Efficacy of a Domestic Simulator for Training in Laparoscopic Surgery: Step by Step Validation

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ABSTRACT

To present the University of Genoa Advanced Simulation Center (SimAv) and the project of a trainer (eLap4D) that would achieve the equivalent goals of the fundamentals of laparoscopic surgery trainer at an economical cost. The validation process is going to be shown too. METHODS. The laparoscopic trainer is a physical low-cost laparoscopic training platform that reproduces the tactile feedback (eLaparo4d) integrated with a software for virtual anatomical realistic scenarios (Unity3D V 4.1). A sample of 20 students was selected, divided into 2 homogeneous groups with respect to the level of confidence with the use of video games, consoles, smartphones (this has been possible thanks to the use of a questionnaire, administered before the practical phase of training). The groups participated in a training program based on 5 basic laparoscopic skills (laparoscopic focusing and navigation, hand – eye – coordination and grasp coordination). So, a second and a third study sample was chosen, consisting of 20 post graduate students (intermediate group) and 20 experienced surgeons; for these groups a training program was provided, identical to the previous group as well as their subdivision into 2 group. The face validity was used for an ergonomic analysis of the simulator, the construct to test the system’s ability to differentiate potential expert users (experienced surgeons) from non-experts (student without experience in laparoscopic surgery). The authors analyzed the results of the three samples obtained by comparing variables such as score, % of fulfillment, panality and time. At the same time, the students’ improvements have been monitored, developing a customized learning curve for each user. To evaluate the structural characteristics of the simulator a specific questionnaire has been used. The results were encouraging. The simulator is ergonomically satisfactory and its structural features are adapted to the training. The system was able to differentiate the level of experience and also has therefore met the requirements of “construct validity”. laparoscopic simulators can be constructed at an economical cost.

KEYWORDS

Construct Validity, Face Validity, Learning Curve, Low Cost Simulation, Training

1. BACKGROUND

The mission of a simulation center in medical reality is to improve patient safety and clinical outcomes by integrating medical simulation based teaching methodologies into the educational curriculum for all students, residents, attending physicians, nurses and other ancillary health care staff.
The main goal of the Simulation Center is to improve safety within patient care. Current and future health care professionals “practice on plastic” honing their skills, refining advanced techniques and learning valuable social interactive tools for delivering important news to patients. This translational research becomes vital for creating the gold-standard in patient safety and medical teaching. One of the most interesting experiences is about a completely original laparoscopic trainer.

Nowadays laparoscopic surgery is considered the gold standard to treat a lot of diseases, but not all surgeons have acquired the skills necessary for laparoscopic procedures, for example such as proficiency in ambidextrous maneuvers with new tools, enhanced hand-eye coordination, depth perception and compensation for the camera angle, the need to repeat the same exercises to improve these laparoscopic skills has made basic laparoscopy amenable to simulator based training. The continually increasing demand of more complex laparoscopic simulators has led to a rise in prices of these tools and has inspired us the creation of a 4d simulator which is a physical low-cost laparoscopic training platform that reproduces the tactile feedback (eLaparo4d) integrated with a software for virtual anatomical realistic scenarios (Unity3D V 4.1). The department of Surgical Sciences (DISC) have created a low-cost model based on existing and brand new software. The simulator allows the team work: two surgeons can work together like in reality and the system allows the use of real operative instruments, all equipped with tactile feedback. But before using this simulator to assess skills and competencies it needs to be seriously and thoroughly validated: among the five validities Recognized (content, face, construct, concurrent and predictive) we have decided to employ the face validity and the construct validity: the first is usually used informally to define the realism of the simulator or whether the simulator represents what it is supposed to represent and the second because mandatory in distinguishing the experts from inexperienced operators based on a performance score. In this paper we are going to describe the platform validation results using these two types of validities: face and construct validity.

2. MATERIALS AND METHODS

2.1. The Advanced Simulation Centre

The SimAv has been introduced in October 2011 from the need to offer students and graduate students of the School of Medical Sciences and Pharmaceutical more adequate professional training to the health needs.

The strongest motivations for the use of simulation for the training of future health professionals are:

- Need to train to perform safety maneuvers increasingly complex and invasive;
- Need to reduce the learning time curves of innovative procedures;
- Increase in the medical-legal litigation and the carrying out of clinical maneuvers on the part of students must take place after an appropriate training that allows to learn from mistakes;
- Introduction on the market of more sophisticated devices for the simulation that allow to reproduce more and more realistic clinical scenarios.

The SimAv has been designed on the model of the Simulation Centre in Montreal at McGill University and is organized into sections: