JOURNAL OF Surgical Simulation

Journal of Surgical Simulation (2020) **7**, 63–72
DOI: https://doi.org/10.1102/2051-7726.2020.0007

ORIGINAL ARTICLE

Who should be teaching vaginal hysterectomy on a task trainer? A multicenter randomized trial of peer versus expert coaching

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Date accepted for publication: 19 August 2020

Abstract

Background: We studied performance on a simulator among senior residents performing vaginal hysterectomy by using an Objective Skills Assessments Test-Simulated Vaginal Hysterectomy (OSAT-SVH). The aim of this study was to determine whether there are differences seen in peer (resident to resident) coaching compared with expert (faculty to resident) coaching. **Methods:** Participants were third- and fourth-year OB/GYN residents at two academic institutions, who had performed fewer than five vaginal hysterectomies as primary surgeon. After orientation, participants performed vaginal hysterectomy on a trainer while being coached by either an expert or a peer. The peer coach was a third-year OBGYN resident and was trained by the expert coach before enrollment of the study participants in a separate 3-hour training session. **Results:** Participants were videotaped performing a second hysterectomy on the model without coaching. A blinded faculty reviewer rated the videotaped hysterectomy using OSAT-SVH. Mean Global Rating Scale (GRS) and procedure-specific checklist (PSC) scores were not statistically significant between the peer and expert groups: GRS 11.6 (SD, 4.5) versus 13.0 (SD, 5.5) (P = 0.59) and PSC 15.0 (SD, 4.4) versus 15.0 (SD, 5.1) (P = 1.0), respectively. **Conclusion:** This study may provide evidence that a trained resident surgical coach could be as effective as a faculty instructor when teaching the steps of vaginal hysterectomy using a task trainer. Further studies are needed to confirm this finding and to assess if the development of these skills transfers to clinical care.

Keywords: *vaginal hysterectomy; simulation; teaching surgical skills; peer versus expert coaching; OBGYN residents; task training*

Introduction

Vaginal hysterectomy is deemed the optimal approach for hysterectomy when feasible.[1,2] Despite this, the proportion of vaginal hysterectomies compared with other routes remains low and is declining.[3] As a result, trainee exposure and opportunities for learning continue to be limited.[4] A recent survey found that fellowship program directors felt that only 20% of recently graduated residents could perform a vaginal hysterectomy independently.[5] There is consensus that simulation training helps teach surgical skills, and task trainers should be utilized before trainees embark on live surgery, with the goal of improving performance in the operating room.[6–9] If the learning curve could be shortened with the use of simulation, perhaps residents could reach higher levels of proficiency with less clinical exposure. Several vaginal hysterectomy task trainers have been described in the literature.[10–13] In 2017, our group studied an Objective Skills Assessment Test-Simulated Vaginal Hysterectomy (OSAT-SVH) using a previously constructed vaginal hysterectomy task trainer by evaluating the performance of surgeons with various levels of experience.[11,12]

As more research emerges to support simulation as a helpful teaching tool before surgical debut and throughout surgical training, questions arise surrounding the best way to teach trainees using these task trainers. When looking at the addition of an expert coach in a surgical simulation curriculum, competency assessment scores tend to improve.[14–16] In practice, however, protected time for attending surgeons to teach residents on simulators is limited and can be expensive. Therefore, it may be unrealistic for the expert to be the coach for the entire learning curve of the trainees in a simulated setting. Trained senior residents could be a suitable and cost-effective alternative to a highly skilled attending surgeon. While it is assumed that an expert coach needs to be present, just as it is done during actual surgery, it may be feasible that a task trainer could be used by peers to teach each other with the same overall result. Peer feedback has been explored in obesity intervention[17] and use of peer versus expert standards have been studied in feedback during laparoscopic training.[18] In 2017, Warren et al.[19] showed that resident to resident teaching on the wards improved the comfort level of internal medicine residents on inpatient service. The concept of a resident as a peer surgical coach has yet to be studied in resident education in the simulation lab and there are no studies that directly compare expert coaching with peer coaching in the surgical setting. We set out to identify whether a group of residents trained by a resident surgical coach (peer coaching) would perform differently than when trained by a faculty instructor (expert coaching) on a vaginal hysterectomy task trainer as measured by OSAT-SVH.

Materials and methods

Study procedure

A vaginal hysterectomy simulation task trainer model was created and studied, as described previously.[11,12] This study was approved by the Institutional Review Boards at each of the two participating medical centers. All third-year OB/GYN residents and any fourth-year OB/GYN resident with fewer than five live vaginal hysterectomies at two separate urban academic institutions received an email invitation to participate in the study. Third-year residents were excluded if they had performed five or more live vaginal hysterectomies in the operating room. We chose to use the cutoff of five hysterectomies for the following reasons. First, we were concerned that simulation training would be less useful later in the learning curve; on the other hand, if we limited eligibility to residents who have not done any live cases, it might be too disorienting and less beneficial to engage in simulation training without any previous operating room experience. We agreed on this number by consensus of the authors of this study after discussion with experts in the field (personal communication) due to considerations mentioned above. Furthermore, we examined OSAT scores that trainees received while performing vaginal hysterectomy in live surgery as described by Chen et al.[13] Although the study setting and OSAT scores in that study are not an exact match to our study, the fact that with each additional year of training, the Global Rating Scale (GRS) score increased by approximately 5 points was useful in our estimations.

Following informed consent, volunteers were then randomized to two groups (expert or peer coaching) using a random number generator and were assigned to a 2-hour simulation session. Two experts were as follows: a female pelvic medicine and reconstructive surgery (FPMRS) board-certified urogynecologist with 11 years of post-training clinical experience at NYU Langone Medical Center (V.L.) and an OBGYN generalist with high surgical volume and 7 years of post-training clinical experience and high vaginal hysterectomy volume at Albert Einstein College of Medicine (M.C.). The latter coach was trained by the former coach (who was part of the original study team that did validity work on this model in the preceding project) in an in-person 3-hour hands-on training session. The peer coach was a third-year OBGYN resident at each institution with experience as a primary surgeon in less than five vaginal hysterectomies. This peer coach was trained by the expert coach before enrollment of the study participants in separate in-person 3-hour hands-on training sessions. Following this training, the coaches functioned independently.

All sessions were individual, one-on-one, between a participant and coach. They took place in a single room in a surgical skills lab. A vaginal hysterectomy instrument set and sutures commonly used in live cases were available. At the beginning of the session, self-reported demographic data, and information about the level of training, baseline confidence in vaginal surgery, previous exposure and future desire to perform vaginal surgery were collected via paper survey. Confidence assessment answers were scored on a scale of one to seven: strongly disagree, moderately disagree, disagree, neutral, agree, moderately agree, strongly agree. Each participant was then asked to take a non-validated 23 multiple-choice question written assessment ('pre-test') composed by the authors of a previous study and designed to evaluate their knowledge of the details of the procedure itself.[11] Next, participants were shown anatomic components of the model via a standardized orientation checklist of all relevant anatomic structures.[11] A teaching session was then conducted using a standardized script to assure that key technical and cognitive aspects of the procedure were covered.[11] Each participant performed a vaginal hysterectomy on the model at his or her own pace while the session coach provided the resident with instruction and feedback in real time. Residents were allowed to ask questions and coaches responded to them at their own discretion in cases where specific questions and concerns were not part of a teaching script. After the teaching session was completed, each participant then performed a second vaginal hysterectomy on the task trainer, which was filmed for assessment. During this assessment phase, passive assistants were available for retraction; they were instructed to assist only if directed by the participant (typically, vaginal hysterectomy requires two assistants). The coach was present as an observer during filming but did not answer procedure-related questions from participants or provide any guidance and only provided passive assistance such as retraction if asked by the participant. While the assessment was being videotaped by the camera set behind the participant's shoulder, only the hand movements of each participant were captured through video and sound was muted during the recording to ensure blinding. After the assessment hysterectomy was completed, the resident and coach debriefed the case. Further teaching took place with individuals at the discretion of the peer or expert coach. Finally, participants completed post-test and confidence surveys.

There were two blinded video graders, both board-certified FPMRS attendings who practiced in an academic training center (NYU Langone Medical Center) and were involved in training residents. After attending a training session on how to grade videos conducted by one of the primary investigators (V.L.), a grader watched each video. Each grader rated a subset of the total videos and each participant was rated by one grader based on his or her ability to perform the crucial steps of a vaginal hysterectomy using OSAT-SVH (Figs 1 and 2). The maximum scores for the procedure-specific checklist (PSC) and GRS were 26 and 25, respectively. Total time to accomplish the task was also recorded.

Study design

The convenience sample size consisted of residents eligible for the study between 10 April 2015 and 4 October 2016. Continuous outcomes were summarized for each group using means and standard deviations. Group differences in continuous variables were compared using t tests, and paired t tests were used to compare within groups pre- and post-session differences. Two-sided P values <0.05 were considered to be statistically significant. Secondary outcomes were total surgical time and confidence scores. In addition, we examined and described the points most commonly missed for both the GRS and PSC in both groups.

Results

Sixteen third- and fourth-year residents were recruited to participate in the study, and all of them were able to complete it (Fig. 3). Demographics are presented in Table 1. Individual scores are presented in Table 2, and results by group are presented in Table 3. There were no differences in the number of vaginal hysterectomies performed as primary surgeon between the groups: those coached by a peer performed a mean of 0.3 (SD, 0.9) vaginal hysterectomies; the group coached by an expert performed a mean of 0.8 (SD, 0.8), which was not a statistically significant difference (P = 0.73). Mean GRS and PSC scores were not statistically significant in the peer group compared with the expert group: the between-group GRS difference between peer versus expert groups was −1.40 points, and for OSAT there was no difference (Table 3).

In evaluating the assessment scores by specific components for both GRS and PSC in the present study, there were no differences in scores between the groups (Fig. 4). The lowest scoring category for the GRS was 'use of assistants' (mean score of 1.1 of 5, 21%). There was no difference between the peer and the expert group for this value (P = 0.77). For the PSC, the lowest scoring category was performance of McCall's culdoplasty (mean score of 0.3 of 3, 10%), which was also not statistically significant between the peer and the expert group (P = 0.10). Similarly, the average time to completion was not significantly different between the peer versus expert groups with an estimated mean difference of

	Category	1	2	3	4	5
1	ECONOMY OF MOVEMENTS	Many unnecessary movements		Efficient motion but some unnecessary movements		Maximum economy of movements
2	INSTRUMENT HANDLING	Repeatedly makes tentative or awkward moves with instruments		Competent use of instruments although occasionally appeared stiff or awkward		Fluid movement with instruments and no awkwardness
3	FLOW OF OPERATION/ FORWARD PLANING	Imprecise, wrong technique in approaching the operative intervention		Careful technique with occasional errors		Fluid, safe and correct technique in all stages of the operative procedure
4	KNOWLEDGE OF THE SPECIFIC PROCEDURE	Deficient knowledge Required specific instruction at most steps of the operation		Knew all important steps of the operation		Demonstrated familiarity with all steps of the operation
5	OVERALL PERFORMANCE	Not safe to perform in a patient without further training		Needs direction to perform appropriately		Ready for in vivo performance

Figure 1. Modified Global Rating Scale (GRS).

	NOT DONE (0)	PARTLY DONE (1)	WELL DONE (2)
1. Makes initial incision with in correct place			
2. Bladder dissected, deflected and protected			
3. Appropriately enters anterior and posterior peritoneum Anterior entry is not a must for uterosacral and cardinal ligament ligations Posterior entry should be made sharply			
4. Identifies the cardinal ligament			
5. Identifies the Uterosacral ligament, tags uterosacrals for use in McCalls			
6. Identifies uterine vessels			
7. Correctly clamps, cuts and ligates ligaments and vessels Opens clamps widely and slides off the cervix or lower uterine corpus before clamping down in an effort to include all vascular collaterals			
8. Removes uterus only once all ligaments and vessels are ligated and secured, delivers fundus through colpotomy			
9. The upper pedicles (cornual end of the fallopian tubes, round and ovarian ligaments) are clamped and cut			
10. Secures upper pedicles with a double ligation technique			
11. Describes/performs closure of vaginal cuff			
12. Incorporates uterosacral ligaments into cuff to reestablish suspensory aspect of vagina			
13. Uses assistants appropriately by positing retractors and optimizing exposure			

Figure 2. Procedure-specific checklist (PSC).

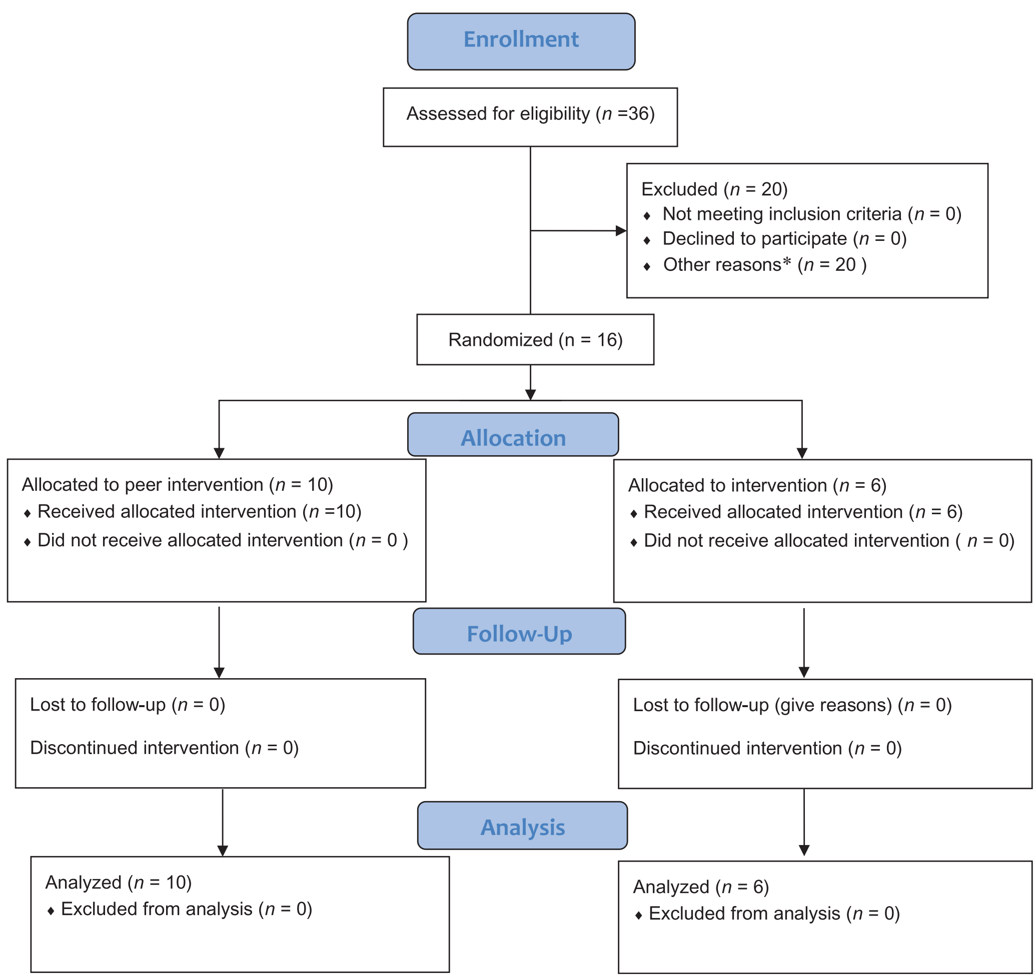

Figure 3. CONSORT flow diagram. *Did not respond to email or had scheduling conflicts.

Table 1. Baseline demographic data for participants

Participant number	Gender	PGY level	Number of VH performed as a primary surgeon	Plans to perform VH as attending (scale of 1–7)	Pre-test score (0–100)
Peer coach group					
1	Female	3	0	4	52
2	Female	3	0	7	70
3	Female	3	0	7	52
4	Male	3	1	7	43
5	Female	3	3	4	65
6	Female	3	0	7	65
7	Female	3	0	5	39
8	Female	3	0	7	65
9	Female	4	2	7	65
10	Male	4	0	7	65
Expert coach group					
11	Female	3	1	3	52
12	Female	3	1	7	65
13	Female	3	0	7	61
14	Female	4	0	7	65
15	Female	4	0	1	65
16	Female	3	0	1	61

PGY, post-graduate year; VH, vaginal hysterectomy.

Table 2. Individual performance scores in peer versus expert coach groups as measured by OSAT-SVH

Participant number	Post-test scores (1-100)	GRS, maximum 25 points	PSC, maximum 24 points	Time (minutes)
Peer coach group				
1	87	8	12	43
2	87	9	14	26
3	82	19	25	24
4	47	7	13	25
5	65	13	14	30
6	61	15	14	25
7	65	14	17	18
8	78	10	16	43
9	91	5	8	18
10	82	16	17	23
Expert coach group				
11	73	7	6	34
12	82	7	12	21
13	95	19	19	20
14	78	11	17	41
15	82	19	20	25
16	96	15	16	15

GRS, Global Rating Scale; OSAT-SVH, Objective Skills Assessment Test-Simulated Vaginal Hysterectomy; PSC, procedure-specific checklist; VH, vaginal hysterectomy.

1.45 minutes and 95% confidence interval of (−8.7 to 11.7) (Table 2).

Pre- and post-test scores (multiple-choice knowledge test and confidence scores) did not differ between the groups (Table 3). There was a significant increase in mean confidence scores from pre-session to post-session in both groups (peer: 1.8 (SD, 1.1) versus 4.1 (SD, 1.6), $P = 0.002$; expert: 2.3 (SD, 1.0) versus 3.8 (SD, 0.4), $P = 0.01$) (Table 4).

Table 3. Performance scores by group

	Peer ($n = 10$)	Expert ($n = 6$)	*P* value*
GRS (max score, 25), mean (SD)	11.6 (4.5)	13.0 (5.5)	0.59
PSC (max score, 26), mean (SD)	15.0 (4.4)	15.0 (5.2)	1.00
Time (minutes), mean (SD)	27.6 (9.1)	26.1 (9.4)	0.77
Pre-test scores, mean (SD)	61.5 (5.1)	58.1 (10.8)	0.48
Post-test scores, mean (SD)	74.5 (14.3)	84.3 (9.3)	0.16
Confidence score before	1.8 (1.1)	2.3 (1.0)	0.88
Confidence score after	4.1 (1.6)	3.8 (0.4)	0.70

GRS, Global Rating Scale; OSAT-SVH, Objective Skills Assessments Test-Simulated Vaginal Hysterectomy; PSC, procedure-specific checklist.
*Corresponds to a two-sample t test.

Residents who reported that they would be performing vaginal hysterectomies in their careers (5 or greater on the Likert scale) scored 15.9 (SD, 4.5) on PSC, whereas those who reported they were neutral or did not feel they would perform vaginal hysterectomies in their careers scored an average of 13.2 (SD, 4.2), $P = 0.27$. There was also no difference in GRS scores for those who reported they would be performing vaginal hysterectomies versus those reporting they were neutral or would not (11.7 [SD, 3.5] versus 8.4 [SD, 3.7], $P = 0.10$).

A post hoc power calculation was performed. Based on our current sample sizes of $n = 10$ and 6, we computed $>80\%$ power at the two-sided 0.05 level of significance to detect a large effect size (Cohen's D = 1.64), which is consistent with a 7.4-point difference in the GRS scores between the two groups and within group (SD, 4.5).

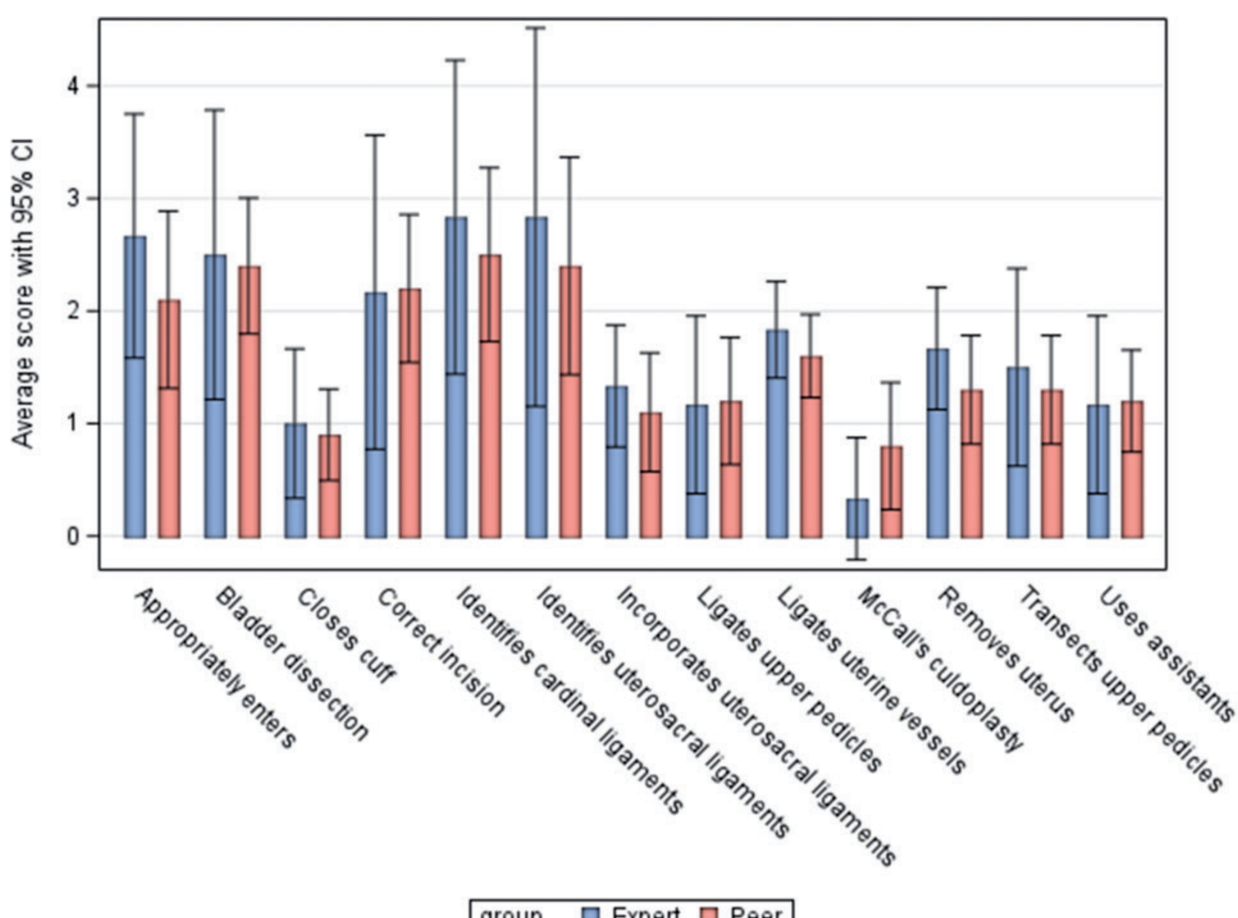

Figure 4. Peer and expert scores on individual components of the procedure-specific checklist. CI, confidence interval.

Table 4. Confidence survey results by group

Participant number	Confidence score before	Confidence score after
Peer coach group		
1	3	6
2	1	5
3	1	4
4	1	1
5	1	4
6	2	2
7	1	5
8	1	4
9	4	4
10	3	6
Expert coach group		
11	3	4
12	3	4
13	1	4
14	1	3
15	3	4
16	3	4

Confidence scores were measured by asking learners to assign a numeric value on a scale of 1–7 in response to the statement 'I feel confident to perform vaginal hysterectomy independently'.
VH, vaginal hysterectomy.

Discussion

Our findings suggest that peer coaching of trainees during a simulation training session on vaginal hysterectomy produced no significant difference in OSAT-SVH performance scores compared with scores for trainees coached by an expert coach. In addition, we showed significant improvement in scores after one coaching session compared with baseline.

In designing this study, we thought that residents might be able to learn the basics of complex surgical procedures such as vaginal hysterectomy equally well from expert and peer coaches. Our results showed no difference in performance between the two groups in this cohort, with an average difference in GRS between peer versus expert groups of −1.4. One explanation of our findings could be that coaching basic skills may be as effective via peer as via expert teaching. Another explanation may be that our trainees were very early on their learning curves, and during this phase of learning, the ability to practice may be more important than the expertise of the teacher. Another avenue to explore in future studies would be whether a coach could be a trained simulation specialist (a technician) with or without any medical background. This model of teaching is often used in surgical skills labs when a technician rather than a clinician is utilized in teaching a Fundamentals of Laparoscopic Surgery curriculum and open surgical skills training.[20,21] This approach would be of greatest use when trainees are early in their learning curves. Perhaps an expert coaching session may be of use later in training for fine-tuning rather than early in the learning curve. In addition, utilizing a technician might address the issue of cost in terms of attending time and difficulties with scheduling.

Interestingly, after just one training session, performance scores increased significantly compared with baseline scores from a previous study.[11] We chose not to include before performance scores in the study design due to time limitations, and instead, compaired OSAT-SVH scores after one training session with previously published baseline data for residents by year of training.[11] Specifically, we looked at scores for first- and second-year residents (all of whom had not performed any vaginal hysterectomies as a primary surgeon). In this baseline cohort of junior residents, mean GRS and PSC scores were 7.0 (SD, 3.2), and 6.6 (SD, 4.1) points, respectively. In the present study, which consisted of senior (third- and fourth-year) residents who on average had performed less than one vaginal hysterectomy as a primary surgeon, the mean GRS and PSC scores for both peer and expert coach groups combined were 12.1 (SD, 4.8) and 15.0 (SD, 4.5). When comparing those two groups, a GRS score difference of 5.1 points and PSC score difference of 8.4 points is noted. For comparison, in the previous study, OSAT-SVH scores of senior residents, with a mean number of vaginal hysterectomies performed as primary surgeon of 10.3 (SD, 7.7), were 16.1 (SD, 6.1) for GRS and 15.2 (SD, 6.1) for PSC. When compared with the current group, GRS scores for the combined coached group were lower by 4 points and the PSC scores were very close (difference of 0.2 points).

The limitation of this comparison is that we do not have similarly derived baseline scores in our study, and as a result, could not use the same cohort to compare scores before and after training sessions. When comparing the same-level residents, PSC scores were similar between those who performed more than ten hysterectomies in the baseline performance group and between those who had not performed any live cases but underwent one training session; seemingly, simulation training could account for this difference. GRS scores showed a gradient of increase, which could be due to an increasing level of overall surgical experience or due to simulation training.

In terms of individual steps of the operation, we found that the most missed step of a vaginal hysterectomy for residents was performance of McCall's culdoplasty. This did not differ between peer and expert coaching groups. When assessing global skills of vaginal surgery, both peer and expert groups scored lowest on use of assistants. Both findings further support the lack of difference between coaching performed by peer or expert in our study, however, our study was not powered for this specific outcome. Perhaps the model is not well suited to teach this specific part of the operation. Yet, another possibility is that both expert and resident coaches focused on other parts of the operation and did not hone in on this specific part. This highlights the need to perform a cognitive task analysis, a way of deconstructing this complex procedure into partial tasks; this would allow trainees to repeat them several times before embarking on performing entire procedure from start to finish.[22–25]

Confidence scores were statistically higher after coaching in both groups, findings consistent with previous work.[26,27] We also found that residents who planned on incorporating vaginal surgery into their surgical repertoire showed a non-significant trend toward higher assessment scores than those who were neutral or did not plan on performing vaginal surgery. This trend toward higher assessment scores may be due to resident interest and self-motivation to learn, which could be viewed as a potential confounder. Another hypothesis would be that inherent adeptness at surgery in general might correlate with a greater desire to perform surgical procedures, or 'self-tracking'. Tracking has not been studied to the best of our knowledge, but it is already being implemented during training and practice.[26,27] Our study was not powered for this outcome, and other studies looking specifically at this outcome can help guide future skills training.

We acknowledge that our study has several limitations. A single rater was used to review each video due to time constraints, and we were not able to calculate intra-rater reliability. Our study also had a small sample size, which may mask differences in outcomes that would be apparent with larger numbers. We have the following considerations with regard to sample size. Since there were no previous studies that we could use as a benchmark of what a meaningful difference in OSAT scores might be from one simulation session coached by two different types of coaches, we examined data from a previous study on the same model.[11] In that study, residents had a mean GRS score of 11.67 with SD of 6.41, whereas FPMRS attendings had a mean GRS of 19.67 with SD of 3.51, resulting in an 8-point difference in GRS scores between residents and FPMRS attendings.[11] In addition, Chen et al.[11] found that each additional year of training increased the GRS score by 5 points. While Chen and her co-workers used a slightly different measurement tool as part of their OSATs and their study setting was live surgery instead of simulation, it is still fairly close to our modified GRS. Considering the 8-point difference between trainees and experts, and the 5-point difference gained from 1 year of training, we estimated that a meaningful difference in scores resulting from training on a model would be 8 points. Based on that, a sample size of five participants was needed in each group to detect an 8-point difference in the GRS scores between two groups with 80% power and alpha of 0.05. Our sample size would have been powered to detect a difference of 7.4 points, which is a large difference; however, it was reasonable to presume that coaching by an expert would result in much higher performance scores given that no previous data were available for us to base on estimations on. Detecting a 5-point difference would require 13 participants in each arm, and a 2-point difference would require 79. We do not feel that conducting larger studies would be of help here, because it would be equivalent to missing the forest for the trees; rather, we think that focusing on understanding individual learning curves in a simulated setting would be of more use in improving the performance of trainees in the operating room. Finally, due to random chance, the peer arm had ten participants, whereas the expert arm only had six; this effect could potentially influence the results.

There are several strengths of this study. To our knowledge this study is the first of its kind to compare peer coaching with expert coaching in simulation training for a surgical procedure. Furthermore, the randomized multicenter design decreases bias and contributes to the study's generalizability, which is important if this model and technique for learning is to be used on a broader scale.

It is the hope that this research will serve as the groundwork for future studies in simulation for vaginal hysterectomies and other surgical procedures where teaching opportunities may be limited during live surgery. A future direction would be to look at clinical performance in the operating room after training sessions and the correlation with patient outcomes, because this provides information about transferability into the clinical arena when assessing implementation of simulation in surgical training. Based on clinical outcomes and performance, determination of various benchmark assessment scores to achieve during simulation performance before transitioning to the operating room is imperative. Lastly, more work is needed to understand the learning curves on this and other models, including how many simulation sessions it would take to 'pass' the benchmark score. Simulation-based deliberate practice and mastering learning requires an intricate mix of motivated learners (possibly self-tracking during residency), specific learning objectives, set measured performance goals, and customized practice experiences with individualized feedback, all of which become a challenge given limited resources for implementation available to both trainees and educators.[28–31] To further understand these parameters, we plan to conduct a study where each individual trainee undergoes multiple serial training sessions, and scores will be compared for improvement from baseline, with hopes of describing what it takes to reach a proficiency standard before debut in the operating room.

In summary, this study demonstrates the potential of using a peer coach to teach the steps of vaginal hysterectomy with a task trainer model to increase vaginal hysterectomy exposure and provide trainees with necessary groundwork skills before operating room exposure. Using coached simulation sessions to teach surgical procedures may further translate to a better status of preparedness before a trainee's surgical debut of vaginal hysterectomy and similar procedures in live surgery.

Acknowledgements

We would like to thank Dr Scott Smilen in generously donating his time to review and rate the videos for this study.

Conflict of interest

None declared.

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