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MEETING ABSTRACTS

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# Proceedings of the 23rd Annual Meeting of the Society in Europe for Simulation Applied to Medicine

Paris, France. 14 - 16 June 2017

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## A1

### Effectiveness of learning cardiopulmonary murmurs using Harvey simulator

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Advances in Simulation 2017, 2(Suppl 1):A1

#### Introduction & Aims

Medical simulation is an important technique to provide education as well as clinical evaluation with physical examination. Simulation is now regarded as a strategy to improve safety of learning (to patient and student) and quality in real medical practice. The aim of this study was to evaluate students' confidence levels in detection of heart and respiratory murmurs with Harvey the Cardiopulmonary Patient Simulator compared to real patients with cardiopulmonary disorders.

#### Methods

Three hundred and eighty 3<sup>rd</sup> year medical students underwent pre-study multiple-choice question test (MCQ) to assess their confidence of cardiopulmonary examination and to detect cardiopulmonary murmurs. Three hundred and eleven students successfully passed (>51% test score). They were divided in two groups: G1 (n=155) firstly examine patients with cardiopulmonary disorders - pneumonia with crackles (CR), bronchial asthma with wheezes (WZ), typical mitral stenosis (MS) and aortic stenosis (AS) and then participate in the Harvey simulation (the same scenarios). G2 (n=156) firstly participate in the Harvey simulation and then examine real patients. At the end, all the students completed the post-study MCQ to assess their confidence in detecting murmurs. Statistical analysis was performed using Statistica 10.0. Data was presented as M±SD. For comparison of frequency we used  $\chi^2$ -criterion. Mann-Whitney and multiple logistic regression analysis were performed.  $P < 0.05$  was considered statistically significant.

#### Results & Discussion

311 students completed all surveys. There was no difference in mean pre-study score between groups (58% vs 63%,  $p > 0.05$ ). After completing the first activity there were no differences in detecting CR and WZ between groups (74% vs 72%, 80 vs 78%,  $p > 0.05$  respectively), but there was significantly higher confidence in detecting MS and AS in G2 (50 vs 72%,  $\chi^2 = 15.1$ ,  $p < 0.001$  and 82% vs 94%,  $\chi^2 = 11.2$ ,  $p < 0.001$ ). After completing second activity, significant increase of confidence level in detection of MS, especially in G1 was observed (for detail information see Table 1). The mean score of post-study MCQ increase in both groups, but was higher in G2 (82 vs 90%,  $\chi^2 = 3.9$ ,  $p < 0.05$ ).

#### Conclusion

Both groups reported confidence in detecting abnormal heart and respiratory sounds after participation in Harvey simulations compared to baseline confidence level. Students who participated firstly in Harvey simulations demonstrated higher confidence level in detection of heart murmurs and higher post-study MCQ score. Our results confirmed that simulation-based training first and then implementation in real clinical practice is the most effective method under certain educational conditions.

**Table 1 (abstract A1).** Students' confidence levels during first and second survey

	Group 1	Group 2	p-level
Pre-study MCQ	58%	63%	>0.05
<b>1<sup>st</sup> Activity</b>			
CR	74%	72%	>0.05
WZ	80%	78%	>0.05
MS	50%	72%	<0.001
AS	82%	94%	<0.001
<b>2<sup>nd</sup> Activity</b>			
CR	80%	80%	>0.05
WZ	84%	85%	>0.05
MS	72%**	82%	<0.05
AS	90%*	100%*	<0.001
Post-study MCQ	82%**	90%**	<0.05

\* $p < 0.05$ , \*\*  $p < 0.001$ , compared to the result in 1st activity in current group

## A2

### There is a need to update performance assessment in high-fidelity simulation

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Advances in Simulation 2017, 2(Suppl 1):A2

### Introduction & Aims

Postpartum hemorrhage (PPH) represents a dynamic environment model that anesthetist must cope with. The ability to manage this situation depends on classical medical knowledge but also on cognitive processes such as situation awareness (SA) or workload (WL). High-fidelity simulation (HFS) allows anesthetists to be faced with standardized environment to measure performance and human factors. The aim of this study is to evaluate anesthetist performance through a multidimensional approach including management performance, expertise and human factors (SA and WL) in simulated PPH.

### Methods

This study took place at the Indian Ocean Health Simulation Center from January to April 2016 (Reunion Island University Hospital, a third level maternity with over 4,500 annual deliveries).

Two groups of anesthetists (novices and experts) were asked to manage a severe PPH in a high-fidelity simulation session. The patient suffered from a complicated refractory PPH with a hemorrhagic shock. Participants were required to prepare and provide all necessary treatments (i.e. drug reconstitution, infusion device installation, blood transfusion management). The decision of emergency surgery and transfer to the operating room ended the scenario. The anesthetists performance was assessed by the analysis of the simulation duration and by a checklist of expected actions supplemented by a bad execution percentage (i.e. drug mistake, bad dilution).

Situation Awareness Global Assessment Technique (SAGAT) tool and NASA Task Load Index were used to measure SA and WL. Each anesthetist also had to self-assess its management performance, the overall situation understanding and stress with numerical scales. ANOVAs and T-tests were carried out to test the effect of expertise on measured or perceived performances, SA or WL levels.

### Results & Discussion

Fifteen experts anesthetists (MDs) and 15 novices anesthetists (Residents) were included. PPH management analysis did not reveal any significant difference between experts and novices ( $76.9 \pm 13.9\%$  of expected therapeutic actions with  $13.4 \pm 10.5\%$  of bad execution in 18min 43sec  $\pm$  03min 52sec). SA and WL levels were not significantly different between the groups ( $66.5 \pm 7.1\%$  and  $74.4 \pm 11.3\%$  respectively). However, perceived PPH management performance or situation understanding was significantly higher among the experts than novices ( $70.0 \pm 14.4\%$  compared to  $51.0 \pm 23.1\%$  for the perceived performance and  $80.0 \pm 7.3\%$  compared to  $62.4 \pm 22.3\%$  for situations understanding). Checklists used to measure performance are not enough discriminant and do not meet the modern expectations of expertise assessment. New assessment tools based on observable behaviors are needed in HFS.

### A3

#### Breaking bad news in the emergency department: A randomized controlled study of a short training course

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*Advances in Simulation* 2017, **2(Suppl 1)**:A3

### Introduction & Aims

For years, the impact of the delivery of bad news on patients and relatives, as well as physicians' stress has been a major concern. Based on studies claiming the efficacy of training courses to help physicians delivering such news, several protocols, such as SPIKES have emerged. However, training to such protocol might be time-consuming and impede their use in acute care settings. This randomized controlled study aimed to assess the impact of a breaking bad news training course using e-learning and role-play.

### Methods

Participation was proposed to medical trainees and residents from emergency, intensive care and anesthesia departments, on a voluntary basis. Participants were randomly assigned to the training course (TC) or a waiting list (WL). Both groups were assessed twice: before and after training for the TC group and at a two-week interval for the WL group. The course included e-learning (theoretical basis on SPIKES model) and a 2-hour role-play session. Assessments included the analysis of video recordings of breaking bad news simulations with two actors playing the relatives' role. Questionnaires collected socio-demographic, stress and self-efficacy data. Two blinded experts rated the videos with the Breaking Bad News Assessment Schedule (Miller et al., 1999). Finally, the actors' experiences were also evaluated. All data have been continuously collected since October 2016.

### Results & Discussion

Of 40 participants, data from 19 participants have been analysed to date: 11 trainees and 8 residents, with a mean age of 24.9. Compared to the WL group, participants of the TC group increased significantly their knowledge level ( $p = 0.001$ ) and self-efficacy ( $p = 0.038$ ). The actors assessed that the announcement of the bad news was significantly more adequate in the TC group, as compared with the WL group ( $p=0.005$ ). There was no difference between groups in terms of stress reduction overtime. All participants were very satisfied about the training (mean = 4.3/5). The analysis of the videos is currently under study. In conclusion, the training course for bad news delivery using e-learning and role playing appears to offer interesting perspectives in the field, enabling a more feasible approach as regards the acute care settings and concerns.

### A4

#### CPR Personal Trainer: A low-cost tool for CPR self-training

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*Advances in Simulation* 2017, **2(Suppl 1)**:A4

### Introduction & Aims

High quality cardiopulmonary resuscitation (CPR) remains essential to improve patient outcome. Several studies have shown that CPR is performed ineffectively, possibly due to irregular training and low skill retention. Feedback on performance is a crucial component of the learning processes associated with simulation and has been shown to improve CPR quality during simulated cardiac arrest on manikins. This study presents a new low-cost feedback device for CPR self-training and compares its efficacy to standard training method.

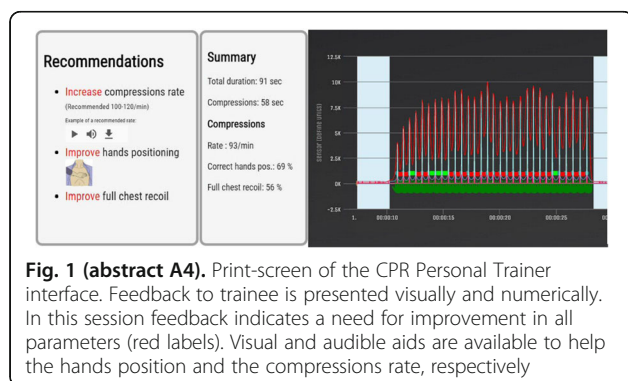
### Methods

CPR Personal Trainer consists of a standard CPR training manikin instrumented with off-the-shelf sensors connected to a pre-processing unit and information system. The signal is analyzed by extracting relevant data of chest compressions performance and scoring them on three different factors associated with compression quality: hands position, compression rate, and chest recoil. The compressions depth and ventilation related parameters are still under development and will be included in a near future. The software is connected to a user-friendly online Graphical User Interface, which provides visual and audio feedback. CPR Personal Trainer software gathers trainees' performance metrics and provides a performance analysis with suggestions to improve the procedure. Figure 1 presents CPR Personal Trainer interface representing a training session of a student. To

evaluate the efficiency of the prototype, 39 students were recruited for a longitudinal double blinded randomized control study. A control group received traditional training using a standard task-trainer and received feedback from an instructor. The intervention group used the same standard task-trainer, instrumented with the CPR Personal Trainer that provided automated performance feedback (with no instructor) on compression related parameters. Students' knowledge and skills were assessed before and after training, through a theoretical knowledge test and 2-min of CPR practical performance.

#### Results & Discussion

The theoretical tests showed an improvement in the scores from the pre- to the post-test, both in the intervention and in the control group. The practical tests showed, for each compression related parameter (hands position, recoil, rate and depth), significant increase in scores, between the pre- and the post-test, in both groups. The intervention and control groups presented similar mean differences for the total score (0.72 vs 0.72,  $p$ -value>0.05). The proposed add-on costed around 150€ and proved to be effective in the acquisition of compressions related skills, with similar outcomes as the traditional instructor-based method, corroborating the hypothesis that a low-cost tool with feedback for CPR self-training can provide an alternative or a complementary extension to traditional training methods. Delivery using e-learning and role playing appears to offer interesting perspectives in the field, enabling a more feasible approach as regards the acute care settings and concerns.



**Fig. 1 (abstract A4).** Print-screen of the CPR Personal Trainer interface. Feedback to trainee is presented visually and numerically. In this session feedback indicates a need for improvement in all parameters (red labels). Visual and audible aids are available to help the hands position and the compressions rate, respectively

#### A5

##### Errors observed during the use of defibrillator in simulated paediatric patients

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*Advances in Simulation* 2017, **2(Suppl 1)**:A5

#### Introduction & Aims

Medical mistakes under stress situations, such as cardiopulmonary resuscitation (CPR) are frequent. Medical mistakes during pediatric emergencies and pre-hospital care have been barely studied. The main goal of this study was to determine the number of life-threatening mistakes incurred by physicians while using a manual external defibrillator (MED) as assessed during pediatric emergency simulations in our environment.

#### Methods

Prospective observational study carried out at the SIMMER medical simulation center, in Buenos Aires, Argentina. Digital-recordings of mistakes made during MED-training sessions, in cases where MED use was indicated (simulated ventricular fibrillation or pulseless ventricular tachycardia clinical cases), were collected. The studied population included all the participants in the pediatric urgency high fidelity clinical simulation training sessions held at the SIMMER center. The observation interval was 2 years (June 2014–May 2016). MED-use mistakes had to be visually and photographically evident in order to be recorded as such.

#### Results & Discussion

During the 2-year interval, 72 meetings were held, including 302 simulated cases and involving a total of 648 physicians. Of all the participants, 446 (68.8%) were resident physicians. The total of simulation sessions amounted to 72 (i.e., 72 groups of physicians), and 7.4% of the physicians (distributed among 8 groups) made evident mistakes. Non-life-threatening mistakes retrieved during the debriefing sessions, regardless of the efficacy of the manoeuvre to recover the appropriate (sinus) heart rate or the proper care of the medical devices, are recorded below:

**Dose (Joules/Kg):** No dose mistakes related to the defibrillator charge or shock intensity were found in general. **Paddle–skin interface:** Failure to use conductive gel was reported for a majority of situations. In no case were the times-to-MED use optimum. Although the study involved simulation situations, concern was raised among trainees and trainers that the results might mirror those of real-life procedures, considering the high fidelity character of the simulations.

#### Conclusion

MED use mistakes during pediatric emergency simulations are not infrequent in our environment. This conclusion should lead healthcare institutions to periodically consider this issue and provide training possibilities, because the risk of serious injury may be important.

#### A6

##### Impact of repeated versus varied scenarios on learning outcomes in simulation trainings

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*Advances in Simulation* 2017, **2(Suppl 1)**:A6

#### Introduction & Aims

Repetitive practice is a key instructional feature in simulation-based training, but whether this repetitive practice should involve the repetition of the same scenario or the exposition to different scenarios is a question still unanswered. This study compared the use of repeated versus varied scenarios for teaching the management of pediatric asthma exacerbations (AE) to medical students.

#### Methods

Third-year medical students were randomized and individually trained in the management of a pediatric AE, with participants in the repetition group being trained three times on the same scenario, and participants in the variation group being trained on three different scenarios. One week later, all participants were evaluated on a scenario of AE new to both groups, a scenario of pneumoniae, and two scenarios used during the training. Participants were also assessed four months later. The main outcome was the performance score on the new scenario of AE at one week, assessed on a checklist custom-designed for the study.

#### Results & Discussion

Eighty-five students were assessed. Even though students in the variation group had a lower self-efficacy score when they attended the

evaluation one week after the training, they performed equally well or better than students in the repetition group on all the scenarios tested. On the new scenario of AE, the two groups obtained similar performance scores, with a median score (IQR) of 8.3 (7.4-10.0) in the variation group versus 8.0 (6.0-10.0) in the repetition group ( $p=0.16$ ). Four months later, performance was similar between the two groups.

#### Conclusion

Despite there was no significant difference on the transfer scenario, our results favor the use of different scenarios over the repetition of the same scenario for short simulation-based training on diseases with various presentations.

#### A7

### Simulation as a necessary and suitable vehicle for maintaining confidence in pediatric anaesthesia following pediatric specialist training

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 Advances in Simulation 2017, 2(Suppl 1):A7

#### Introduction & Aims

We hypothesize that confidence in treating sick children following dedicated pediatric anaesthesia may decline over time. Additionally, we hypothesize that simulation may be an effective method for increasing and maintaining confidence in dealing with sick children. If both facets prove true, we aim to propose a convincing argument for on-going pediatric simulation following dedicated pediatric training.

#### Methods

This study was performed in two separate, simultaneously conducted arms. Part A) A structured questionnaire was submitted to trainees upon completion of paediatric anaesthesia training in two dedicated paediatric hospitals and also to three adult anaesthesia departments in consecutive six-month blocks in 2015-2016. Respondents self-assessed their ability to manage specific aspects of five clinical scenarios on a scale from 1-5, 1 being "very unconfident" and 5 being "extremely confident." Part B) All simulation participants in a nationally delivered trainee pediatric anaesthesia simulation programme from 2010 – 2016 completed a pre-course confidence questionnaire on clinical skill competencies (e.g. managing a sick child, a child with breathing difficulty) that were matched to eight scenarios delivered. A post-course confidence questionnaire for eight simulation scenarios was completed afterwards. For both arms, subgroup analysis based on duration of prior clinical experience with pediatric patients was performed.

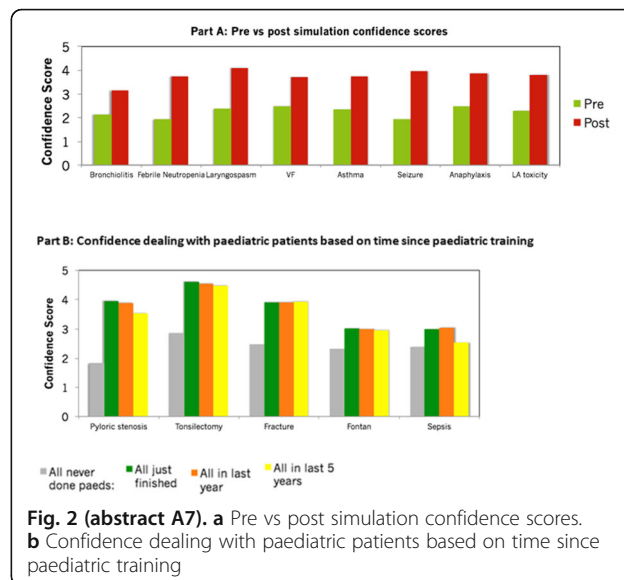
#### Results & Discussion

Part A) – Fig. 2. 60 questionnaires were completed. The largest decline in confidence for case management was seen in the neonatal pyloromyotomy patient (0.42), and resuscitation and transfer of a toddler with meningoencephalitis (0.60). Of free text respondents, 53% volunteered that paediatric simulation would enhance their confidence in managing these scenarios. Part B) – Fig. 2. 235 trainees completed the simulation programme. 52% had no previous pediatric experience, 15% had > 5 years experience, and 33% were currently managing pediatric patients. Baseline confidence across all skill sets was higher in those with > 5 years anaesthesia (3.1), currently treating children (2.7), compared to those never done paediatrics (1.5). Post course confidence scores were similar across all 4 subgroups (range 3.6-3.9).

#### Discussion

There is a self-perceived decline in confidence dealing with pediatric patients following dedicated pediatric training. Additionally, our

simulation programme considerably increases confidence in managing pediatric patients across all candidates, irrespective of previous pediatric anaesthesia exposure. These data support the role for on-going pediatric simulation following dedicated training, and highlight a need in particular for scenarios that emphasize resuscitation of a neonate and a septic child.



**Fig. 2 (abstract A7).** a Pre vs post simulation confidence scores. b Confidence dealing with paediatric patients based on time since paediatric training

#### A8

### In situ simulation to look for latent errors in a Paediatric HDU

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 Advances in Simulation 2017, 2(Suppl 1):A8

#### Introduction & Aims

The aim of this project was to look for latent errors within our Paediatric HDU which may cause problems in the management of rare and serious illness. We wanted to see if our existing departmental protocols were adequate to manage a patient with a duct-dependent cardiac lesion presenting with a closing duct.

#### Description

We approached one of our Paediatric Consultants with the project and developed the idea of using the case of a neonate with as yet undiagnosed Transposition of the Great Arteries (TGA). This case would allow us to examine our team's ability to recognise an unwell baby, the protocols for administration of prostaglandin and for transfer to a tertiary centre. The simulation was set up in one of the bays on the Paediatric HDU. Consent from the parents of other children was obtained. We used our neonatal manikin controlled wirelessly from the next room and had sound and video recording for use in debriefing. The session was timed to coincide with a training day on PHDU. The nursing staff participating in our scenario were on duty, but the doctors were attending the training day. We had 5 participants in the scenario and a further 11 observers. The session ran for 40 minutes with a 40 minute debrief. The team correctly diagnosed the problem and set about managing it and arranging for transfer. Latent errors identified centred around two themes; the administration of prostaglandin and the practicalities of

transferring a child with a duct dependent circulation. Initially, staff did not know where to find the prostaglandin and there were process snags in the prescription and setting up of the infusion. The team also did not anticipate the need to have an anaesthetist present to intubate the child in the event of apnoeas caused by the high dose prostaglandins.

Debriefing focused on these two main points, as well as the more generalisable aspects of the case.

**Discussion**

The issues with the prostaglandin prescription raised a potential issue with the prescription of all infusions not routinely used in our HDU. There was a lack of knowledge of the standardised prescription chart published by our regional retrieval service. There was a lack of knowledge of where to find the prostaglandin vials which needed to be addressed. These points were addressed by the circulation of a report and the production of posters to signpost staff to these two items.

**A9**

**Awareness of Non-Technical Skills in Surgery (NOTSS): a national survey**

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Advances in Simulation 2017, 2(Suppl 1):A9

**Introduction & Aims**

Failures in human factors (HF) and non-technical skills (NTS) have been recognised as important contributors to adverse events in surgery<sup>1,2</sup>. Non-Technical Skills for Surgeons (NOTSS) is a behavioural rating scale which promotes NTS in theatre through structured feedback<sup>3</sup>. NOTSS has since been incorporated into the Intercollegiate Surgical Curriculum Programme, but is not routinely used. This project aimed to survey trainees and trainers to find out why NOTSS has not been more widely adopted, despite evidence about the benefits.

**Methods**

An anonymised survey of 17 questions was distributed online between November 2016 and February 2017 amongst surgical trainers and trainees in the UK. Free text questions and five-point Likert rating scales were used. The questions were designed to elicit awareness of human factors, NOTSS, and barriers to using NOTSS.

**Results & Discussion**

A total of 209 surgeons and trainees responded to the survey (Table 2). There is poor awareness of HF and NOTSS among junior surgeons (17% and 39% respectively) compared to registrars (35% and 88%) and consultants (41% and 72%). However, 74% of all respondents believed failures in NTS contribute most to adverse events in surgery. Ninety-four percent of respondents believed NTS is equally or more important as technical skills.

Forty-eight percent of all trainees rarely or very rarely received feedback on NTS in theatre, while 70% welcome standardised feedback on NTS using NOTSS. Of all respondents, 40% had used NOTSS and 73% of these reported positive or very positive experiences.

Qualitative data indicate that trainees were clear about the potential value of NOTSS, especially in the context of patient safety and improving their own practice. They also identified clear barriers to the use of NOTSS, including a training regime with little free time and space, and the perceived lack of experience of trainers with NOTSS. Trainers felt that they were not well equipped to use the system to support trainees, especially to give corrective feedback.

Despite a good appreciation of the importance of NTS in surgical adverse events, HF as a concept is poorly understood. NOTSS is a welcome addition to current work-based assessments however there are barriers to its widespread implementation. Increased awareness and use of NOTSS at an earlier stage may help improve NTS amongst trainees and give trainers greater confidence in overseeing the development of NTS in trainees.

**Table 2 (abstract A9).** Summary of findings

Domain	Junior Surgeons F1-ST2	Junior Registrars ST3-ST5	Senior Registrars ST6-ST8	All Registrars	Consultants
Number of respondents	18	16	52	68	123
Aware of definition for human factors	17%	38%	35%	35%	41%
Believes failures in NTS contributes most to adverse events in surgery	61%	82%	75%	77%	74%
Believes NTS is equally or more important than technical skills	89%	100%	92%	94%	95%
Are aware of NOTSS	39%	94%	87%	88%	72%
Has used NOTSS in practice	0%	33%	41%	39%	42%
Has had positive experience with NOTSS	NA	60%	73%	71%	74%

<sup>1</sup>GAWANDE, A. A., ZINNER, M. J., STUDDERT, D. M. & BRENNAN, T. A. 2003. Analysis of errors reported by surgeons at three teaching hospitals. *Surgery*, 133, 614-21

<sup>2</sup>ROGERS, S. O., GAWANDE, A. A., KWAAN, M., PUOPOLO, A. L., YOON, C., BRENNAN, T. A. & STUDDERT, D. M. 2006. Analysis of surgical errors in closed malpractice claims at 4 liability insurers. *Surgery*, 140, 25-33

<sup>3</sup>YULE, S., FLIN, R., PATERSON-BROWN, S., MARAN, N. & ROWLEY, D. 2006. Development of a rating system for surgeons' non-technical skills. *Med Educ*, 40, 1098-104

**A10**

**Performance impact of serious game training: an example of 3D-SC1 for forward combat casualty care**

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Advances in Simulation 2017, 2(Suppl 1):A10

**Introduction & Aims**

In modern warfare, almost 25% of combat related deaths are considered preventable. Most of them include extremity hemorrhages that could have been stopped on the battlefield. Therefore, the Tactical Combat Casualty Care (TCCC) training of soldiers is a major challenge for armed forces. Serious games could represent an innovative and complementary tool to improve this training. In 2014, the French Military Health Service supported the development of 3D-SC1®, a serious game specially designed for the French soldiers' TCCC training program, entitled "Sauvetage au Combat de niveau 1" (SC1, Forward Combat Casualty Care). The objective of our study was to evaluate the performance impact of 3D-SC1®, as a complementary tool for SC1 training.

**Methods**

The study assessed the SC1 performance of soldiers divided into two randomized, parallel groups, before (measure 1) and after (measure 2) receiving additional SC1 training, either with 3D-SC1® (Group A intervention), or with DVD (Group B control). The primary endpoint was a 16 points- score for each participant during physical simulation sessions, assessed by 2 investigators. A Wilcoxon-Mann-Whitney test was used to compare the performance scores obtained in each group.

**Results & Discussion**

Ninety-six subjects were included: 50 in Group A, 39 in Group B while 7 lost to follow-up. Figure 3 shows the comparison of SC performance scores in both groups, at measure 1 and measure 2. In both groups, performance was significantly improved at measure 2, compared to measure 1. At measure 2, the performance score obtained in Group A intervention was significantly higher than in Group B control (14.08 and 12.51, respectively,  $p < 0.00001$ ). Most importantly, the study evaluated the performance of a serious game on changes in attitude and behavior, the third level of the Kirkpatrick's 4-Level Training Evaluation Model. Actually, others studies evaluated mainly levels 1 (reaction, appraisal of training) or 2 (improvement of knowledge) of the Kirkpatrick's model. Our study showed that 3D-SC1® is a powerful and relevant tool for further training in SC1. Further development of 3D-SC1® should be considered, including new scenarios and regular updates.

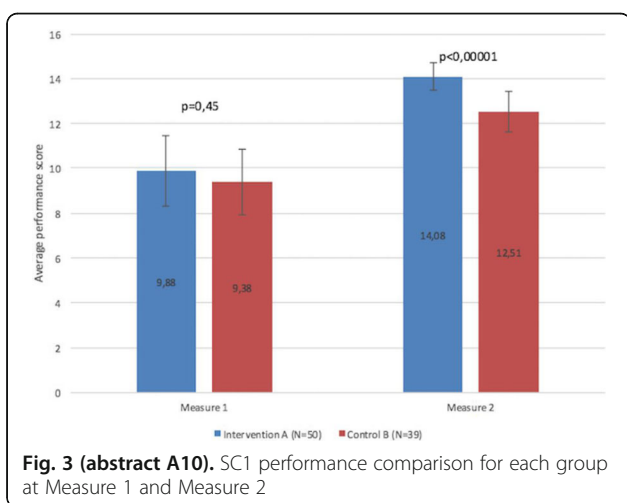


Fig. 3 (abstract A10). SC1 performance comparison for each group at Measure 1 and Measure 2

**A11**

**TracheoSimApp enhancing part-task simulation**

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**Introduction & Aims**

The training of medical skills is often performed in low-fidelity part-task simulators, that have, by nature, limitations in realism and teaching of theoretical instructions. The TracheoSim simulator, developed by the authors, is an example of model from that category, dedicated to the teaching and training of tracheostomy. Seeking to overcome those obstacles and facing the increasing use of smartphones in the academic environment, the aim of this project was to develop and test a mobile app able to enhance the learning of the user of a low-fidelity simulator, using the TracheoSim as a pilot project.

**Methods**

The TracheoSimApp was programmed in HTML/CSS/JavaScript and made available to Android (Fig. 4). The app contains images and texts that guide the user during the execution of the proposed procedure. The images were produced in an operation room scenario, using the TracheoSim simulator. The texts were based on a literature review of the subject. The final product was submitted to testing with a sample of 10 professors – experts in simulation and tracheostomy – of medicine from the Universidade Federal do Paraná, Curitiba, Paraná, Brazil.

**Results & Discussion**

The developed app can guide the procedure step by step, from surgical paramentation and positioning of the patient to the removal of

the tracheal cannula and skin suture. During the execution of the procedure, the app allows photographing of the stage and registers the period of time used in each step. At the end, the app also offers the function of report generation, that can be sent to any registered email address. The main advantages in comparison to the isolated use of the simulator are: enhancement in realism and the possibility of theoretical teaching. This occurs through the provocation of the user's imagination and the written comments about indications, complications and other informations. The tests signalized satisfactory results related to the app's features (average of  $9,3 \pm 0,823$  on a zero to 10 scale). Also, the participants stated that they would like to use other apps with the same concept (average of  $10 \pm 0,0$ ). The developed app can be used in any part-task simulator, being only necessary to adapt the images and instructions regarding the new subject. This project reached its goal of developing a teaching tool to assist the already existing models in medical simulation.



Fig. 4 (abstract A11). TracheoSimApp' screens

**A12**

**An algorithm to automatically tune cardiovascular model parameters on patients-specific condition**

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**Introduction & Aims**

Cardiovascular simulators are largely used for the representation of general pathophysiological conditions for educational applications and for the training of medical and paramedical staff. But so far the use of simulators in the clinical care is not consolidated yet. The lack of standardized procedures on how to simulate a patient-specific condition limits their applicability and impedes their integration in the standard care as clinical decision support systems. Aim of this work is to develop an algorithm that permits an automatic tuning of a cardiovascular simulator into a patient-specific condition.

**Methods**

We developed an algorithm in LabVIEW and integrated it into a cardiovascular simulator. The algorithm works as it follows:

- The clinician inserts patient-specific data as inputs into the algorithm. The translates these inputs into model parameters (i.e. peripheral resistance, ventricular contractility etc.) that are sent to the cardiovascular simulator,
- An automatic procedure refines some parameters, if needed, until the output of the simulator approaches patient-specific condition.

We tested the algorithm on 6 end stage heart failure patients (3 ischemic and 3 dilated cardiomyopathies) whose data were collected retrospectively at the University Hospitals of Leuven. The input collected and provided to the algorithm were: systemic blood pressure (BP), pulmonary arterial pressure (PAP), capillary venous wedge pressure (Pwedge), central venous pressure (CVP), cardiac output (CO), end systolic/diastolic left ventricular volumes (ESV/EDV), left ventricular ejection fraction (EF%), heart rate (HR), body weight and height. All patients were affected by mitral valve regurgitation.

#### Results & Discussion

Average data among patients were: BP=65±4 mmHg, PAP=38±4 mmHg, Pwedge=33±3 mmHg, CVP=15±4 mmHg, HR=87±15 bpm, CO=3.4±0.7 l/min, EDV=247±35 cm<sup>3</sup>. The algorithm successfully tuned the simulator for each patient's condition, individually. The average error between patient-specific data and simulation outputs was of 6.5%, with a maximum error of 21.6%. Using a 4th generation IntelREG Core i7-4702HQ processor and a simulator execution time of 500 ms for a heartbeat, the time needed for the algorithm to tune the simulator was of ~ 1 minute.

The algorithm we propose permits to tune a cardiovascular simulator on patient-specific condition, with a good approximation between clinical data and simulation outputs. In the future, the algorithm will be tested on larger groups of patients affected by multiple cardiovascular diseases. We believe this algorithm will encourage the use of cardiovascular modelling in the standard care.

This work was supported by Marie Curie Scholarship (PIEF-GA-2013-624296) and by "Le Fonds pour la Chirurgie Cardiaque" (Ref. 489 589).

#### A13

##### Serious game vs brochure for initial nurse training about urinary tract infection prevention

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*Advances in Simulation* 2017, **2(Suppl 1)**:A13

#### Introduction & Aims

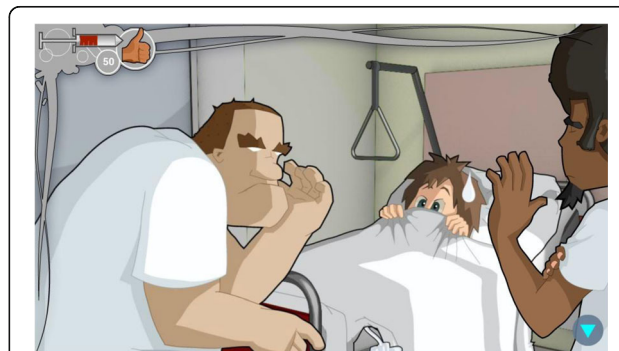
Healthcare associated urinary tract infections (UTI) are often preventable but remain frequent. Their prevention needs infection control measures by care givers for the installation and management of a urinary catheter and hygieno-dietary rules by the patient; their systematic application remains complex and requires the use of several information and awareness-raising tools by trainers and infection control teams. The aim of this study was to determine the impact of a serious game on the prevention of IUAS among 582 nursing students in terms of knowledge and declarations of practices.

#### Description

A 6-month exposed-unexposed study was carried out on seven classes from six nurse training institutes. Each class was separated into two groups: the first group played the game "Code-name U.T.I." (Fig. 5. Screenshot of the sixth scene) in an amphitheatre with remote control poll (n = 295, 15 minutes); the other group read a pedagogic brochure with identical educational content (n= 287, 15 minutes). A questionnaire was completed by each student before and after the game. A single and multivariate analysis was performed. Results showed 86% of the students in the game group and 90% in the brochure group acquired at least one teaching following the intervention: learning was more clinical for the students of the game group (41% draining technique) than students of the brochure group (39% epidemiology). Game group declared significantly to feel better prepared to take care of a catheterized patient after the game (p <0.001). More than 95% of the game group said they changed their practices after this intervention, mainly about UTI diagnosis and surveillance (93% for the brochure group, mainly concerning therapeutic education).

#### Discussion

This study confirmed the interest of serious games (cost-effectiveness) in initial training and also suggested an interest as part of continuing education. The game is complementary to the diffusion of a brochure; it seemed to mobilize more practical knowledge with an ability to engage more the student. But further study remains to evaluate the impact on good practices compliance.



**Fig. 5 (abstract A13).** Screenshot of the sixth scene from « Code name U.T.I. ». A catheterised patient must undergo a radiography, the stretcher-bearer calls you covertly. He reminds you the headquarter instructor but you're not the kind of agent that can be disrupted. He points the collection bag which is half full of urine. What is your attitude?

#### A14

##### LaryngoSim

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*Advances in Simulation* 2017, **2(Suppl 1)**:A14

#### Introduction & Aims

Young residents consider that pediatric anesthesia is very stressful. Indeed, it is a very specialized domain for which there is a lack of training during the traditional curriculum. The laryngospasm (closure of the larynx that blocks the passage of air to the lungs) is very frequent during pediatric anesthesia. It can be very impressive for residents because it requires immediate action to avoid severe complications. However, there are no validated recommendations and residents often learn the management of laryngospasm during their clinical practice. Simulation is a novel tool that allows the training and teaching of technical and non-technical skills during medical training without risks for the patients. The objective of the study was to evaluate the management of laryngospasm by young anesthetist and nurse anesthetists during a high-fidelity simulation session.

#### Methods

Residents and nurse anesthetists from an internship in pediatric anesthesia were included to participate in a simulation session in pediatric anesthesia. They were informed that it was a laryngospasm case just before the simulation. The students were randomized in two groups: group A was given a simple algorithm based on data from the literature to manage laryngospasm in four steps before the simulation and group C was invited to do exactly as usual to manage a laryngospasm. We analyzed the videos recording of their performances during the simulation session. Our primary endpoint was the



evaluation of the management of laryngospasm using 10 technical items on the videos. We did statistical analysis on SPSS.

#### Results & Discussion

71 participants, 35 anesthetist residents and 36 nurse anesthetists in training were included in this study. There is a statistically significant difference between group A and C on the management of the laryngospasm (Fig. 6). Anesthetist residents and nurse anesthetist students in pediatric anesthesia are not efficient in the management of a laryngospasm. A simple algorithm improves significantly the quality of the management of acute laryngospasm.

#### Conclusion

The teaching and training of Pediatric anesthesia is insufficient before their residency and before they are exposed to real cases. However, our study shows that the implementation of a simple algorithm would improve the management of laryngospasm and therefore patient's safety. Simple strategies of management of emergency situations can be taught and evaluated in simulation settings to avoid learning directly on the patient.

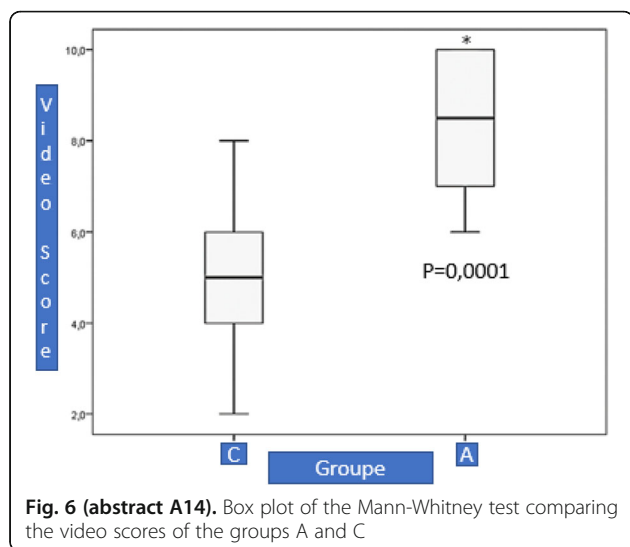


Fig. 6 (abstract A14). Box plot of the Mann-Whitney test comparing the video scores of the groups A and C

#### A15

##### Mednav improving teamwork in emergencies

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*Advances in Simulation* 2017, **2(Suppl 1)**:A15

#### Introduction & Aims

Globally confidential enquiries into maternal deaths identify sub-standard care in around 70% of cases. These enquiries further pinpoint failures of teamwork and communication with failures to recognize, act and refer unwell women appropriately. Post-Partum Haemorrhage (PPH) is one of the main causes of maternal mortality globally. MedNav is a platform based software service that guides, scribes and prompts teams managing emergencies. In the way that satellite navigation devices have replaced maps MedNav is replacing notes and protocols. It has been designed for use on a tablet or

smart phone. Initially MedNav has been designed for maternity teams. We report our study using MedNav in simulated environment to manage PPH.

#### Methods

Multidisciplinary (MDT) maternity teams (Chelsea and Westminster Hospital, UK) were randomised from clusters of staff grade to using the decision support tool or control during PPH full platform simulations. This was recorded and reviewed by assessors and teamwork scored. Primary outcome measures were validated team work scores the Global Assessment of Obstetric Team Performance (GAOTP) and Clinical Teamwork Scale (CTS) secondary outcome measures were 'friends and family' test, technical skills achieved and System Usability Scale (SUS).

#### Results & Discussion

Thirty-eight teams from August 2014 – February 2016 were recruited and randomised. Teamwork improved across all domains with the intervention. CTS improved between 6.7 - 16.8 % (average 14.2%) and GAOTP between 8.6 -17.1% (average 13.5%). Using the control group as baseline, the intervention improved teamwork by 25% and 22%. Fewer technical skills were missed with the intervention (p=0.003). There was no statistical difference in the time that technical skills occurred.

More assessors would recommend intervention teams (78/91) than control teams (57/92) p<0.01 to their friends or family. The SUS found the device as 'Good' (69) becoming excellently 'Usable' (81.6) in the study period. We report a 'usable' decision support system, which rather than reporting failures in teamwork is improving it, as demonstrated by increases in teamwork assessment scores. This is using technology to assist and improve non-technical skills rather than reporting when they fail.

#### A16

##### Communication in a Trauma Team: Focus on Leadership in Practice

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*Advances in Simulation* 2017, **2(Suppl 1)**:A16

#### Introduction & Aims

One of the cornerstones of treating emergency patients is the communication and leadership of a trauma team. This study investigated these two factors through in-situ simulation exercises that started with a trauma alert made by nurses of a first aid unit on their way to a central hospital from a road traffic accident and ended in a trauma room in an emergency clinic. The study focuses especially on the role of leadership in a trauma team during the medical treatment of a trauma patient. The aim was to reveal the nature of leadership as it occurs and evolves in action, as well as to use these findings to develop pedagogical practices for a trauma team's simulation-based training. This approach to researching leadership differs from more traditional, leader-centred views, as it recognises leadership as something that is constantly developing, flowing, produced and negotiated as a part of everyday interactions and practices (i.e. Crevani, Lindgren & Packendorff, 2010).

#### Methods

This study consisted of three subsequent trauma simulation exercises. In these exercises, the scenario, a road traffic accident, was the same every time, but the participants changed. Studying leadership as practice and interactions implies qualitative research methods, and therefore, the data was gathered in an ethnographical manner as the two authors observed the communication and leadership in the teams and made field notes. The notes were compared afterwards, and a common understanding of the perceptions and

interpretations was constructed. With video recordings of the simulation exercises, we would have gained more detailed information about the team's operations, but the teams did not allow video or even audio recordings to be used. The content analysis method was employed to analyse the data.

#### Results & Discussion

Communication within a trauma team plays a crucial role when taking care of a trauma patient. Leadership seemed to shift between the members of the team – especially between a team leader, an anesthesiologist and a surgeon – and the leadership-related communication between these three had a significant impact on the success of the team. Our study confirms the idea of the transitive nature of leadership in the context of the medical treatment of trauma patients. However, this shifting nature of leadership seemed to be a challenge for some of the team members, especially the critical points of ceding leadership or stepping aside.

#### A17

##### Focusing on an explicit debriefing in healthcare simulation

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*Advances in Simulation* 2017, **2(Suppl 1)**:A17

#### Introduction & Aims

Debriefing is often presented as a key factor in the simulation learning process. However, to date, there has been a lack of evidence about the real impact of debriefing. What is its role in the learning process? Are all types of debriefing as effective for all learners? To answer these questions, we have undertaken three studies to assess the effectiveness of simulation debriefing in healthcare. The aim was to identify which features of debriefing may influence learning of a novice learner or an expert learner.

#### Methods

In study 1, we examined the impact of a training program based on high-fidelity simulation followed by post-simulation debriefing. One hundred and sixteen novice learners (student nurses) volunteered for this program. Each participant completed a knowledge questionnaire and a short French version of the self-efficacy scale before and after the program. Their behavioral efficiency during simulated emergency situations was also assessed before and after the program. In studies 2 and 3, we tested the effectiveness of two types of debriefing: one based on a reflexive approach with weak guidance by the trainer (reflexive debriefing) and another based on a strong guidance and an explicit reminder of the procedure by the trainer (directive debriefing). One hundred and thirteen novice learners (student nurses) volunteered for study 2. One hundred and thirty-six expert learners from emergency multi-professional teams volunteered for study 3. As in study 1, each participant completed a knowledge questionnaire and a short French version of the self-efficacy scale before and after the programs.

#### Results & Discussion

The findings of study 1 indicated that a training program based on high-fidelity simulation followed by post-simulation debriefing may have positive effects: improvement of knowledge and self-efficacy. The findings of studies 2 and 3 specified the role of debriefing according to the type of learner. Study 2 showed that novice learners only benefit strongly from directive debriefing. Study 3 showed that expert learners benefit as much from both reflexive and directive debriefing. On balance, these findings support the idea that a program of simulation training followed by debriefing may be useful to increase the acquisition of theoretical and practical knowledge and

learner self-efficacy. However, they also show its impact varies according to learner-type and debriefing style. In conclusion, they point to the benefits of using an explicit procedure rather than an implicit procedure, especially for novice learners

#### A18

##### Effect of the use of a video tutorial in addition to simulation in learning the manoeuvres for shoulder dystocia

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*Advances in Simulation* 2017, **2(Suppl 1)**:A18

#### Introduction & Aims

Shoulder dystocia is a rare obstetric complication responsible for severe maternal and fetal morbidity. Simulation enables the improvement of both practice and of theoretical knowledge but its effect appears to be limited in time. The development of video tutorials is flourishing and may make it possible to maintain knowledge learned during instruction with simulation. The aim of this study was to assess the effect of adding a video tutorial to a lecture and simulation for learning the manoeuvres and protocol for the management of shoulder dystocia.

#### Methods

This prospective randomized blinded study took place from March 20, 2015, to June 30, 2015 in a level-3 university hospital obstetrics department and included student midwives and medical students. They attended a lecture class including instruction about the McRoberts, reversed Wood, and Jacquemier manoeuvres and a presentation of an algorithm for the management of shoulder dystocia. They were then assessed during a first session with a manikin and then randomized into two groups. The video group was reminded every two weeks to watch a short tutorial (< 3 minutes) reviewing this information. The control group was simultaneously reminded to consult the slide show from the lecture. At the end of two months, they were again assessed during simulation with the manikin, evaluated by graders blinded to study group. Practice and theory were compared for both groups.

#### Results & Discussion

The study included 26 medical students and 24 student midwives. The practice, theory, and global scores of the students in the video group were significantly higher than those of the students in the control group at the end of the study period (respectively, 14.8 vs 10.4; 5.6 vs 3.4; and 9.3 vs 7.0,  $p < 0.001$ ). Moreover, the scores for the video group improved at the second simulation session, compared with the first (respectively 14.8 vs 9.9; 5.6 vs 2.9; and 9.3 vs 7,  $p < 0.001$ ), while no significant change occurred between sessions in the control group (respectively 10.4 vs 10.1,  $p = 0.87$ ; 3.9 vs 2.9,  $p = 0.34$ ; 7 vs 7.2,  $p = 0.62$ ). The addition of a video tutorial improved learning compared to a standard lecture and simulation session alone, without the video. It enables students to maintain and even increase what they learned from the simulation.

#### A19

##### Serious game versus online course for pretraining medical students before a simulation-based mastery learning course on cardiopulmonary resuscitation: a randomised controlled study

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*Advances in Simulation* 2017, **2(Suppl 1)**:A19

### Introduction & Aims

To compare an online course (OC) and a serious game (SG) for pre-training medical students before simulation-based mastery learning (SBML) on the management of sudden cardiac arrest (SCA).

### Methods

A randomized controlled trial was conducted with 82 medical students from two French medical faculties. Participants were pre-trained using either an online course (OC group) under the form of a narrated presentation or the serious game *Staying Alive* (SG group) on days 1 and 7. On day 8, participants were evaluated individually and repeatedly on a scenario of sudden cardiac arrest until they reached a minimum passing score (MPS) on a custom-designed checklist. The main outcome was the median total training time needed for students to reach the MPS on day 8. Participants were trained again four months later.

### Results & Discussion

The median training times necessary for students to reach the MPS was similar between the two groups: 20.5 min (IQR 15.8-30.3) in the SG group versus 23 min (15-32) in the OC group,  $p=0.51$ . Four months later, the median training times decreased significantly in both groups, but no correlation was found at an individual level with the training times observed on day 8. The SG used in this study was not superior to an OC for pretraining medical students on cardiopulmonary resuscitation, with similar training times between the two groups. The homogeneity in students' performance obtained at the end of the first session of SBML did not persist four months later.

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