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CONTRIBUTION OF SIMULATION EXERCISES FOR LEARNING OF CARDIOVASCULAR SEMIOLOGY: MOROCCAN EXPERIENCE

Mohamed EL Minaoui* and Wassim Beladel

Cardiology Department, Agadir University Hospital, Ibn Zohr University, Faculty of Medicine And Pharmacy of Agadir; Tilila Bp 7519 Agadir Al Fidia Cp80060.

*Corresponding Author: Mohamed EL Minaoui
Cardiology Department, Agadir University Hospital, Ibn Zohr University, Faculty Of Medicine And Pharmacy of Agadir; Tilila Bp 7519 Agadir Al Fidia Cp80060.

ABSTRACT

Introduction: Since the new reform of Moroccan medical studies. The limited volume of time reserved for teaching cardiovascular semiology imposes an additional effort, in terms of pedagogical innovation, to achieve the expected objectives, which is why parallel teaching by simulation constitutes an attractive modality and perhaps a complement to efficient training. **Objective:** To study the relevance and impact of simulation on the learning of cardiac auscultatory semiology. **Materials and Methods:** This is a monocentric prospective study, carried out at the simulation center of the Faculty of Medicine and Pharmacy of Agadir, including students in the 4th year of Medicine in cardiology internship at the regional hospital center of Agadir from November 2019 to November 2020. The students benefited from twelve training workshops in cardiac auscultatory semiology by simulation over six half-days. Student satisfaction and the impact of the training were assessed through a pre-and post-test scoring system and a satisfaction grid. **Results and discussion:** forty students were included in the study divided into six groups. 60% of the students said they had attended the lecture on cardiovascular semiology. All students expressed a good to an excellent level of satisfaction. The average score out of 20 obtained by the students improved significantly between the pre-test and the post-test (6.3 ± 2.1 and 11.3 ± 2.7 respectively) ($p<<0.005$). **Conclusion:** Training sessions in cardiac auscultatory semiology by simulation are practically feasible and beneficial. The terms of application will require the establishment of a standardized and continuous evaluation system on a larger sample among our future doctors.

KEYWORDS: Learning, Medical semiology, Cardiac auscultatory semiology, Simulation.

I. INTRODUCTION

Since the new reform of Moroccan medical studies, the teaching of medical semiology is now done in the 2nd year of the 1st cycle, in the form of a lecture. The modular organization allocated to the teaching of semiology a total hourly volume of 56 hours with an hourly volume of 6 hours for cardiovascular semiology including 1 hour reserved for the clinical examination in cardiology.

On the other hand, the cardiovascular pathology courses are given in the 3rd year of medical studies, with a total hourly volume of 40 hours. The cardiology internship is done in the 4th year with a minimum duration of 22 working days.

The limited number of hours reserved for the teaching of cardiovascular semiology imposes an additional effort in terms of pedagogical innovation to achieve the expected objectives of this teaching, which is why parallel teaching by simulation constitutes an attractive modality and is an integral part of the description of the training carried out within the faculties of medicine and pharmacy.

The Faculty of Medicine and Pharmacy of Agadir is in its seventh promotion with a capacity of 4500 students. With a new generation medical simulation center with a technical platform allowing the rotation of several disciplines.[1] Simulation in health occupies more and more space in the dispensation of teaching in medicine, and makes it possible to respond to an ethical principle: "never the first time on a patient ". The development of repositories frames this practice and standardizes its applications. According to the French High Authority for Health (HAS), the term health simulation corresponds to the use of equipment, virtual reality or a standardized patient to reproduce situations or care environments, with the aim of teaching diagnostic and therapeutic procedures and rehearsing processes, medical concepts or decision-making by a healthcare professional or a team of professionals.[2,3]

The principal objective of this work is to evaluate the relevance and impact of simulation on the learning of cardiac auscultatory semiology in a population of 4th year students from the Faculty of Medicine and Pharmacy of Agadir in an internship in the cardiology department, and subsequently facilitate the integration of this module as an integral part of the training.

II. MATERIALS AND METHODS

1. Study population
Our study is a monocentric prospective study conducted at the simulation center of the Faculty of Medicine and Pharmacy of Agadir since November 2019.

From November 2019 to November 2020, 40 4th year students doing an internship in the cardiology department at the Agadir Regional Hospital Center benefited from 12 workshops supervised by an assistant cardiology professor spread over 6 half-days.

6 groups (named from 1 to 6) benefited from the simulation training, then these groups are split into two groups: group A had the simulation session at the end of the course and group B had the simulation session at the beginning of the course.

2 workshops of 2 hours each are carried out over a half-day internship supervised by the internship supervisor.

The first workshop is reserved for auscultation techniques on 3 medium-fidelity dummies – Normal and pathological cardiac auscultation (heart murmurs, added noises).

The second is reserved for pathological situations in cardiology on a high-fidelity dummy (auscultatory diagnosis).

The evaluation of knowledge is done before and after the workshops on the answers given by the students with a scoring grid on 20 points.

2. Inclusion criteria
All 4th year students enrolled in the Faculty of Medicine and Pharmacy of Agadir on an internship in the cardiology department at the CHR of Agadir.
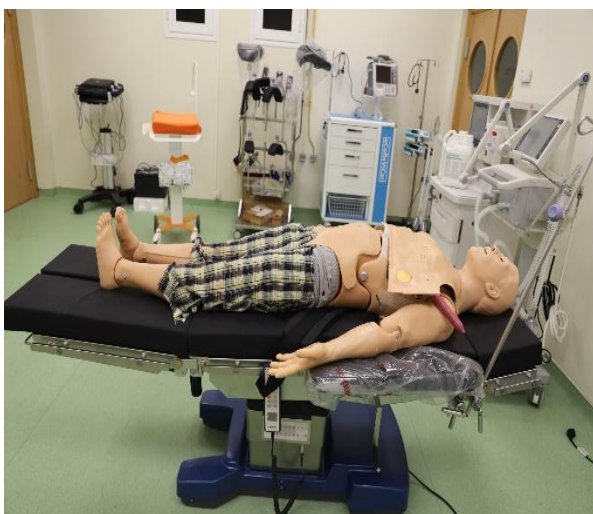
3. Exclusion Criteria
Students from other levels and students who have already had a cardiovascular semiology workshop at the simulation center.

Late students who did not attend the debriefing session.

Students who have pursued their 1st cycle in another faculty of medicine.

Students who have already had training in cardiovascular semiology by simulation.

4. Course of the study and Educational Tools
The sessions are carried out in several stages

1st step: After welcoming the participants, a 30-minute presentation recalling elementary cardiac sthetacoustic semiology, followed by a 15-minute debriefing explaining the progress of the sessions. Students are invited to review their course of the cardiovascular semiology module done in the 1st cycle of medical studies before the workshops.

2nd step: 1st auscultatory simulation workshop on HAL® S315.200 type mannequins - Adult Heart and Lung Sounds Skills Trainers and Nasco Life/form ® For auscultation on an adult model and on the dummy type HAL® S314.200 Five-Year-Old Pediatric Simulator for auscultation on a pediatric model. Sub-groups of 3 to 4 students rotate on the different mannequins.

3rd step: the second workshop carried out on the standard high-fidelity dummy HAL® S3201 Advanced Multipurpose Patient Simulator where pathological situations are proposed to the students. The restitution of the results is done on an individual basis with a score from 0 to 20 attributed to each student.

Figure 1: Adult high-fidelity manikin HAL® S3201.

Figure 2: Pediatric mannequin type HAL ® S S314.200.

Figure 3: HAL ® S S315.200 Adult Manikin.

Figure 4: Nasco Life/form® Adult Manikin.

5. Location and programming of teaching through simulation

The workshops are organized at the premises of the simulation center of the Faculty of Medicine and Pharmacy of Agadir with a conference room for the theoretical presentation and debriefing, an emergency medicine simulation room and an intensive care room.

The programming of the sessions was done initially by phone call to the head of the simulation center and then directly on a platform dedicated to this purpose (see appendices).

6. Statistical analysis

The quantitative variables are expressed as mean ± standard deviation and the qualitative variables as a percentage.

P values are considered statistically significant if they are less than 0.05.

The statistical study is carried out using IBM STATISTICS SPSS version 22.0 (USA, CHICAGO) and EXCEL MICROSOFT version 2010 software. The comparison of means is made by means comparison tests on samples with a headcount < 30, and the comparisons between the groups are carried out by ANOVA.

III. RESULTS

### 1. Demographics and general characteristics of the population included

Over a period of 12 months, 40 2nd year undergraduate medical students met our inclusion criteria and were interviewed during simulation sessions. Only one exclusion was made. We did not regret any delay in all groups. 75% of the student population is female.
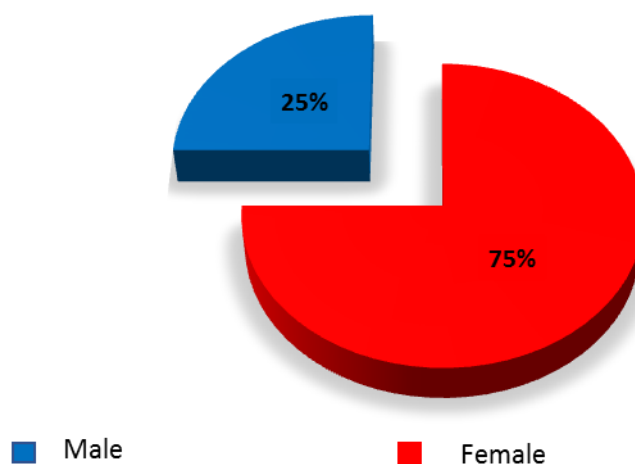

Graph 1: Distribution of students by gender.

Internship groups usually consist of 6 to 8 people.
The study was interrupted during the period of confinement in connection with the global pandemic of the SARS-COV2 virus.
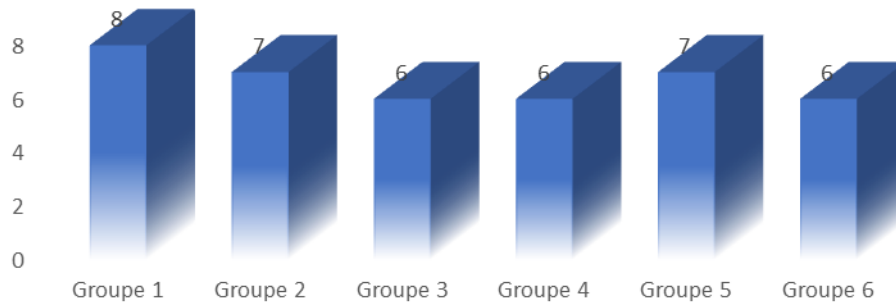
Graph 2: Number of students by group.

40% of students say they did not attend the lecture on cardiovascular semiology in the 2nd year.

■ Students who have attended the semiology course   ■ Students who did not attend the semiology course
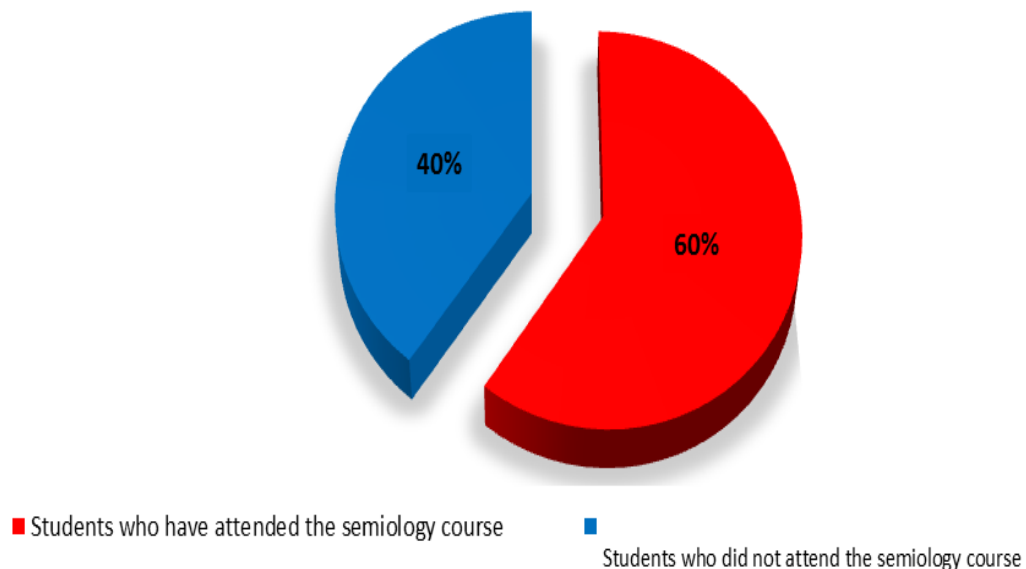
Graph 3: Number of students who attended the lecture on cardiovascular semiology.

2. Satisfaction of students with the teaching of cardiac auscultatory semiology by simulation

Overall, all students rated the training workshops as good to excellent.

In detail, 62% of students found the training sessions relevant, while 5% judged the relevance to be average.

For the quality of the teaching material, 63% of the students judged it to be excellent, and 3% of the students judged this quality to be insufficient.

70% judged the quality of the teaching methods used during the sessions to be excellent.

For the quality of the animation and the interactivity of the group, they were judged excellent by 80% and 52% of the students respectively.

Regarding the impact of simulation sessions on improving practice, 95% of students rated this impact as at least good.
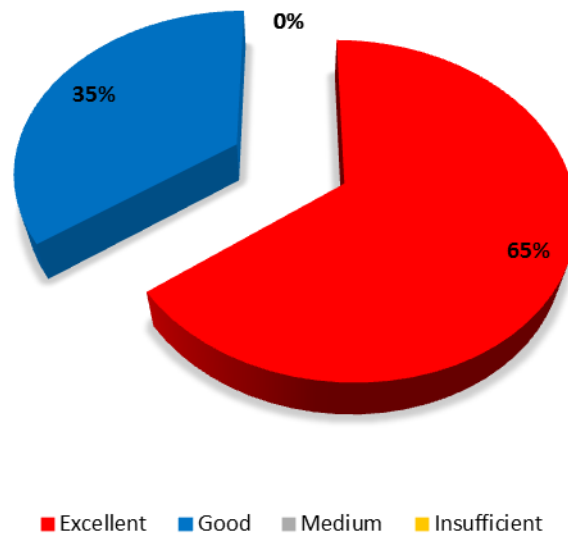
Graph 4: Overall appreciations.
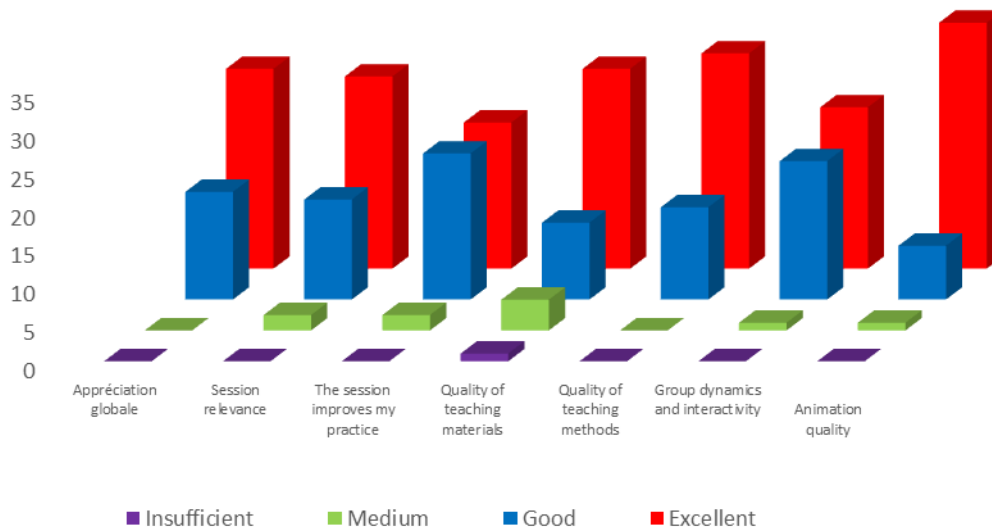
Graph 5: Evaluation of student satisfaction by dimension.

### 3. Impact of simulation on learning cardiac auscultatory semiology

The average score out of 20 obtained by the students in the pre-test and the post-test was 6.3±2.1 and 11.3±2.7 respectively.

The improvement in the scores obtained before and after the training sessions is statistically significant (p<<0.005).

All groups saw their skills improve before and after the sessions.
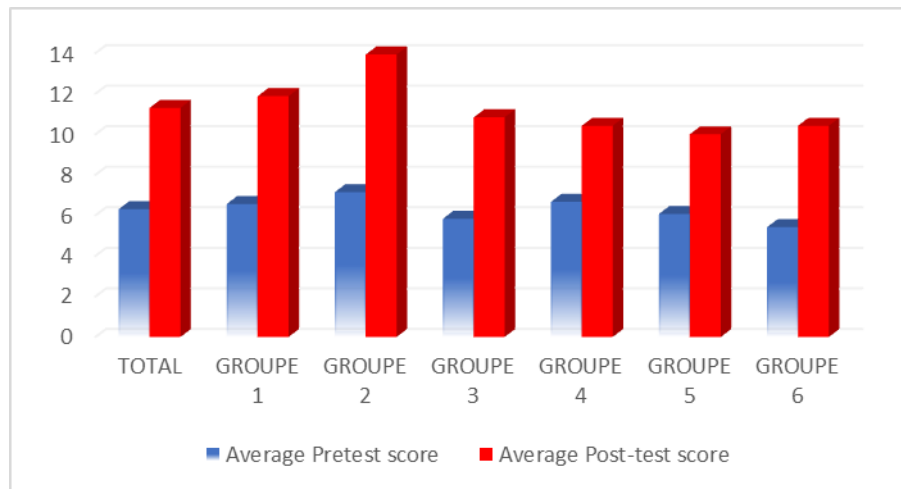
Graph 6: Score out of 20 per student before and after simulation sessions.
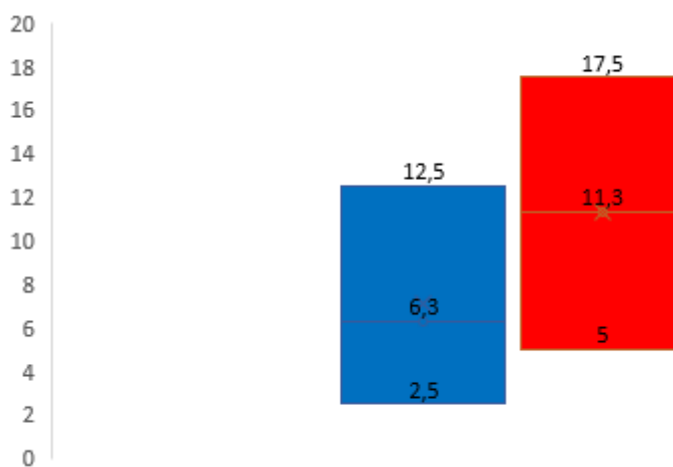
Graph 7: Average score out of 20 obtained before and after the simulation sessions.

No statistically significant difference was found between groups 1 to 6 with regard to the mean scores obtained pre- and post-test.

There is no significant difference in the average scores obtained, pre- and post-test, between group A, which received training at the start of the cardiology course,

and group B, which received training at the end of the course in pre and post test ($p=0.723$ and $p= 0.140$ respectively).

Similarly, there is no statistically significant impact on whether or not to attend the lecture course in cardiovascular semiology in the 2nd year ($p=0.885$).

Table 1: Summary of mean scores obtained by the group in pre and post-test.

	TOTAL	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6
Numbers (N, %)	40 (100%)	8 (20%)	7 (17.5%)	6 (15%)	6 (15%)	7 (17.5%)	6 (15%)
Male sex (N, %)	10 (40%)	3 (37.5%)	1 (14.3%)	1 (16.7%)	1 (16.7%)	2 (28.6%)	1 (16.7%)
Average score out of 20 in Pretest ± SD	6.3±2.1	6.6±1.9	7.1±1.7	5.8±1.3	6.7±3.8	6.1±2.4	5.4±1.9
Average score out of 20 in Post-test ± SD	11.3±2.7	11.9±1.8	13.9±3.9	10.8±1.3	10.4±4.9	10.0±2.0	10.4±1.9

IV. DISCUSSION

Good knowledge of semiology or the study of clinical signs is an important step in learning the medical profession. The teaching of semiology has undergone a radical change with the new reform of medical studies in Morocco. Courses are given in the form of a lecture in

the second year of the first cycle, while this teaching was done during clinical internships in the third year. This change required an effort to adapt the teaching staff to a practical teaching that was supposed to be tutored.

Indeed, cardiovascular semiology has its particularities and the volume of hours allocated to the teaching of this part of semiology (six hours for the example of the Faculty of Medicine of Agadir, one hour of which is reserved for the clinical examination in cardiology), requires an effort during the internship in the cardiology departments. In the same way as the short duration of the hospital internship (normally three weeks). The simulation exercises find their place in a natural way insofar as they allow the dispensation and the reinforcement of the skills of the students in a short time. If the ultimate objective of the teaching of cardiovascular semiology is the acquisition of skills and to be able to examine the patient in an optimal way, which defines the ultimate objective of any teaching as it is defined by Marguerite ALTET "interpersonal process, intentional, which essentially uses communication, it is a pedagogical situation carried out by the teacher as a means of provoking, promoting, making the learning of knowledge or know-how successful".[4]

This simulation-based acquisition can easily be integrated into the clinical internship and even in the form of tutorials from the 2nd year of medical studies in addition to the lecture course.

The acceptability of this teaching method is largely demonstrated in our study, reinforced by a satisfactory appreciation of these training workshops by the students on the various items evaluated.

In the literature, the usefulness and impact of simulation teaching have been widely recognized. Indeed, on a meta-analysis carried out in 2011, the benefit of simulation exercises improved by technology is considerable among health professionals, especially in terms of acquiring knowledge of skills and behaviors and this is independently of the degree of fidelity of the material pedagogical used.[5,6] This has been proven in several studies, even if these often-lacked scientific strengths in view, most often, of the weakness of the sampling.[7.8]

In Morocco, on an article published in 2012, establishing the state of play, several faculties of Medicine at the national level have been provided with a simulation center. These implementations have made it possible to enhance teaching by simulation, with regard to the results obtained by the different teams.[9]

This impact was found in our study since the average score obtained among the students improves considerably in pre and post-test on different models while being statistically significant ($p \ll 0.05$). These results even exceed those reported by other teams who have used interactive E-learning platforms for learning cardiovascular semiology.[8]

Moreover, whether or not to attend the lecture did not impact the score obtained by the students either in the pre or in the post-test, hence the need to take corrective measures or to reinforce the theoretical teaching by teaching practice. While knowing that attendance at lectures is strongly recommended and not compulsory and that the statements of students in relation to this point are not verifiable.

The evaluation of the impact of these training sessions was inspired by the modified Kirkpatrick Model with its 4 levels, which approximates real-life conditions, even if the evaluation of the results on patients will not be verified by our study.[10,11]

Finally, several students expressed the wish to have more simulation sessions and considered the duration of the workshops insufficient. Even if this wish can come up against a great overload of work for the teaching staff.

V. CONCLUSION

The simulation for the acquisition of skills in medicine seems to take an increasingly important place, and seems to offer prospects for measurable, effective, and efficient evolution and should be an integral part of training programs.

The training sessions in cardiac auscultatory semiology by simulation are feasible on a practical level and bring an indisputable benefit. The terms of application will require the establishment of a standardized and continuous evaluation system for a larger sample among our future doctors.

VI. ACKNOWLEDGEMENT

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