately	3.73 ± 2.76	7.43 ± 0.98	0.004*
Q3.2: Confidence in knowledge of PFPT exercises	3.09 ± 2.47	6.71 ± 1.79	0.004*
Q3.3: Confidence in the anatomy of the pelvic musculature	5.0 ± 2.49	7.0 ± 0.82	0.059
Q3.4: Degree that residency training to this point has prepared you as a trainee to counsel patients regarding PFPT	2.45 ± 2.62	6.71 ± 1.38	0.001*
Q3.5: Degree of likelihood that you will counsel patients on PFPT in practice (if you were to pursue generalist practice)	5.54 ± 3.14	7.86 ± 1.57	0.09
Mid-urethral sling (MUS) placement			
Q4.1: Confidence in performing a MUS placement independently	1.42 ± 2.27	5.0 ± 1.91	0.003*
Q4.2: Confidence in knowledge of the steps of MUS placement	2.67 ± 2.90	6.71 ± 1.38	0.003*
Q4.3: Confidence in the anatomy of the retropubic space	2.92 ± 2.57	6.14 ± 1.95	0.01*
Q4.4: Confidence in the ability to recognize a complication in MUS placement	2.09 ± 2.39	5.71 ± 2.63	0.008*
Q4.5: Degree that surgical training to this point has prepared you as a trainee to perform a MUS placement	2.08 ± 2.75	6.0 ± 1.41	0.003*
Q4.6: Degree of likelihood that you will perform a MUS placement in practice (if you were to pursue generalist practice)	2.75 ± 2.53	4.14 ± 2.67	0.27
Pessary fitting and placement			
Q5.1: Confidence in performing a pessary fitting independently	1.36 ± 1.80	6.14 ± 2.11	<0.001*
Q5.2: Confidence in knowledge of the steps of a pessary fitting	1.45 ± 1.87	7.14 ± 1.21	<0.001*
Q5.3: Confidence in the anatomy of the pelvic floor	4.27 ± 2.94	6.57 ± 1.27	0.07
Q5.4: Confidence in the ability to recognize a pessary-related complication	2.09 ± 2.30	6.57 ± 1.27	<0.001*
Q5.5: Degree that residency training to this point has prepared you as a trainee to perform a pessary fitting	1.82 ± 2.60	6.29 ± 1.25	<0.001*
Q5.6: Degree of likelihood that you will perform a pessary fitting in practice (if you were to pursue generalist practice)	3.18 ± 3.18	6.14 ± 2.48	0.054
Sacrocolpopexy			
Q6.1: Confidence in performing a laparoscopic sacrocolpopexy independently	0.73 ± 1.56	3.71 ± 2.06	0.003*
Q6.2: Confidence in knowledge of the steps of a laparoscopic sacrocolpopexy	1.73 ± 3.41	5.86 ± 2.79	0.012*
Q6.3: Confidence in the anatomy of the presacral space	2.18 ± 2.67	5.43 ± 2.37	0.019*
Q6.4: Confidence in the ability to recognize a complication in laparoscopic sacrocolpopexy	1.45 ± 2.77	4.71 ± 2.63	0.024*
Q6.5: Degree that residency training to this point has prepared you as a trainee to perform a laparoscopic sacrocolpopexy	1.64 ± 2.73	5.43 ± 2.30	0.008*
Q6.6: Degree of likelihood that you will perform a laparoscopic sacrocolpopexy in practice (if you were to pursue generalist practice)	1.55 ± 2.70	2.71 ± 3.35	0.43
Cystoscopy and ureteral stent placement			
Q7.1: Confidence in performing a cystoscopy and ureteral stent placement independently	2.36 ± 3.11	7.14 ± 1.21	0.001*
Q7.2: Confidence in knowledge of the steps of a cystoscopy and ureteral stent placement	3.45 ± 3.42	7.71 ± 1.79	0.008*
Q7.3: Confidence in the anatomy of the bladder and ureters	4.36 ± 3.47	8.0 ± 1.73	0.021*
Q7.4: Confidence in the ability to recognize a complication in cystoscopy and ureteral stent placement	2.36 ± 2.46	7.29 ± 1.38	<0.001*
Q7.5: Degree that residency training to this point has prepared you as a trainee to perform a cystoscopy and ureteral stent placement	3.0 ± 3.43	7.71 ± 1.49	0.004*
Q7.6: Degree of likelihood that you will perform a cystoscopy and ureteral stent placement in practice (if you were to pursue generalist practice)	4.0 ± 2.89	7.57 ± 1.61	0.009*

CREOG: Council on Resident Education in Obstetrics and Gynecology.
*Indicates statistical significance ($P < 0.05$).

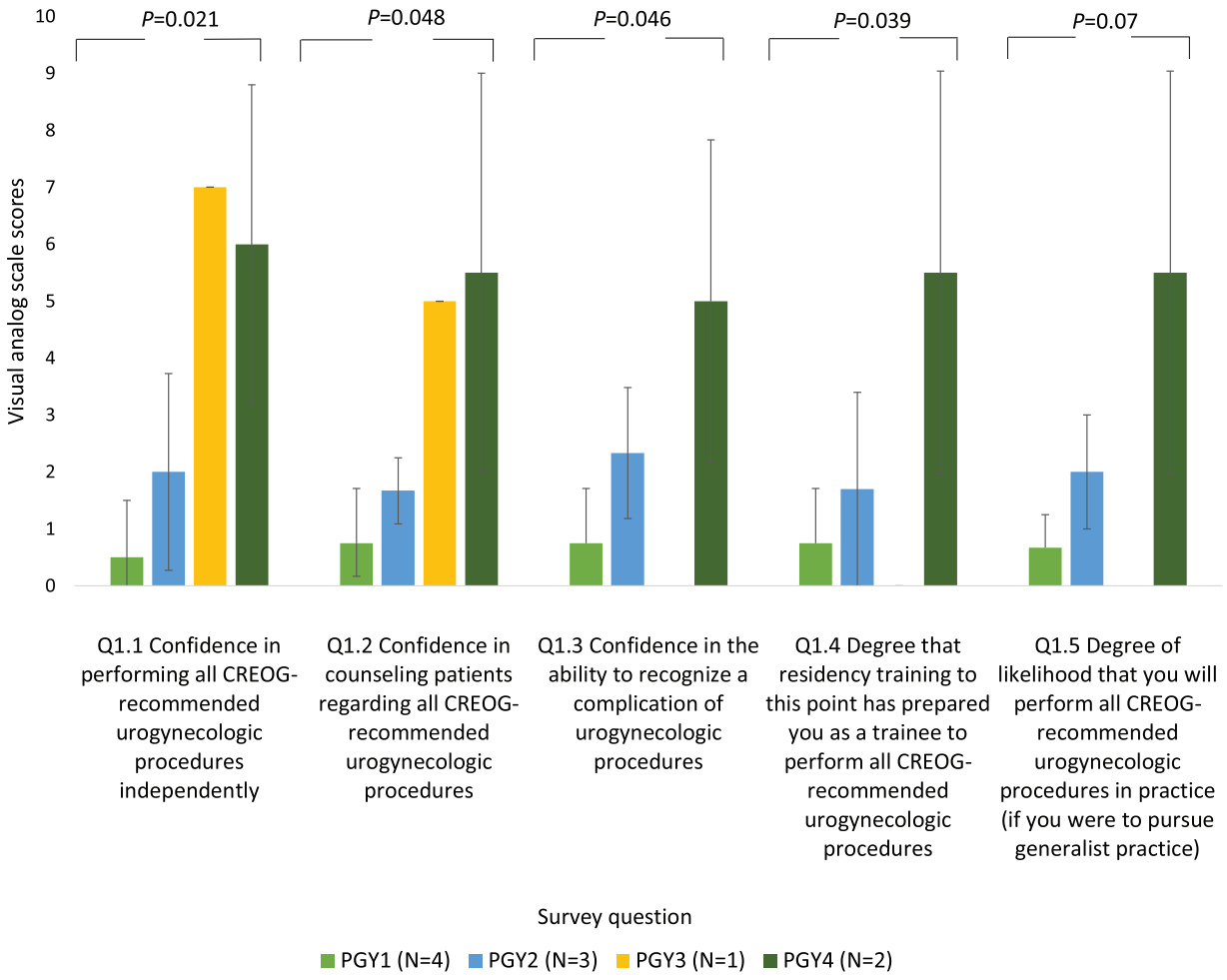

Figure 3. Pre-simulation general urogynecology knowledge visual analog scale scores by residency year. CREOG: Council on Resident Education in Obstetrics and Gynecology.

decreases in incontinence and pelvic floor procedures and vaginal hysterectomies between 2013 and 2019, respectively.[4] This suggests that, while simulation may improve resident comfort, understanding, and counseling with these procedures, residency paradigms may need to shift to further train residents and encourage independent practice in these procedures outside of the learning environment in those areas lacking access to subspecialist care.

Strengths of this intervention included its comprehensive interprofessional design, with multiple diverse instructors who were able to add to the depth and breadth of knowledge. Additional strengths included the ability of the intervention to remain low- to no-cost by repurposing materials already in use by our institution and the adaptability that may come with this during implementation at other institutions. A final strength included the application of vignettes combined with hands-on task training in order to provide context to each simulation task.

This intervention did have several limitations. Due to the variable nature of resident scheduling, the study sample size was small and limited to the available residents in one residency program. This suggests a lack of generalizability of the results of this study. While these data were prospectively collected, residents were not randomized to other interventions and there was no long term follow up or secondary training program, which limits the conclusions that can be made from the data collected. This is a major gap in much of the current urogynecology simulation literature, and would be important to address in further study of this curriculum.[17] The large-scale nature of this intervention and requirement of available materials and staff may also be a limitation of this study, as these resources may not be

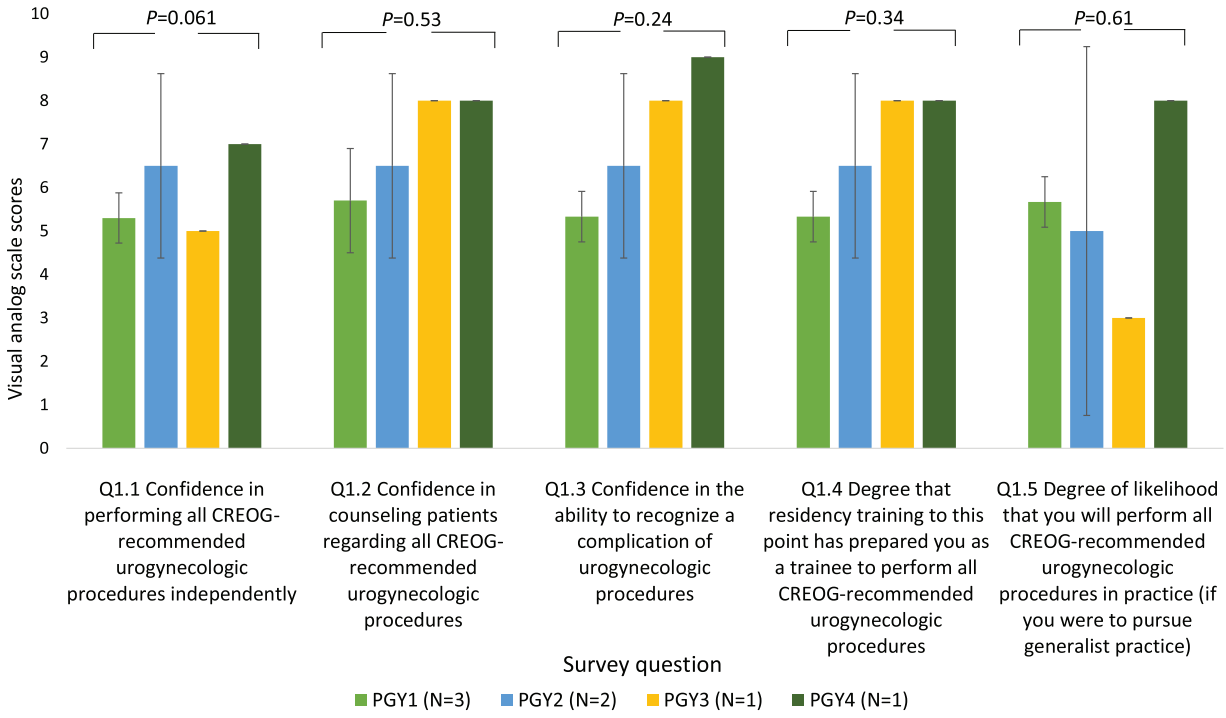

Figure 4. Post-simulation general urogynecology knowledge visual analog scale scores by residency year. CREOG: Council on Resident Education in Obstetrics and Gynecology.

Table 3. Suggested simulation station competency assessments

Station	Competency assessment
Obstetric anal sphincter injury (OASIS) repair	• ACOG Obstetric Laceration Repair Quiz.[10] • Task-specific obstetric laceration repair candidate assessment algorithm proposed by Uppal et al.[18]

Pelvic floor physical therapy (PFPT)	• Knowledge-based assessment of pelvic musculature and physical therapy tools.
	  • Picture of pelvic floor musculature with labels and blanks.
	  • Picture of pelvic floor simulator with multiple choice name selection.
	• Picture of vaginal dilator/wand set with multiple choice name selection.

Mid-urethral sling (MUS) placement	• Time to complete retropubic sling placement (after 10 minute practice time allowed). • MUS task-specific checklist and modified OSATs as published by Oliphant et al.[9]

Pessary fitting and placement	• Knowledge-based assessment of pessary types and sizes.
	  • In-person assessment, participant provided with pessaries of different types and asked to name.
	• Modified three-item GRS assessment for ring pessary placement (VAS scale).
	  • Respect for tissue.
	  • Time and motion.
	  • Handling of pessary.

Sacrocolpopexy	• Time to complete anterior and posterior mesh attachment (after 10 minute practice time allowed). • GOALS scale as previously published by Tunitsky-Bitton et al.[11]

Cystoscopy and ureteral stent placement	• Time to complete cystoscopy with single-sided ureteral stent/catheter placement (after 10 minute practice time allowed).
	• GRS assessment for ureteral stent/catheter placement (5-point VAS scale).
	  • Respect for tissue.
	  • Time and motion.
	  • Handling of cystoscope.
	  • Flow of procedure and forward planning.
	  • Use of assistants.
	• GOALS assessment for ureteral stent/catheter placement (5-point VAS scale).
	  • Depth perception.
	  • Bimanual dexterity.
	• Autonomy.

generalizable to all programs. This may be combatted in future implementation of this curriculum via smaller weekly sessions, or by implementing this course on a larger scale via a longer regional or multi-center curriculum.[17] Additionally, the number of participants who completed the post-intervention survey was smaller than that of the pre-intervention survey, which may indicate an overestimation of the change in confidence. Lastly, there was no included competency assessment as part of this pilot curriculum; however, suggested competency assessment for future implementation is included in Table 3. Despite these limitations, our findings contribute meaningfully to the literature surrounding simulation in urogynecology training.

This study demonstrates that simulation-based curricula may be useful to improve resident performance in all ACGME-recommended urogynecologic procedures prior to graduation. This simulation curriculum was comprehensive and impactful in improving resident confidence in performing the involved procedures. Residency programs may consider implementation of this program as a valuable tool for resident education in urogynecology.

Conflict of interest

The authors have no conflicts of interest to disclose.

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Data availability

The data supporting the findings of this article are available from the corresponding author on request.

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