International Surgery Journal
*Egedovo A et al. Int Surg J. 2017 Jul;4(7):2131-2138*
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20172760

**Original Research Article**

# Awareness of surgeons and surgical trainees of online web-based techniques for teaching laparoscopic surgery in north Queensland

**Alfred Egedovo[1,2]*, Yik-Hong Ho[1,3], Sarah Larkins[1], Chrispen Mushuya[3], Muhammad Ashraf[4], Masimba Nyandowe[3], Theophilus I. Emeto[2], Venkat N. Vangaveti[2]**

[1]Department of Surgery, Townsville Hospital, JCU Clinical School, College of Medicine and Dentistry, James Cook University, James Cook Drive, Douglas, Townsville, QLD 4811, Australia
[2]Department of Public Health, Public Health and Tropical medicine, College of Public Health, Medical and Veterinary Studies, James Cook University, Townsville, QLD 4811, Australia
[3]Department of Surgery, The Townsville Hospital, Townsville, QLD 4814, Australia
[4]Department of Surgery, Mackay Base Hospital, Mackay, QLD 4740, Australia

**Received:** 05 May 2017
**Accepted:** 29 May 2017

***Correspondence:**
Dr. Alfred O. Egedovo,
E-mail: alfred.egedovo@my.jcu.edu.au



## ABSTRACT

**Background:** For generations, surgical training has followed the example of an apprenticeship model. However, many doctors see this training as insufficient and potentially unsafe for the patient. Web-based simulation training for teaching laparoscopic surgery is not only becoming increasingly popular but is cheaper in comparison to the traditional apprenticeship method. Objective is to assess the educational value of web-based training videos
**Methods:** Data was obtained through questionnaires sent to consultant surgeons and surgical trainees at three sites in North Queensland. Study invited participants to complete a 24-item questionnaire on knowledge and attitudes. The questionnaires were distributed using online survey monkey software to send emails to the three Government Hospitals.
**Results:** There was a response rate of 11.40%, Consultant surgeons (13/17; 72.20%) and surgical trainees (4/17; 22.20%). Majority of participant`s sources of learning laparoscopic surgery was from supervisors in operating theatre (64.30%) and online Web-based training video (WBTV; 7.10%), although satisfaction with current web-based training video resources was found to vary widely for a variety of reasons. WBTV were used mainly when required for clinical rotation.
**Conclusions:** There was a response rate of 11.40%, Consultant surgeons (13/17; 72.20%) and surgical trainees (4/17; 22.20%). Majority of participant`s sources of learning laparoscopic surgery was from supervisors in operating theatre (64.30%) and online Web-based training video (WBTV; 7.10%), although satisfaction with current web-based training video resources was found to vary widely for a variety of reasons. WBTV were used mainly when required for clinical rotation.

**Keywords:** Laparoscopic skills training, Surgical education, Surgical simulation, Surgical training, WBLTV, WBTV

## INTRODUCTION

### *History of teaching/learning laparoscopic surgery*

Laparoscopic surgery, also called minimally invasive surgery (MIS), band aid surgery, or keyhole surgery, is a modern surgical technique in which operations are performed through small incisions (usually 0.5-1.5 cm) elsewhere in the body.[1] Since its acceptance in the 1980s, laparoscopic surgery has become the gold standard[2,3] in surgical practice for operations such as appendicectomy and cholecystectomy. Training in laparoscopic surgery

started with short two to three-day courses, frequently unstructured and not accredited, in a rush to provide surgeons with supposedly adequate training in laparoscopic techniques before performing a laparoscopic cholecystectomy on patients.[1,4,5]

Traditional standard surgical training has involved an apprenticeship model, where experts instruct trainees using patients.[6] Techniques to learn surgery have undergone several modifications. Surgery was initially taught through 2D anatomy in medical school. This teaching method incorporates lectures, PowerPoint presentations and videos. However, this gradually shifted to a 3D training model that added cadavers.[7] Also, surgical education in the 1900`s started using the model proposed by William Halsted; "see one, do one, teach one ". Here, the surgical trainee learns to perform surgical procedures under the supervision of a senior surgeon[8-10] by practising on real patients. This type of teaching lead the surgical trainee to have feelings of doubt, consequently leading to mistakes.[12,13] as it lacks the necessary depth of practise for surgical trainees to be able to perform procedures on their own.[11] The model may compromise patient safety because of patient exposure to longer surgical time and inexperienced operators. The time spent in the theatre teaching raises enormous and inappropriate costs if it is the only avenue of teaching.[14,15] Pape-Koehler et al argued that web-based training videos (WBTV) offer a solution to these problems.[13] The way the operations are presented in combination with videos allows the surgeons to watch the surgery and adopt the ways of the experienced surgeon. After undergoing web-based training, the surgeon may feel better trained and more secure in the procedure itself, possibly avoiding potential mistakes. Before practising on patients, the surgeon has already gathered some knowledge and will not use expensive operating room time for practise.

Furthermore, the drive to achieve improved patient outcomes and patient safety has led to innovations in surgery and surgical education. The introduction of laparoscopic surgical procedures into surgical practise comes with various challenges as: transferring surgical skills learnt from the traditional setting of the operating theatre to laparoscopic surgical procedures is complicated. This is especially so since surgical trainees learn and acquire skills at different rates, 16,17 which is associated with surgical performance changes over time. These changes in surgical performance may represent a "learning curve", which is a function of: (1) the technical developments or refinements in techniques after the introduction of a new procedure; (2) surgeon familiarity with new techniques; and (3) changes in infrastructure such as better- trained assistance and improved postoperative care. As Tekkis et al16 highlighted, these changes often lead to an improvement in surgical performance after some time and have been used for the evaluation of the learning curve in the clinical and nonclinical literature. Cundy et al, further stated that operating theatre acquired surgical skills are of variable effectiveness because of the learning curve.[16,17]

## METHODS

All general surgeons and surgical trainees (n=148) at Townsville, Mackay and Cairns Hospital (major Northern Queensland Hospitals) were invited to participate in an anonymous online survey. The survey consisted of 24 questions (Appendix 1) arranged in themes, and distributed to surgical staff of the three target hospitals using Survey Monkey software (www.surveymonkey.com), which was delivered electronically between June 2014 and July 2015. Two email reminders were sent during each cycle of questionnaire distribution. Non-responders were emailed another survey 3 to 4 weeks after the first email and contacted directly by phone. Informed consent was obtained if the participants chose to complete the online survey. Emails were obtained electronically and verified by a direct contact with the head of surgical division offices.

Multiple assessments, including Likert scale and single answer questions; predominantly using the following numerical scoring system: 5- strongly agree: 4 - agree; 3 - neutral; 2 - disagree; 1 - strongly disagree. The survey had five separated rate categories: Surgeons and surgical trainee hospital demographics, surgical hiring experiences, teaching of laparoscopic surgery, training for laparoscopic surgery and perception of online web-based laparoscopic training video.

De-identified data was collected, coded and exported into SPSS version 22 (IBM, Chicago, IL, USA) for descriptive statistics using proportions and bivariate comparisons. The Chi-Square test was used to analyse Likert-type responses, and free text were analysed thematically. A P-value <0.05 was considered as statistically significant

## RESULTS

Surgical supervisor in operating theatre as a major source for learning laparoscopic surgery.

The survey was undertaken between August 2014 and July 2015. Thirteen (72.20%) of the consultant surgeons and four (22.20%) surgical trainees of the 148 invited completed the questionnaire.

The characteristics of consultant surgeons and surgical trainees who completed the questionnaire are shown in Table 1. Overall, we had a response rate of 11.50% from the three survey sites. One participant did not consent to provide their expertise. A significant number of participants chose not to reveal their gender (47.10%), the rest were 35.3% male and 17.6 % were female. 52.90% of the participants did not reveal their age, with 23.5% in the age group between 40 and 49 years. 5.9 % of the

participants were in the age groups 21-29 with an equal number above 60 years. A majority of the respondents from the three-site obtained medical qualification from Queensland (35.3%) followed by international graduates (17.6%). Only 7.1% had been exposed to learning Laparoscopic Surgery with online web-based training video (WBTV) while 64.3% had learnt laparoscopic surgery from surgical supervisors in the operating theatre. Other sources of laparoscopic surgical procedures reported include animal lab (7.1%), and Black box trainer (7.1%). 14.4% indicated they have not learnt laparoscopic surgery.

**Table 1: Demographic data details of consultant surgeons and surgical trainees.**

| | Number | Percent |
|---|---|---|
| Total invitation | 148 | 100 |
| Overall response | 17/148 | 11.48 |
| Consultant surgeons | 13 | 72.20 |
| Surgical trainees | 4 | 22.20 |
| Total | 17 | 94.40 |
| Not provided | 1 | 5.60 |
| **Gender** | | |
| Female | 3 | 17.60 |
| Male | 6 | 35.30 |
| Not provided | 8 | 47.10 |
| Total | 17 | 100 |
| **Age group** | | |
| 21-29 | 1 | 5.90 |
| 30-39 | 2 | 11.80 |
| 40-49 | 4 | 23.50 |
| 60 or older | 1 | 5.90 |
| Not provided | 9 | 52.90 |
| Total | 17 | 100 |
| **Location of first medical qualification** | | |
| International graduate | 3 | 17.60 |
| Queensland | 6 | 35.30 |
| Not provided | 8 | 47.10 |
| Total | 17 | 100 |
| **Source of learning laparoscopic surgery** | | |
| From surgical supervisor/operating room | 9 | 64.30 |
| Online web-based training video | 1 | 7.10 |
| Using animal labs | 1 | 7.10 |
| Black box trainer | 1 | 7.10 |
| Have not learnt laparoscopic surgery | 2 | 14.40 |

Lack of awareness is the main reason for not knowing WBTV. Table 2 represents results regarding the most significant comments on awareness of web-based training video by participants. At the time of this survey, 86.7% responded that they have had no experience in WBTV during their surgical education. 13.3% had experience in the WBTV method. Furthermore, 77.8% of respondents said the main reason for not using WBTV was their lack of awareness about WBTV learning methodology. Other responses included, laparoscopic surgery was not their field of surgical practice (11.1%) and not relevant to their surgical practices (11.1%).

For those participants that have had experience in WBTV, 40% stated that it had improved their personal expertise moderately while other 40% of consultant surgeons and surgical trainees recorded that this WBTV did not improve their surgical proficiency at all. However, 20% of participants stated that WBTV verily improved their personal surgical skilfulness.

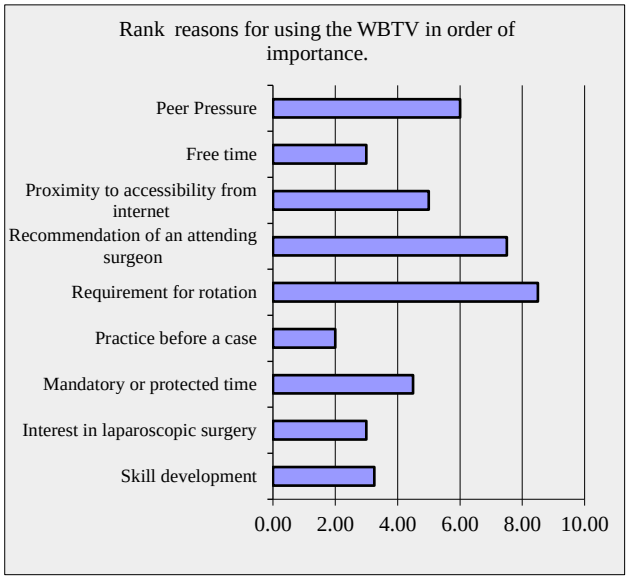


**Figure 1: Reasons for using web-based training video (WBTV).**

Amongst the respondents, 25% had obtained minimal information about WBTV from internet and colleagues that had not used WBTV as one of the techniques of learning laparoscopic surgery stated they are not aware of how easy it is to WBTV. While those that have used other method, but not WBTV, said that they have not used it so they cannot assess how easy it to use it was. 12.5% of those that are aware of WBTV that used it, agreed that it was moderately easy. Another 12.5% stated it is not easy to use at all. 12.5% revealed WBTV is not relevant to their surgical practice and application. Nonetheless, 25% of the surgeons' declared that WBTV was very easy to use in learning laparoscopic surgery techniques. Although 40% responded that their theoretical knowledge was not increased at all when they used WBTV, 20% stated that WBTV increased their theoretical knowledge a great deal, the other 20% stated that the effect was moderate, and the remaining indicated WBTV increase their theoretical knowledge a little bit.

In addition, 60% of responders indicated no increase in their skill, 20% reported a slight increase in their practical accomplishment, and the remaining 20% indicated using WBTV had increased their practical skills a great deal.

However, overall the consultant surgeons and 40% of the surgical trainees, in the study indicated that they were moderately satisfied with WBTV as a laparoscopic training technique. 20% stated they were slightly satisfied with WBTV as a laparoscopic training technique, 20% indicated they were neither satisfied nor dissatisfied, and the remaining 20% responded that they were extremely dissatisfied with learning using WBTV. When the participants were asked if they would recommend WBTV, 25% responded that they are unlikely to recommend WBTV, 50% indicated they are likely to recommend WBTV, and 25% stated they are extremely likely to recommend it.

Requirement for rotation was the main reason for using WBTV. The top 3 reasons for consultant surgeons and surgical trainees to use WBTV were pointed out as a requirement for rotation and recommendation from an attending surgeon in laparoscopic surgical trainings and peer pressure (Figure 1).

There was convincing variation between the rank score for the 9 reasons for using the WBTV at $p<0.05$. In Pearson chi-square comparison and the least rank score was practiced before a surgical case in the operating theatre.

**Table 2: Responses of participants.**

| Questions | Responses | Number | Percent |
|---|---|---|---|
| Have you had experience with WBTV | No | 13 | 86.7 |
| | Yes | 2 | 13.3 |
| | Total | 17 | 100 |
| Why have you not used it? | Not aware of it | 7 | 77.8 |
| | Not my field | 1 | 11.1 |
| | Not relevant | 1 | 11.1 |
| | Total | 17 | 100 |
| Was the WBTV improving your personal expertise? | Moderately | 2 | 40 |
| | Not at all | 2 | 40 |
| | Very | 1 | 20 |
| | Total | 17 | 100 |
| How easy is the web-based laparoscopic training video to use? | Have not used | 2 | 25 |
| | Have not used it | 1 | 12.5 |
| | Moderately easy | 1 | 12.5 |
| | Not at all easy | 1 | 12.5 |
| | Not relevant to me | 1 | 12.5 |
| | Very easy | 2 | 25 |
| | Total | 8 | 100 |
| To what degree has the Web-based training video(WBTV) increased your theoretical knowledge about laparoscopic surgery | A great deal | 1 | 20 |
| | A little bit | 1 | 20 |
| | A moderate amount | 1 | 20 |
| | Not at all | 1 | 40 |
| | Total | 5 | 100 |
| To what degree has the WBTV increased your practical skills in laparoscopic surgery? | A great deal | 1 | 20 |
| | A little bit | 1 | 20 |
| | Not at all | 3 | 60 |
| | Total | 5 | 100 |
| Overall, to what degree are you satisfied with the web-based laparoscopic training technique on-line? | Extremely dissatisfied | 1 | 20 |
| | Moderately satisfied | 2 | 40 |
| | Neither satisfied or dissatisfied | 1 | 20 |
| | Slightly satisfied | 1 | 20 |
| | Total | 5 | 100 |
| How likely is it that you would recommend the web-based laparoscopic surgery training video to a friend or colleague? | 0 = Likely | 1 | 25 |
| | 6 moderately likely | 2 | 50 |
| | 9 extremely likely | 1 | 25 |
| | Total | 4 | 100 |

The results from this study argued that despite the acknowledge usefulness of WBTV as requirement for clinical rotation for surgical training in principle, the majority respondents do not use it to practise before surgical cases (Figure 1). This reflected that surgical trainees preferred to use operating theatre model surgical training (Table 1) though more risk since patients are used. Because after undergoing web-based training, the surgeon may feel better trained and more secure in the procedure itself, possibly avoiding potential mistakes. Before practising on patients, the surgeon would have already gathered some knowledge and will not use expensive operating theatre time for practice.

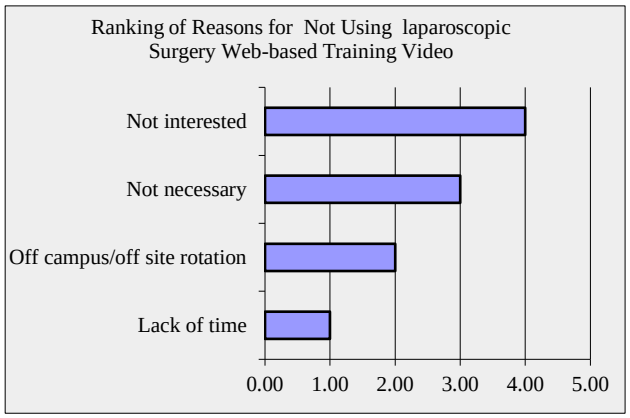


**Figure 2: Reasons for not using the web-based training video (WBTV).**

Figure 2 shows that the two most common reasons for respondents not using WBTV were lack of time and being campus for clinical rotation.

Present study also showed that most surgical trainees who used WBTV did so on basis of clinical rotation requirement. Although majority of participant indicated they were not interested.

## DISCUSSION

This study reports the views and opinions of a very small sample of 17 consultant surgeons and surgical trainees in North Queensland regarding their sources of learning laparoscopic surgery; awareness of a WBTV was the main reason for using WBTV. Such views and opinions have not been documented or used previously in the area of surgical education provision in North Queensland. This is particularly implicit in WBTV techniques in learning Laparoscopic surgery amongst surgeons in Hospital (rather than learning from supervisors at the operating theatre) settings. The views of the consultants and surgical trainees surveyed provided important insights into consultant surgeon's and surgical trainee`s methodology of learning laparoscopic surgery and the reasoning for their choice of method and highlights what consultant surgeons and surgical trainees considered to prefer.

Our survey shows that the currently used laparoscopic teaching techniques do not exactly reflect the initial expectations because there is a significant difference in the application of the use of the various techniques and a majority of respondent's motivation for using WBTV.

In this study, the most common source of learning laparoscopic surgery is from a supervisor in an operating theatre. However, a significant number of those surveyed (7.1%) learnt laparoscopic surgery skills from online WBTV, highlighting the differences in the most common means used by surgeons to learn laparoscopic surgery. Our study indicated that the traditional method is mostly used to learn laparoscopic surgery which could be as result of close acquaintance with the technique. Having had more experience in the operating room, the senior residents preferred traditional model, possibly perceiving the surgical simulation and Online WBTV models as less stimulating. This is in line with the observed surgical training for generations that has followed the example of an apprenticeship model propagated by William Halsted: "see one, do one, teach one".[8-10]

Shetty et al highlighted a voluntary use of other teaching techniques leads to minimal use of the tools in a training curriculum and this study could have been influence by this factor.[19] Furthermore, this study may help to inform whether mandatory/protected training time, as a part of the residents' curriculum is essential to enhance the use of different tools for surgical training in a simulation laboratory. The mandatory training time would give resident the chance to participate in a surgical simulation laboratory session. The Residency programs are trying to incorporate simulation into the resident training curriculum to supplement the hands-on experience gained in the operating room. Despite the availability and proven utility of surgical simulators and simulation laboratories, they are still widely underutilized by surgical trainees as a result of familiarity with method of training in operating theatre and the use of other models for that is being made voluntary choice for surgical trainees.

It has been well documented that laparoscopic surgery is demanding and needs various techniques to learn. Ramsay[30] highlighted: Laparoscopic procedures require various skills and learning abilities than open surgical procedures. Because of these demands, mastery in fundamental laparoscopic skills is being added to the surgical training syllabus. These advances, together with meeting the educational needs of surgical trainees in the current era continues to be confronted by such circumstances as the Working Time Directive already implement in Europe and USA.[20-22] These changes have resulted in a reduction in working hours, with consequently more shift-working and time-limited training; have necessitated that surgical education expand from the operating theatre to surgical skills labs and this would necessitate the need to deliver consistency of training, and teaching that suit the needs of the individual trainees. WBTV may offer a greater degree of benefit

which could assist uniformed surgical training. Evidence of the educational value of simulators for surgical training is accumulating rapidly[23] and our study is assess the use of WBTV .

Lack of awareness the main reason for not knowing WBTV. Contrary to expectation, participants' overall reasons of not knowing WBTV was lack of awareness compare to operating theatre model and another concern was adaptation to the use WBTV in learning.

It is possible that the currently used laparoscopic skill lab curriculum does not accurately show the value of WBTV as an effective teaching and training method. At the time of the survey, consultant surgeons and surgical trainees were of the opinion that laparoscopic surgery education in their respective academic surgery programs were mainly learned from supervisors in operating theatres, followed by animal labs, and black box simulation. This comparison was established based on aggregated sources of learning laparoscopic surgery obtained in the study Table 1.

Other reasons for lack of awareness of WBTV (Table 2), can be attributed to the fact that participants have not been exposed to the WBTV technology used in surgical simulation. Respondents' response to question about WBTV were varied indicating their lack of applications. The Web-based training video (WBTV) contains a large collection of streaming and downloadable HD quality videos of surgical procedures, combined with how-to step-by-step surgical teaching guidelines to aid the implementation of laparoscopic surgical procedures for various surgical disciplines.[24,25]

Further, just recently, the first interactive e-learning program for laparoscopy has been introduced.[25] The e-learning program is called ''SimpraxisTM Laparoscopic Cholecystectomy Trainer'', a customizable, interactive, simulation software training platform for cognitive learning of surgical procedures. This technology integrates multimedia (such as video, 3D models, radiology, illustrations, text, and still images, all captured from live procedures), and combines them with expert cognitive training pedagogy to create a powerful simulation of the procedure.

Adaptation to the WBTV is required, indeed, this adaptation effect, using WBTV learning method for laparoscopic surgery was observed in previous studies.

Therefore, using this deduction method allow an assessment of awareness relative to this population of learners. Thus, it may not be appropriate for application in this studies without modifications. Hence a general awareness assessment method that is not source of learning or does not include WBTV adaptations effects, but specific, should be used in future comparison studies.

Compare to our study, Fraser et al page 3 also documented awareness about WBTV could be influenced by availability of WBTV and stated; "Respondents' rating of currently available WBTV are satisfactory and were Satisfied with current WBTV resources" though varied widely, but most respondents considered them satisfactory or more than satisfactory as a resource for specialty training when asked whether a specialty-specific, evidence based e-learning resource would be used if it were available and free, 86 per cent (101) of respondents agreed.[18] Hence WBTV provision for free could influence its awareness.

This may reflect that using of WBTV did diversify based on a respondent internal motivational agenda. This corresponded with Fraser et al studies which highlighted that reasons for knowing WBTV varied, but most commonly included searching for new research, accessing the best evidence, guidelines and protocols, obtaining help with patient management, and learning surgical techniques. Most information was gained after random Internet searches or following recommendation of a website by a colleague.[18]

Other studies indicate that Online Web-based laparoscopic training video when used efficiently for surgical skill simulation increases laparoscopic surgery knowledge and practical skills.[18] The presence of added educational value demonstrated that web-based laparoscopic training video is used as a tool to supplement or complement other methods for teaching laparoscopic surgery and when it is well formatted, laparoscopic surgery cases video programmed in a website can be used in learning and improve laparoscopic surgery practical skills. Existing research and evaluation of teaching methodologies have shown that online web-based training can increase knowledge retention when used as part of a combined learning strategy whereby learning takes place through a number of different types of learning experience.[26]

However, according to Schreduder et al, although web-based training is being used for learning laparoscopic surgery, and is one of the various techniques for teaching laparoscopic surgery, no evidence of the superiority of one technique over the other in skill acquisition is known.[25]

Additionally, there is a need to validate the WBTV and its simulation of the feeling of performing the actual physical procedure while only using a computer. Similarly, simulation-based training is claimed to be more effective than video-based instruction.[27] However, the value of these web-based simulations has not been extensively evaluated.

The main limitation of the study was a poor response rate. The response rate in the study was 11.5 % which is less than ideal. Some studies have used financial incentives such as gift cards to encourage participation.

We had no financial resources to offer such incentives. Another limitation was the movement of surgical trainees at the completion of their rotations to different departments or hospitals.

## CONCLUSION

Most surgeons and surgical registrars are already familiar with the concept of online web-based laparoscopic training video. However, participants of the study are facing the challenge of been commonly aware of specific methods of obtaining laparoscopic surgery skills and the majority of Surgeons believe teaching in the operating theatre still is the most valuable tool but are interested in learning with WBTV. This is because laparoscopic training has evolved into a platform of combining traditional apprenticeship in the Operating theatre with supplemental training in surgical skills labs.

The Online Web-based laparoscopic training video will hopefully address this gap. This cheaper, easily accessible, self-directed web-based initiative aims to support and enhance laparoscopic surgery training by improving knowledge and clinical and surgical skills, ultimately ensuring the delivery of safe patient care.

Most surgical trainees are receptive to the implementation of a specialty-specific web-based laparoscopic surgery training videos. In other word, laparoscopic web-based training videos are slowly gaining acceptance as their software and technology improve. It is hard to ignore the ever-evolving world of technology and the possible advantages it offers surgeons and surgical trainees. However, caution needs to be exercised in inferring that Online web-based Laparoscopic surgery training videos can compete with existing training methods by virtue of its technological advantages and wide availability, or in assuming that it will even appeal to current trainee surgeons. Continued evaluation is vital to ensure the success of the online laparoscopic surgery training techniques. Web based video teaching is felt to be useful and hence should be made more readily available as well as improved in quality.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the institutional ethics committee*

## REFERENCES

1. Stefaniak TJ, Laski D, Patrzyk M, Bigda J, Sledzinski Z. Training in classic and laparoscopic surgery-neds and remedies. Polski Przeglad Chirurgiczny. Polish J Surg. 2013;85(7):412-8.
2. Bharathan R, Aggarwal R, Darzi A. Operating room of the future. Best practice and research: Clin Obstet Gynaecol. 2013;27(3):311-22.
3. Roslyn JJ, Binns GS, Hughes EFX, Saunders-Kirkwood K, Zinner MJ, Cates JA. Open cholecystectomy: a contemporary analysis of 42,474 patients. Annals Surg. 1993;218(2):129-37.
4. Hunter JG, Sackier JM, Berci G. Training in laparoscopic cholecystectomy - quantifying the learning curve. Surg Endos. 1994;8(1):28-31.
5. Ali MR, Mowery Y, Kaplan B, DeMaria EJ. Training the novice in laparoscopy: more challenge is better. Surg Endos Other Interventional Techniques. 2002;16(12):1732-6.
6. Basdogan C, Sedef M, Harders M, Wesarg S. VR-based simulators for training in minimally invasive surgery. IEEE Comput Graph Appl. 2007;27(2):54-66.
7. Brinke Bt, Klitsie PJ, Timman R, Busschbach JJV, Lange JF, Kleinrensink GJ. Anatomy education and classroom versus laparoscopic dissection-based training: a randomized study at one medical school. Academic Med. 2014;89(5):806-10.
8. Singh P, Darzi A. Surgical training. Br J Surg. 2013;100(s6):19-21.
9. Scott J, Rankin M, Halsted WS. Ann Surg. 2006;243(3):418-25.
10. Scott DJ, Cendan JC, Pugh CM, Minter RM, Dunnington GL, Kozar RA. The changing face of surgical education: simulation as the new paradigm. J Surg Res. 2008;147(2):189-93.
11. Scott DJ, Cendan JC, Pugh CM, Minter RM, Dunnington GL, Kozar RA. The changing face of surgical education: simulation as the new paradigm. J Surg Res. 2008;147(2):189-93.
12. Rodriguez-Paz J, Kennedy M, Salas E, Wu AW, Sexton JB, Hunt EA, et al. Beyond "see one, do one, teach one": toward a different training paradigm. Quality Safety Health Care. 2009;18(1):63-8.
13. Andreatta PB, Hillard M, Krain LP. The impact of stress factors in simulation-based laparoscopic training. Surg. 2010;147(5):631-9.
14. Pape-Koehler C, Immenroth M, Sauerland S, Lefering R, Lindlohr C, Toaspern J, et al. Multimedia-based training on Internet platforms improves surgical performance: a randomized controlled trial. Surgical Endos. 2013;27(5):1737-47.
15. Reznick R, Regehr G, MacRae H, Martin J, McCulloch W. Testing technical skill via an innovative "bench station" examination. Am J Surg. 1997;173(3):226-30.
16. Hamamci EO, Besim H, Bostanoglu S, Sonisik M, Korkmaz A. Use of laparoscopic splenectomy in developing countries: analysis of cost and strategies for reducing cost. J Laparoendoscopic Advanced Surgical Techniques. 2002;12(4):253-8.
17. Tekkis PP, Fazio VW, Lavery IC, Remzi FH, Senagore AJ, Wu JS, et al. Evaluation of the learning curve in ileal pouch-anal anastomosis surgery. Ann Surg. 2005;241(2):262-8.

18. Herrell SD, Smith JA. Robotic-assisted laparoscopic prostatectomy: What is the learning curve? Urol. 2005;66(5):105-7.
19. Fraser L, Gunasekaran S, Mistry D, Ward VM. Current use of and attitudes to e-learning in otolaryngology: questionnaire survey of UK otolaryngology trainees. J Laryngol Otol. 2011;125(4):338-42.
20. Shetty S, Zevin B, Grantcharov TP, Roberts KE, Duffy AJ. Perceptions, training experiences, and preferences of surgical residents toward laparoscopic simulation training: a resident survey. J Surgical Educ. 2014;71(5):727-33.
21. Drolet BC, Sangisetty S, Tracy TF, Cioffi WG. Surgical residents' perceptions of 2011 Accreditation Council for Graduate Medical Education duty hour regulations. JAMA Surg. 2013;148(5):427-33.
22. Jagannathan J, Vates GE, Pouratian N, Sheehan JP, Patrie J, Grady MS, et al. Impact of the Accreditation Council for Graduate Medical Education work-hour regulations on neurosurgical resident education and productivity. J Neurosurg. 2009;110(5):820-7.
23. Iglehart JK. Revisiting Duty-Hour Limits-IOM Recommendations for Patient Safety and Resident Education. New England J Med. 2008;359(25):2633-5.
24. Stefanidis D, Heniford B. THe formula for a successful laparoscopic skills curriculum. Archives Surg. 2009;144(1):77-82.
25. Didier Mutter MV, Dallemagne B, Perretta S, Leroy J, Marescaux J. WeBSurg. An Innovative Educational Web Site in Minimally Invasive Surgery--Principles and Results. Surg Innov. 2011;18:8.
26. Schreuder HW, Oei SG, Maas M, Borleffs JC, Schijven MP. Implementation of simulation for training minimally invasive surgery. J Med Edu. 2011;30(5):206-20.
27. Gardner J, Holmes B. E-Learning: Concepts and Practice. SAGE Publications Ltd; 1st ed; 2006.
28. Rege RV. Commentary on: "Cost: The missing outcome in simulation-based education research: A systematic review" by Zendejas et al. Surg. 2013;153(2):177-8.
29. Parkinson A, Jorm L, Douglas KA, Gee A, Sargent GM, Lujic S, et al. Recruiting general practitioners for surveys: reflections on the difficulties and some lessons learned. Australian J Primary Health. 2015;21(2):254-8.
30. Burns KE, Duffett M, Kho ME, Meade MO, Adhikari NK, Sinuff T, et al. Academy group. A guide for the design and conduct of self-administered surveys of clinicians. CMAJ. 2008;179(3):245-52.
31. Ramsay CR, Grant AM, Wallace SA, Garthwaite PH, Monk AF, Russell IT. Assessment of the learning curve in health technologies: a systematic review. Int J Technol Assess Health Care. 2000;16:1095-8.

**Cite this article as:** Egedovo A, Ho YH, Larkins S, Mushuya C, Ashraf M, Nyandowe M, et al. Awareness of surgeons and surgical trainees of online web-based techniques for teaching laparoscopic surgery in north Queensland. Int Surg J 2017;4:2131-8.