International Urogynecology Journal (2019) 30:423–428
https://doi.org/10.1007/s00192-018-3654-y

ORIGINAL ARTICLE

Optimizing resident operative self-confidence through competency-based surgical education modules: are we there yet?

Roxana Geoffrion[1] · Nicole A. Koenig[1] · May S. Sanaee[1] · Terry Lee[2] · Nicole J. Todd[1]

Received: 28 January 2018 / Accepted: 3 April 2018 / Published online: 11 April 2018

Abstract

Introduction and hypothesis Self-confidence is the belief in one's ability to perform and can be enhanced by training. Surgical education should aim to optimize trainee confidence. We designed three procedure-specific competency-based modules to teach vaginal hysterectomy (VH), anterior (AR) and posterior repair (PR) to novice gynecology residents. We hypothesized each module would improve self-confidence and satisfaction during index procedure performance in the operating room.

Methods This was an ancillary analysis of a larger randomized-controlled trial of gynecologic educational interventions. Residents at three Canadian universities were included if they had previously performed fewer than five index procedures independently. Intervention residents received educational modules; controls engaged in self-directed learning. All residents performed one or more of the three surgeries and filled out a validated Self-Confidence Scale and a Satisfaction Scale. Scores were compared between groups. Correlations were sought between self-confidence and various variables.

Results Forty-six residents at three Canadian universities were randomized (21 intervention, 25 control). Most residents had never performed the index procedure. Overall, self-confidence was significantly higher ($p = 0.021$) in the intervention group for VH, but not for AR and PR ($p = 0.94$ and $p = 0.12$, respectively). Compared with controls, self-confidence was also significantly higher in intervention residents who had never performed VH ($p = 0.026$) or PR ($p = 0.027$) and in first and second year intervention residents. There was a positive correlation between self-confidence and satisfaction.

Conclusions Surgical modules improved self-confidence preferentially in the most junior residents and for more complicated procedures. The wide self-confidence ranges observed suggest that optimization should be an important goal for surgical educators.

Keywords Competency-based surgical education · Gynecology · Junior residents · Self-confidence

Introduction

Surgery is stressful, and stress can affect human performance [1–3]. Stress is "a process by which environmental demands evoke an appraisal process in which perceived demand exceeds resources and results in undesirable outcomes" [4]. The concept of stress in surgery is not widely discussed, and surgical trainees learn stress management techniques from directly observing their superiors [1]. With the advent of competency by design, surgical residency programs across North America are developing curricula to teach surgical skills through simulation. High-fidelity simulation, which may mimic the real-life stressful environment of an operating room (OR), is costly and does not improve basic surgical skills above and beyond low-fidelity simulations [5–7]. Therefore, many programs have adopted low-fidelity simulation such as

Meeting presentation
Poster, Association of Academic Professionals in Obstetrics and Gynecology/Society of Obstetrics and Gynecology Canada Ontario Continuing Medical Education conference, Toronto Ontario, Canada, December 1–3, 2017.

✉ Roxana Geoffrion
roxygeo@hotmail.com

[1] St. Paul's Hospital, Department of Obstetrics and Gynecology, University of British Columbia, Suite 930, 1125 Howe Street, Vancouver, British Columbia V6Z 2K8, Canada

[2] Centre for Health Evaluation and Outcome Sciences, University of British Columbia, Vancouver, British Columbia, Canada

Fundamentals of Laparoscopic Surgery (FLS) training into their curricula. We know that stress can affect performance on a simulator even in low-fidelity simulations such as FLS [3]. Military research shows that building positive performance expectations is crucial to prepare operating personnel for high-demand conditions [4]. Positive performance expectations are present when the perception of available resources exceeds the perceived threat, and this is also known as self-efficacy in the psychology literature [8]. Improving self-efficacy in athletes is desirable, as it is linked to enhanced effort investment, greater persistence and improved performance [9]. Many stress-coping training programs for industries such as aviation and sport incorporate self-efficacy or self-confidence improvement into their performance training [4]. It is currently largely unknown if simulation programs we develop are effective at optimizing self-efficacy in surgical trainees. We developed and partially validated three procedure-specific competency-based modules to teach vaginal hysterectomy (VH), anterior (AR) and posterior repair (PR) to novice gynecology residents [10]. Our objectives in the current study were to evaluate whether each module improved self-confidence and satisfaction during performance of the index procedure in the real operating room (OR).

Materials and methods

This was an ancillary study of a larger randomized controlled trial of competency-based procedure-specific modules designed to teach vaginal surgery to junior residents in gynecology.

Residents at three Canadian universities (University of British Columbia, University of Calgary and University of Alberta) were included if they had previously performed fewer than five index procedures independently. Local Institutional Review Board approval was received at each participating site. Residents were randomly allocated to one of the two groups using a web-based randomization scheme. Intervention residents received educational modules; controls engaged in self-directed learning. Each module was procedure specific for VH, AR or PR and has been previously described [10]. Baseline knowledge was tested in both groups at recruitment. Following the didactic online portion, knowledge was again tested in the intervention residents. A 20-question multiple choice test designed for each module was used to test knowledge pre- and post-didactic teaching. If a passing grade was achieved (>60%), the intervention residents pursued guided practice on low-fidelity models with a trained gynecologic staff surgeon. All three mentoring staff surgeons (one at each institution) were fellowship-trained urogynecologic surgeons with high-volume clinical practices and academic interest. All three are routinely engaged in teaching of trainees at various levels (medical students, residents and fellows) on a daily basis as part of their practice in tertiary care university centers. When deemed ready by each staff surgeon, the intervention residents performed the index procedure (VH or AR or PR) in the real OR under supervision. Control residents engaged in usual self-directed learning and also performed VH, AR or PR in the OR under supervision. Immediately after the OR procedure, all residents filled out a validated self-confidence scale [11] and a satisfaction scale. Possible scores on the self-confidence scale varied between 0 and 30, with higher scores reflecting increased confidence and a score of 30 reflecting the self-confidence of an expert gynecologic surgeon [11]. Satisfaction was measured on a Likert scale, with scores from 0 to 4 and higher scores reflecting increased satisfaction with training. Scores were compared between groups. The knowledge score and self-confidence score were compared between groups using two-sample t-test. Satisfaction scores between groups were compared based on the chi-square of Fisher's exact test as appropriate. Correlations were sought between self-confidence and various variables using Spearman correlation. Analyses were conducted using SAS software, version 9.4 (SAS Institute).

Results

Forty-six residents were recruited, 21 intervention and 25 control (Table 1). Each intervention resident completed one or more of the three modules followed by the corresponding index procedure. Most residents were in the second or third year of Obstetrics and Gynecology residency, and most had not performed the index procedure independently before enrollment in the trial.

Baseline knowledge scores were similar between the two groups (mean score: 12.3/20 versus 11.7/20, $p = 0.419$). Following the didactic portion of the modules, knowledge improved significantly in the intervention group and for each module tested (mean score increased by 3.3, 2.5 and 5.2 for VH, AR and PR, respectively; $p < 0.001$ for all three). Overall, the mean knowledge score improved from 58% to 76% ($p < 0.001$; 95% CI for improvement: 12–24%).

Scores on the post-test or improvement in knowledge in the intervention group did not show any significant strong correlations with self-confidence on any of the modules (Spearman correlation coefficient range − 0.24 to 0.48).

Overall, the VH module significantly improved self-confidence for performance of a vaginal hysterectomy (mean 20.2 intervention vs. 16.6 control, $p = 0.021$; Fig. 1). The AR and PR modules did not significantly improve self-confidence for performance of an AR ($p = 0.938$) or a PR ($p = 0.116$).

When the analysis was repeated only in residents who had never performed these procedures independently before, both VH and PR modules significantly improved self-confidence (mean 20.2 intervention vs. 16.4 control, $p = 0.026$ and mean

Table 1 Baseline resident demographics

Variable	All ($n = 46$)	Control ($n = 25$)	Intervention ($n = 21$)
Female, n (%)	41 (89.1)	22 (88.0)	19 (90.5)
University, n (%)*			
UA	4 (8.7)	3 (12.0)	1 (4.8)
UBC	33 (71.7)	16 (64.0)	17 (81.0)
UC	9 (19.6)	6 (24.0)	3 (14.3)
Age			
Missing, n (%)	2 (4.3)	0 (0.0)	2 (9.5)
Mean (SD)	28.6 (2.0)	28.8 (2.2)	28.3 (1.8)
Median (IQR)	28.0 (27.5, 29.0)	28.0 (27.0, 30.0)	28.0 (28.0, 29.0)
Range	(25.0, 34.0)	(26.0, 34.0)	(25.0, 32.0)
Resident level, n (%)**			
PGY1	7 (15.2)	3 (12.0)	4 (19.0)
PGY2	15 (32.6)	9 (36.0)	6 (28.6)
PGY3	16 (34.8)	7 (28.0)	9 (42.9)
PGY4	8 (17.4)	6 (24.0)	2 (9.5)
Vaginal hysterectomy performed independently before, n (%)			
Unknown	2	1	1
None	35 (79.5)	17 (70.8)	18 (90.0)
1 or more	9 (20.5)	7 (29.2)	2 (10.0)
Anterior repair performed independently before, n (%)			
Unknown	2	1	1
None	37 (84.1)	19 (79.2)	18 (90.0)
1 or more	7 (15.9)	5 (20.8)	2 (10.0)
Posterior repair performed independently before, n (%)			
Unknown	2	1	1
None	39 (88.6)	20 (83.3)	19 (95.0)
1 or more	5 (11.4)	4 (16.7)	1 (5.0)

*UA = University of Alberta; UBC = University of British Columbia; UC = University of Calgary

**PGY = Postgraduate year

19.4 intervention vs. 16.6 control, $p = 0.027$). Again, the AR module did not significantly improve self-confidence for performance of an AR ($p = 0.899$) (Fig. 2).

Overall satisfaction was significantly better in intervention vs. control residents for the VH module ($p < 0.001$) but not for AR or PR modules. In residents who had never performed these procedures before, satisfaction improved through training on the VH (93% scored 3 or higher vs. 25%; $p = 0.002$) and PR (75% scored 3 or higher vs. 33%; $p = 0.047$) modules, but not on the AR (63% scored 3 or higher vs. 73%; $p = 0.58$) model.

Self-confidence or satisfaction was not significantly improved for any of the modules when higher level residents (PGY 3 and 4 combined) were examined separately (Fig. 3).

There were significant positive correlations between self-confidence and satisfaction scores for each of the three

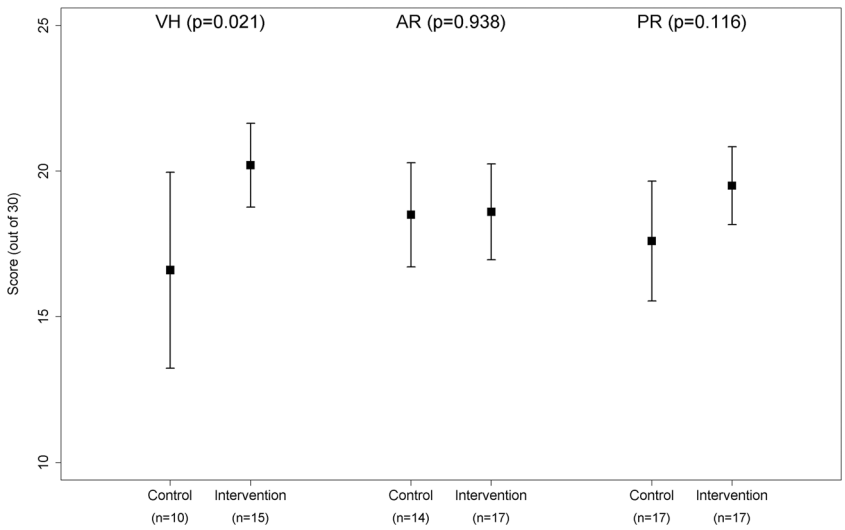

Fig. 1 Overall procedure-specific self-confidence score (all residents)

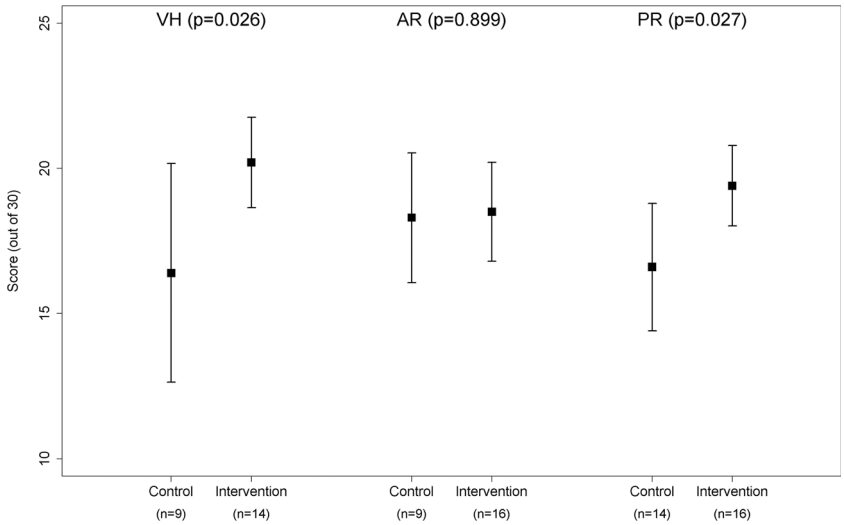

Fig. 2 Procedure-specific self-confidence score (residents who had never performed procedures independently before)

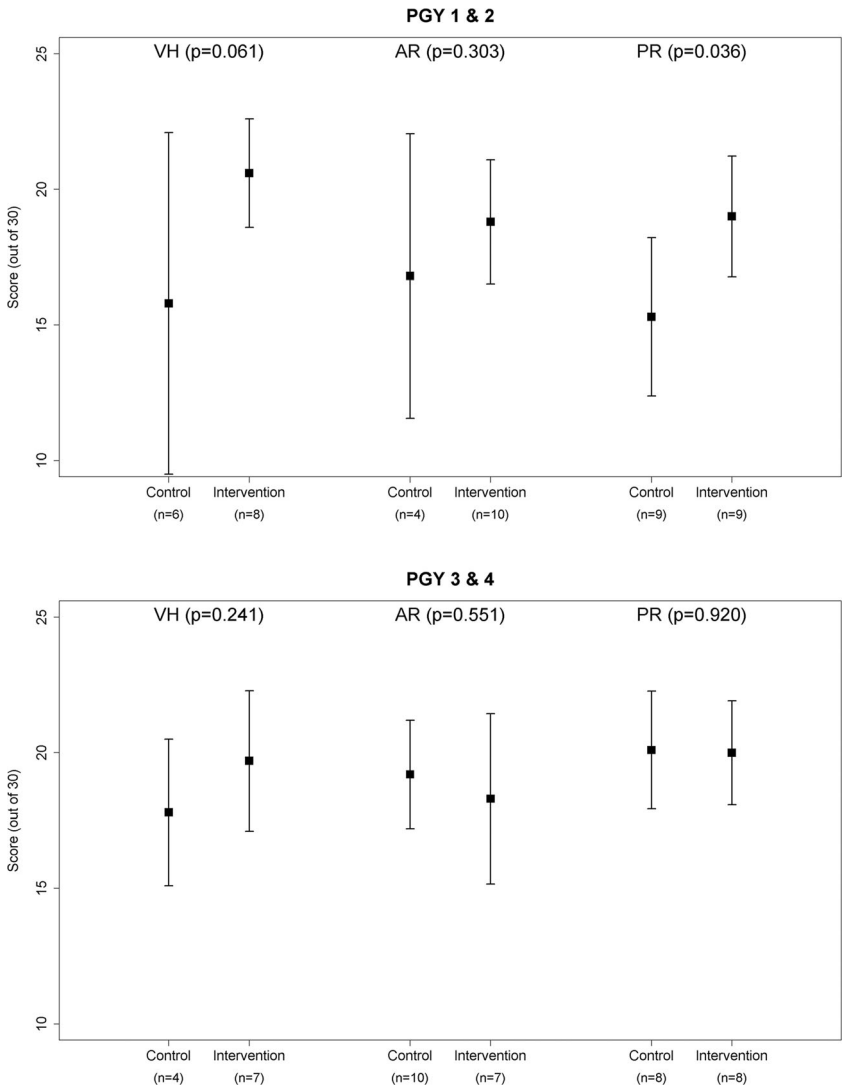

Fig. 3 Procedure-specific self-confidence score by resident level

modules and overall. The Spearman correlation coefficient was 0.64 ($p < 0.001$) for all residents and the average of all three procedures.

There were varying ranges of self-confidence scores in both control and intervention groups. For example, in control residents who had never performed these procedures, self-confidence for the average of all three procedures ranged from 9/30 to 23/30, whereas in intervention residents, after completion of the modules, self-confidence ranged from 15/30 to 24/30).

Discussion

This ancillary study of procedure-specific modules for vaginal surgery training in junior gynecology residents showed that self-confidence for actual surgical procedures was improved through training, preferentially in residents who had never performed these procedures independently, for vaginal hysterectomy and posterior repair but not for anterior repair. In addition, procedure-specific knowledge acquired through the didactic online portion of the module did not strongly correlate with improved self-confidence, suggesting that simulation training is needed, in addition to didactic training, for improved self-confidence.

The finding that self-confidence in the actual OR was only improved in the most novice trainees and for vaginal hysterectomy and posterior repair over anterior repair can be partially explained by the fact that these procedures have different perceived levels of difficulty and different complication types and rates. Among the three procedures, vaginal hysterectomy is likely the highest stakes procedure and thus more intimidating for trainees to undertake. It is not surprising that preparation for vaginal hysterectomy was associated with the largest improvements in self-confidence and satisfaction. The fact that these improvements disappeared in more senior residents is likely attributable to the basic nature of our practical models, designed to teach the most elementary yet essential surgical skills required. Presumably, the PGY 3 and 4 level residents felt they already possessed these skills despite the fact they had never had the opportunity to perform the index procedures independently.

Our findings are consistent with existing literature on low-fidelity simulation enhancing self-confidence and satisfaction in Obstetrics and Gynecology [12–14]. For example, a low-fidelity simulator used to teach primary care gynecologic procedures such as endometrial biopsy increased the self-confidence and satisfaction of trainees [12]. This holds true in other surgical and acute medical specialties as well [15, 16]. All these studies evaluated self-confidence immediately after simulation training rather than during actual OR performance of the procedure being taught. On the other hand, as far as we can tell from the literature search, our study is the first to assess self-confidence in a real OR environment after low-fidelity procedure-specific module training. We used a detailed, validated questionnaire for self-confidence assessment, which increases the value of our findings. Our trial was conducted at three different institutions across Canada and involved multiple trainees, trainers and evaluators, which improves the generalizability of our findings. Limitations of our study include the fact that our modules were designed for teaching and practice of basic surgical skills and did not include self-confidence-building strategies per se. In addition, we did not evaluate self-confidence at baseline; however, this can be explained by our trial design, calling for enrollment of the most novice residents who had preferably not performed the index procedures prior to training. The relatively small number of residents enrolled is also a limitation of our study; larger surgical education studies may refine our ability to draw conclusions on trainee self-confidence for various surgical procedures.

The wide range of self-confidence scores in the control residents, who did not undergo any standardized training before performing these procedures, suggests that self-efficacy beliefs in surgery do not rely on training alone but are multifactorial. Baseline technical competence and personality may also influence self-efficacy, just like in other hazardous or high-stress occupations [4]. There is some evidence to suggest that, before instruction, greater trainee confidence is significantly correlated to poorer performance [17]. On the other hand, many surgical surveys of trainee readiness for practice report low confidence among surgical graduates [18]. A recent systematic review of these surveys made a recommendation for more robust self-efficacy research and the development of "measurable benchmarks" [18]. Surgical self-efficacy is clearly a complex construct, and its relationship to performance is not yet fully elucidated. Future competency-based training programs may research ways to optimize self-confidence when it is too high or too low in individual trainees. Our research group is hoping to better delineate the relationship between self-confidence and actual OR performance during vaginal surgery procedures in the near future.

Funding Financial support from a Medical Education Research Grant (competitive), the Royal College of Physicians and Surgeons of Canada. The funding source did not have any role in any aspect of this research.

Compliance with ethical standards

Conflicts of interest

- R Geoffrion: Preceptor/proctor Boston Scientific Capio and Obtryx devices; Advisory Board Duchesnay.

- N Todd: Advisory board, Bayer Pharmaceuticals.
- Remaining authors claim no conflict of interest.

References

1. Arora S, Sevdalis N, Nestel D, et al. Managing intraoperative stress: what do surgeons want from a crisis training program? Am J Surgery. 2009;197:537–43.
2. Arora S, Sevdalis N, Nestel D, et al. The impact of stress on surgical performance: a systematic review of the literature. Surgery. 2010;147(3):318–30.
3. Arora S, Sevdalis N, Aggarwal R, et al. Stress impairs psychomotor performance in novice laparoscopic surgeons. Surg Endosc. 2010;24(10):2588–93.
4. Driskell JE, Salas E. Stress and human performance. Mahwah: Lawrence Erlbaum Associates Inc.; 1996.
5. Geoffrion R. Standing on the shoulders of giants: contemplating a standard national curriculum for surgical training in gynecology. J Obstet Gynaecol Can. 2008;30(8):684–95.
6. Denadai R, Saad-Hossne R, Raposo-Amaral CE. Simulation-based rhomboid flap skills training during medical education: comparing low- and high-fidelity bench models. J Craniofac Surg. 2014;25(6):2134–8.
7. Skoy ET, Eukel HN, Frenzel JE. Comparison of low- and higher-fidelity simulation to train and assess pharmacy students' injection technique. Am J Pharm Educ. 2013;77(2):33.
8. Bandura A. The exercise of control. New York: WH Freeman & Co; 1997.
9. Feltz D, Short S, Sullivan P. Self efficacy in sport: research and strategies for working with athletes, teams and coaches. Int J Sports Sci Coach. 2008;3:293–5.
10. Geoffrion R, Suen MW, Koenig NA, et al. Teaching vaginal surgery to junior residents: initial validation of 3 novel procedure-specific low-fidelity models. J Surg Educ. 2016;73(1):157–61.
11. Geoffrion R, Lee T, Singer J. Validating a self-confidence scale for surgical trainees. J Obstet Gynaecol Can. 2013;35(4):355–61.
12. Hellier SD, Ramponi DR, Wrynn A, Garofalo S. An innovative approach: using simulation to teach primary care gynecologic procedures. Simul Healthcare. 2017;12(4):268–73.
13. Farrar Highfield ME, Scharf-Swaller C, Chu L. Effect of nurse-led review plus simulation on obstetric/perinatal nurses' self-assessed knowledge and confidence. Nurs Womens Health. 2017;20(6):568–81.
14. Silva DR, Mazzo A, Jorge BM, Souza Júnior VD, Fumincelli L, Almeida RG. Intermittent urinary catheterization: the impact of training on a low-fidelity simulator on the selfi-confidence of patients and caregivers. Rehabil Nurs. 2015. https://doi.org/10.1002/rnj.226.
15. Naylor RA, Hollett LA, Castellvi A, et al. Preparing medical students to enter surgery residencies. Am J Surg. 2010;199(1):105–9.
16. Healey A, Sherbino J, Fan J, et al. A low-fidelity simulation curriculum addresses needs identified by faculty and improves the comfort level of senior internal medicine resident physicians with inhospital resuscitation. Crit Care Med. 2010;38(9):1899–903.
17. Leopold SS, Morgan HD, Kadel NJ, et al. Impact of educational intervention on confidence and competence in the performance of a simple surgical task. J Bone Joint Surg Am. 2005;87(5):1031–7.
18. Elfenbein DM. Confidence crisis among general surgery residents: a systematic review and qualitative discourse analysis. JAMA Surg. 2016;151(12):1166–75.