A Method to Evaluate Trainee Progression During Simulation Training at the Urology Simulation Boot Camp (USBC) Course

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OBJECTIVES: To evaluate skills progression at the Urology Simulation Boot Camp (USBC), a course intended to provide urology trainees with 32 hours of 1:1 training on low and high-fidelity simulators.

DESIGN: In this single-group cohort study, trainees rotated through modules based on aspects of the United Kingdom urology residency curriculum and undertook a pre and postcourse MCQ. Specific procedural skill was evaluated by an expert and graded as either: "A"—Good (≥4 on a 5-point Likert Scale) or "B"—Poor (Likert scale of 1-3). Competence progression was calculated as the change in score between baseline and final assessments.

SETTING: The USBC was held at St James' University Hospital, Leeds, U.K.

PARTICIPANTS: Of the 34 trainees attended the second USBC, 33 trainees participated in all the pre and postcourse assessments. The mean duration of urology training prior to undertaking the USBC was 15 months.

RESULTS: Competence progression was assessed in 33 urology trainees. Mean MCQ scores improved by 16.7% ($p < 0.001$) between pre and postcourse assessment. At final assessment, 87.9% of trainees scored "A" in instrument knowledge and assembly compared to 44.4% at baseline ($p < 0.001$). There was a mean improvement of 439s ($p < 0.001$) in the time taken to complete the European-Basic Laparoscopic skills assessment.

CONCLUSIONS: The USBC has shown to aid trainees in competence progression during the simulation on a variety of urological skills; however, retention of skill in the long-term was undetermined. The use of our grading system is simple to understand and may be used in other simulation courses to guide participants with their future training needs. (J Surg Ed 76:215–222. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Surgical education, Competence progression, Simulation, Surgical skills, Nontechnical skills, TURP

COMPETENCIES: Practice-Based Learning and Improvement, Patient Care, Medical Knowledge, Interpersonal and Communication Skills, Professionalism

INTRODUCTION

Competence is a core principle in surgical practice, and is defined as "the ability of the provider to administer safe and reliable care on a consistent basis."[1] The assessment

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of surgical competence, which encompasses both technical and nontechnical skills, is a vital component of the surgical training process.[2,3] "Competence progression" is a method of charting these skills to assess a trainees' development through their training. In the United Kingdom (UK), this is evaluated during an "Annual Review of Competence Progression" meeting in which work-place based assessments and attendance of simulation courses are appraised to ensure that a satisfactory standard is met prior to advancing to the next stage of training.[4,5]

Simulation-based learning is used to complement surgical training as it offers the opportunity to practice skills in a safe and controlled environment.[6-9] Simulation courses such as Basic Surgical Skills and Advanced Trauma Life Support are highly valued as they offer goal-directed teaching activities and assessment.[10,11] The formative and summative assessments performed during these courses are beneficial for learning,[12-14] yet, the results are only used to determine a "pass" or "fail."

There is a lack of formal assessment of competence progression at surgical simulation courses which may be due to the short nature of simulation courses or lack of validated tools for assessment. The assessment of competence progression at simulation courses may be invaluable for trainees to highlight areas for development and trainers to ensure that teaching material is provided appropriately.

The Urology Simulation Boot Camp Course (USBC) is offered to trainees in urology training at the beginning of their residency training program. It has been designed to aid the development of technical and nontechnical skills over a 5-day course.[15] The learning environment is a rich and intensive program comprising of 8 teaching modules based on aspects of the UK urology residency curriculum (Intercollegiate Surgical Curriculum Programme [ISCP] 2012) for higher speciality training. During each module, participants are assessed relevant to the module's learning content. On the fifth day, the assessments are repeated with summative assessments of technical skill and knowledge.

The objective of this paper is to describe our method of measuring competence progression at the USBC by examining the differences between assessments of knowledge and skills before, during and the postcourse with the summative assessments on the final day of the course.

Methods

The teaching content of each module of the USBC is listed in Table 1. Modules 1-4, 6, and 8 focus on the development of various technical skills using animal tissues and a combination of low and high fidelity simulators. Modules 5 and 7 utilize SimMan 3G (an advanced high-fidelity patient simulator) and patient actors respectively to focus on the development of nontechnical skills for surgeons (NOTSS) in common urological emergencies and elective urology scenarios. The learning environment and content of the USBC has been described previously.[15] The methods of assessment of participants' knowledge and skills are described below:

1. Knowledge. A minimum of 6 MCQs were designed by the each module lead based on knowledge taught during the USBC. A total of 40 MCQs were selected and the same set of questions was used during pre and postcourse online assessment. The pass rate set was calculated using the norm-referenced method (Pass mark = Mean test score—1 standard deviation). The norm-referenced method was used as it allows comparison of a trainees' knowledge against a cohort with similar ability. A grade of "A" was attributed to those participants who scored above the pass rate. Trainees were blinded to answers from the precourse online assessments.
2. Technical skills. There are limited validated tools for the assessment of technical skills in urology.[16] We therefore adapted a global-assessment score on a 5-point Likert Scale (Table 2) from the Intercollegiate Surgical Curriculum Programme (ISCP).[17] The ISCP is an approved framework for UK surgical trainees and provides standards of speciality-based knowledge, clinical judgment, and operative skills. Scores were provided with structured verbal feedback for areas of improvement. (a) Instrument knowledge and assembly—instrument knowledge and assembly were examined in modules 4 and 8 on 3 different instruments: cystoscope, urethrotome, and resectoscope. Each trainee was examined on all three instruments. (b) Endourological skills—each trainee was tested on their ability to simulate TURP and URS in modules 4 and 8, respectively. **(c)** Laparoscopic skills (E-BLUS)—the E-BLUS exam is a validated tool to test a trainees' skill in laparoscopy based on the completion of 4 tasks. An E-BLUS pass time for the completion of 4 laparoscopic tasks is 905 seconds (peg transfer = 126 seconds, cutting a circle = 151 seconds, needle guidance = 268 seconds, and knot tying = 360 seconds).[16] Time taken to complete the tasks during baseline and final assessments were compared with global assessment scores provided by our experts. Trainees who failed to complete any of the laparoscopic tasks on summative assessment were given a time of 999 seconds.
3. Nontechnical skills. Following completion of a module, experts would conduct a group discussion with cofaculty and assess each trainee's NOTSS based on 4 categories: situation awareness, decision making, communication, and team-working and leadership.[18] A score 1-4 was assigned in each category with 1—poor, 2—marginal, 3—acceptable, and 4—good.

TABLE 1. Modules Skills, models and assessments used at the USBC (Formative and summative assessments of technical skills were held for trainees at Modules 2-4, and 8. Formative assessments were performed during the module, while summative assessments were held on the final day of the USBC)

Module	Skills Learnt	Models/Equipment	Assessment
1	Scrotal examination, testicular fixation, hydrocele, priapism, penile fracture, troubleshooting with catheterisation, communication, consent, step up from CT to ST, leadership	Synthetic model Animal model (Bull's scrotum)	NOTSS
2	Intermediate surgical skills: bowel anastomosis, ileal conduit and stoma formation, bladder repair and ureteric reimplantation	Animal model (Pigs intestine)	OSAT NOTSS
3	Basic laparoscopic skills: laparoscopic access, E-BLUS exercises Task 1: peg transfer Task 2: cutting circles Task 3: needle guidance Task 4: knot tying	LapMentor Lap trainer box, Bench top (Ports)	NOTSS E-BLUS pass times Global assessment score using 5-point Likert Scale
4	TURP, TURBT, bladder washout, INSTRUMENT knowledge and assembly	TURMentor, (Simbionix, Israel) TURP (SAMED GmbH, Germany) Karl Storz—Cystoscope, Urethrotome, Resectoscope	NOTSS Global assessment score using 5-point Likert Scale
5	Scenario 1—human factors: acute urological emergencies	SimMan	NOTSS
6	Urodynamics, intravesical botox, midurethral tapes, urethral bulking agent simulation	Bench top models Urodynamic machine	NOTSS Global assessment score using 5 point Likert Scale
7	Scenario 2—human factors: simulated ward round	Simulated ward with actors	NOTSS
8	Ureteroscopy, stent placement, cystoscopy	Bench top models UroMentor (Simbionix) *k*- box	NOTSS Global Assessment Score using 5-point Likert Scale
	Urology knowledge	MCQs	Pre and postcourse MCQ exam

Scores were supplemented by qualitative feedback for areas of strength and future improvement.

Once a participant completed a particular module and a formative assessment score had been awarded, a summative assessment for 5 specific skills was performed on day 5 of the course. Experts at the final assessments were blinded to the trainees' baseline performance.

CALCULATION OF COMPETENCE PROGRESSION

Differences in the assessment scores between a module and final summative assessments were used to calculate competence progression, graded on a 4-point Likert Scale (Table 2).

The ability of participants was different before the start of USBC. This meant that there was a range of scores at formative assessment. This range of assessment scores was evident despite attempts to include trainees with similar ability based on the inclusion criteria for participants invited to USBC. We aimed to capture all trainees about to commence the UK higher surgical training program in urology (specialty training years 3-7). Some participants were ending their core surgical training (core training year 2),[1] while others were employed in nontraining posts equivalent to years 2 or 3. We hypothesized that trainees who performed well during formative assessment could have little room for improvement on the day 5 summative assessment and

[1] All UK medical graduates undertake a 2-year foundation programme, comprising of Foundation Year 1 (FY1) and 2 (FY2), which acts as a bridge between undergraduate medical training and core surgical/medical training. On completion of FY2, trainees undertake a 2-year Core Surgical Training post, in which they are expected to pass the Intercollegiate Membership of the Royal College of Surgeons (MRCS) examinations.On completion of Core Surgical Training, trainees undertake Higher Surgical Training (approximately 6 years; ST3-ST7) in one of the ten surgical specialties.

TABLE 2. Description of competence grade, progression, and final module grade

Global Assessment Score	Competence Grade	Comment
Level 1	B—"Poor"	Insufficient evidence observed to support a summary judgement
Level 2		Unable to perform the procedure, or part observed, under guidance
Level 3		Able to perform the procedure with guidance required for the majority of the procedure
Level 4	A—"Good"	Able to perform the procedure with minimum guidance (needed occasional help)
Level 5		Competent to perform the procedure unguided (could deal with complications that arose)
Change in global assessment score between baseline and final assessment	Competence Progression	Final module grade (Final competence grade + progression)
>1-point increase	4—Considerable Improvement	A4—excellent outcome B4
= 1-point increase	3—Improved	A3 B3
No change (0)	2—Stable	A2 B2
Summative score less than baseline score	1—Suboptimal	A1 B1—Poor outcome

Global assessment score for simulation performance (Adapted from ISCP).

therefore fail to show progression even though they possess satisfactory competence.

We have attempted to mitigate against this by creating binomial (alphanumerical) grading system to summarize their overall performance during the USBC. This comprised of their summative assessment grade as either "A"—good ($\geq$4 on a 5-point Likert Scale) or "B"—poor (Likert scale of 1-3) with their competence progression score (ranging from 1 to 4).

For example, a participant who scored "4" in a formative assessment of a skill and then "5" in the final assessment, has progressed but was good to begin with, would be graded "A3." Whereas a participant who scored "1" in a formative assessment and then "3" in the final assessment has also progressed but was poor to begin with, scores a higher competence progression value and would be graded as "B4."

An individual participant calculation of competence progression was communicated by a final summary report which included an explanation of the scoring system. There was no final summative assessment of nontechnical skills on the day 5 of the course but we included a qualitative summary of the scores which included summarized written text of feedback comments made during expert group discussions.

Statistical analysis

Data were statistically analyzed using IBM SPSS Statistics Version 22. The "McNemar test" was used to test differences in competence between baseline and final assessment. The "Wilcoxon Signed Rank test" was utilized to assess competence progression. A paired sample *t* test was used to determine differences in the means of MCQ scores and laparoscopic times at baseline and at the final assessment.

RESULTS

Demographics

Of the 34 trainees attended the second USBC, 33 trainees participated in all the pre and postcourse assessments, due to an absence of a trainee on day 5 of the course. A total of 56% (19/34) of trainees were male and the mean duration of urology training prior to the USBC was 15 months. Approximately 67% (23/34) of participants had commenced or were beginning to commence urology speciality training.

Knowledge

The mean precourse MCQs score was 52.7% (SE: $\pm$1.533, SD: 8.939). The pass mark set was 43.8% (norm-reference method). A significant improvement in mean MCQ of 16.7% (SE: $\pm$1.98, $p < 0.001$) was observed between pre and postcourse MCQ exam. Approximately, 68% (23/34) of trainees improved their MCQ score by more than 1 standard deviation (>1 S.D).

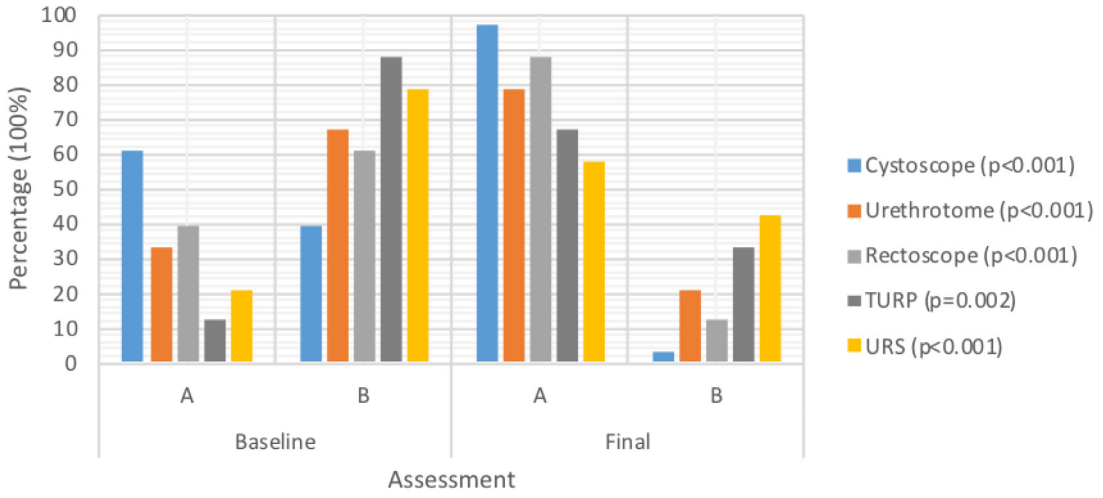

FIGURE 1. A Bar chart comparing baseline and final summative assessment competence grades of various assessments (*n* = 33). There was a significant improvement of 36.4% (cystoscope), 45.5% (urethrotome), and 48.5% (rectoscope) in competence grade from "B" at baseline to "A" at final assessment in the testing of instrument knowledge and assembly. Sixty-two percent (41/66) of endourological assessments (TURP and URS) were passed with "A" on the final day as opposed to 16.7% (11/66) at baseline ($p < 0.001$).

Technical skills

(a) Instrument knowledge and assembly—approximately, 44.4% (44/99) of assessments for all 3 instruments were graded "A" at baseline, which improved to 87.9% (87/99) at final assessment (Fig. 1). Only 3/99 of final assessments scored less than at baseline. In total, 70% (69/99) of final assessments scored significantly higher than at baseline for all 3 instruments (cystoscope—$p < 0.001$, urethrotome—$p < 0.001$, resectoscope—$p < 0.0001$). Of those who improved from their baseline assessment, 46.3% (32/69) improved considerably ("4"). (b) Endourological skills—62% (41/66) of endourological assessments (TURP and URS) were passed with "A" on the final day as opposed to 16.7% (11/66) at baseline ($p < 0.001$). Subgroup analysis showed that only 4/33 and 7/33 trainees passed TURP and URS, respectively at formative assessment. Approximately 45.5% (15/33) and 42.4% (14/33), respectively improved their score with "3" on TURP and URS (Fig. 2). Fifteen percent (5/33) of trainees did not improve their score on URS. (c) Laparoscopic skills—competence progression for laparoscopic skills data were

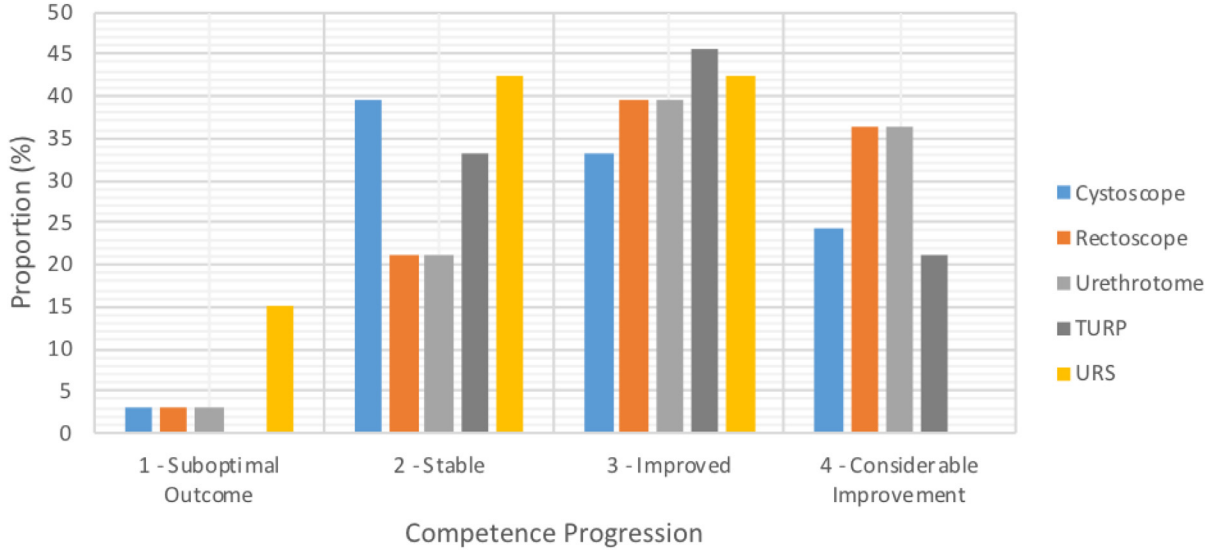

FIGURE 2. A Bar chart demonstrating competence progression scores of trainees for all assessments (*n* = 33). A large proportion of trainees (64%) had a competence progression of "3" or "4." Of trainees who scored a "2" for competence progression, 60% had a competence grade of "A" at final assessment and therefore could not improve their score. Only 4.8% of trainees had scored less ("1") at summative assessment compared to baseline.

only available for 32 trainees. The proportion of trainees graded as "A" at final assessment slightly decreased in comparison to baseline, from 62.5% (20/32) to 56.2% (18/32), respectively. Approximately, 31.3% (10/32) of trainees who were graded as "B" at baseline, did not improve their competence level.

The mean time for trainees graded as "A" at final assessment was 1069s (SE: ±110), whereas those graded as "B" was significantly longer ($p < 0.001$) at 2033 seconds (SE ± 110).

Nontechnical surgical skills sssessment: The median quantitative overall scores of each component (situation awareness; decision making; communication; and team working and leadership) were "3" (IQR: 3-3, n = 901) using the NOTSS rating scale but these scores were not applicable to measure competence progression.[18]

DISCUSSION

This paper introduces the concept of measuring competence progression during a simulation skills course and highlights the value of a "Boot Camp" course for trainees. A "Boot Camp" course is used to recreate experiences and situations that new speciality trainees may face in their first weeks of clinical practice.[19] In the first USBC, we demonstrated an increase in self-reported confidence levels in trainees across all surveyed skills and procedures.[20] Yet, an improvement in confidence may not necessarily translate to competence.[21,22] We, therefore, adapted current tools used in the clinical setting for assessing competence progression for simulation training.[17] There is a lack of literature that has utilized such systems at simulation courses.

The USBC has shown to be successful in the delivery of competence progression to trainees with approximately 40% and 24% of final assessments improving by a grade of "3" or "4," respectively (Fig. 2). Furthermore, 78% of all final assessments were classified as "A" (Fig. 1). These results were achieved using multiple teaching methods including precourse delivery of e-learning modules, video instructions to prepare the trainee, didactic teaching, and the use of an array of low and high-fidelity simulators. Simulation-based learning and assessment has been shown to be a useful tool in urology training, with good evidence to pursue the development of a simulation cocurriculam.[23] This is important due to changes within the UK healthcare system affecting the time of hands-on training opportunities for surgical trainees.

The significant improvement in mean MCQ scores of approximately 17% ($p < 0.001$) demonstrates a considerable increase in urology knowledge. Similar intensive boot camps in other surgical specialities such as general surgery, neurosurgery, and orthopedics have shown that the knowledge acquired is retained for several months after the course.[13,24,25] Boot Camp can, therefore, aid in facilitating the steep change in responsibility and may improve both patient safety and reduce clinician anxiety.[19]

The 5-point global assessment score was validated with E-BLUS which showed there was approximately 70 seconds difference between those who were graded competent ("A") and candidates who pass the standardized and validated practical examination of the E-BLUS training programme.[16] This marginal difference (7.7%) in total laparoscopic time shows that our assessors were able to appropriately differentiate candidates who were "good" and/or "A" with those who were "poor" and/or "B" on the laparoscopic module. In total, trainees had a total of 3 hours on the laparoscopic module to practice and improve their times. Although data on laparoscopic precourse experience was not gathered in this study, it is likely that the significant improvement in times (439 seconds [SE: 100s, $p < 0.001$]) between the formative and summative stages were likely due to increased familiarity with the requirements of the individual tasks in addition to improved training.

LIMITATIONS

The main limitation of the competence progression scoring system that we propose is the short duration between formative and summative assessment and that we have not assessed skill and knowledge weeks or months after the course ended leading to an argument that any competence gained might not be sustained. The summary report communicated to participants contains the quantitative competence progression score plus qualitative feedback of NOTSS. We suggested to participants that this could provide educational supervisors areas of suggested focused training, yet we have not been prescriptive in enforcing these discussions take place.

We also recognize that the global assessment scores are a subjective measurement of competence by an expert and may be susceptible to observer bias. For example, the use of simulator metrics from LapMentor such as hand speed, number of movements, and path length were not used to generate the competence levels of trainees. Although this method is likely to be the future of assessing performance, a subjective assessment that is similarly used in the clinical setting was felt adequate.

A time penalty of 999 seconds was chosen for the failure of completing the laparoscopic tasks in the allotted time slot for assessment. This value was chosen as it provides an equal weighting among all 4 laparoscopic tasks that test different levels of dexterity and depth perception. In addition, the same set of questions were used for the pre and postcourse assessment of knowledge which may have introduced performance bias, however, trainees were blinded to answers from their precourse assessment.

Furthermore, the results for NOTSS indicate that the trainees performed comparably, may indicate that all trainees had good nontechnical skills but it is also plausible that the nontechnical assessments may have been too easy. We are in constant discussion with the trainers and trainees to overcome such limitations and to deliver improvements within the course.

CONCLUSION

The USBC has emerged as a successful simulated learning platform for urology trainees and is being planned annually with a view to incorporating it into the National urology program. A large proportion of trainees demonstrated immediate competence progression on a variety of technical skills after utilizing the advantages of simulation; however retention of skill in the long-term was undetermined. The use of our binomial grading system provides an instant appreciation of a trainees' ability among other candidates of similar aptitude and career aspirations. This evidence, attained by multiple expert assessments may be used to guide participants with their future training needs.

FUNDING

Yorkshire Deanery, British Association of Urological Surgeons, Storz, Coloplast.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AVAILABILITY OF DATA AND MATERIALS

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

ACKNOWLEDGMENTS

We would like to thank all participants and entire faculty, especially module leads (Mr Phil Cornford, Ms Mary Garthwaite, Ms Ruth Doherty, Mr Mark Rochester, Ms Alex Colquhoun, Ms Felicitiy Reeves, and Mr Joby Taylor) for their support and work in preparing the Urology Simulation Boot Camp.

REFERENCES

1. O'Toole MT. Miller-Keane Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health. Elsevier; 2005.
2. Darzi A, Mackay S. Assessment of surgical competence. *Qual Health Care*. 2001;10(Suppl 2):ii64–ii69.
3. Jaffer A, Bednarz B, Challacombe B, Sriprasad S. The assessment of surgical competency in the UK. *Int J Surg*. 2009;7:12–15. https://doi.org/10.1016/j.ijsu.2008.10.006.
4. Programme, I.S.C. Overview of the assessment Assessment systemSystem. 2016 [cited 2016 09/10/2016]; Available from: https://www.iscp.ac.uk/curriculum/surgical/assessment.aspx.
5. Viney R, Rich A, Needleman S, Griffin A, Woolf K. The validity of the annual review of competence progression: a qualitative interview study of the perceptions of junior doctors and their trainers. *J R Soc Med*. 2017;110:110–117. https://doi.org/10.1177/0141076817690713.
6. Arora S, Sevdalis N, Suliman I, Athanasiou T, Kneebone R, Darzi A. What makes a competent surgeon? Experts' and trainees' perceptions of the roles of a surgeon. *Am J Surg*. 2009;198:726–732.
7. Grant DJ, Marriage SC. Training using medical simulation. *Arch Dis Child*. 2012;97:255–259.
8. Kneebone RL, Scott W, Darzi A, Horrocks M. Simulation and clinical practice: strengthening the relationship. *Med Educ*. 2004;38:1095–1102.
9. Ates O, Aktug T, Hakguder G, Olguner M, Akgur FM. The role of simulated models in pediatric surgery to acquire diagnostic skills of inguino-scrotal disorders. *J Pediatr Surg*. 2003;38:1616–1620.
10. Acosta S, Sevonius D, Beckman A. Extended score interval in the assessment of basic surgical skills. *Med Educ Online*. 2015;20:25819. https://doi.org/10.3402/meo.v20.25819.

11. Templeton-Ward O, Solan M. Simulation in orthopaedic training: would a national curriculum improve trainees' surgical skills? *The Bulletin*. 2014: 96.

12. Macluskey M, Hanson C. The retention of suturing skills in dental undergraduates. *Eur J Dent Educ*. 2011;15:42–46.

13. Sonnadara RR, Garbedian S, Safir O, et al. Orthopedic boot camp: examining the effectiveness of an intensive surgical skills course. *Surgery*. 2011;149:745–749. https://doi.org/10.1016/j.surg.2010.11.011.

14. Yu TC, Wheeler BR, Hill AG. Clinical supervisor evaluations during general surgery clerkships. *Med Teach*. 2011;33:e479–e484.

15. Biyani CS, Hanchanale V, Rajpal S, et al. First urology simulation boot camp in the United Kingdom. *Afr J Urol*. 2017;23:258–267.

16. Brinkman WM, Tjiam IM, Schout BM, et al. Results of the European basic laparoscopic urological skills examination. *Eur Urol*. 2014;65:490–496.

17. ISCP. ISCP Competency Levels. [cited 2016 18/10/2016]; Available from: https://www.iscp.ac.uk/static/plas2012/Levels1-4competencies.pdf; 2016.

18. University of Aberdeen; 2012. Available from: https://www.iscp.ac.uk/static/help/NOTSS_Handbook_2012.pdf.

19. Singh P, Aggarwal R, Pucher PH, Development DA. Organisation and implementation of a surgical skills 'boot camp': SIMweek. *World J Surg*. 2015; 39:1649–1660.

20. Hanchanale, V, Rajpal, S, Reeves, F et al., First urology simulation boot camp: education value and impact on improving trainees' confidence in common urological procedures, In EAU 2016, EU Supplements, Elsevier B.V.: Munic. abstract 357

21. Chatenay M, Maguire T, Skakun E, et al. Does volume of clinical experience affect performance of clinical clerks on surgery exit examinations? *Am J Surg*. 1996;172:366–372.

22. Morgan PJ, Cleave-Hogg D. Comparison between medical students' experience, confidence and competence. *Med Educ*. 2002;36:534–539.

23. Rashid P, Gianduzzo TR. Urology technical and non-technical skills development: the emerging role of simulation. *BJU Int*. 2016;117(Suppl 4):9–16.

24. Sonnadara RR, Garbedian S, Safir O. Toronto orthopaedic boot camp III: examining the efficacy of student-regulated learning during an intensive, laboratory-based surgical skills course. *Surgery*. 2013;154:29–33.

25. Sonnadara RR, Garbedian S, Safir O, et al. Orthopaedic boot camp II: examining the retention rates of an intensive surgical skills course. *Surgery*. 2012;151: 803–807.

SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jsurg.2018.06.020.