Teaching Prenatal Care via Hybrid Simulation: A Descriptive Study at Hassan First University in Morocco

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Abstract

Introduction: The training of health professionals requires special attention because it has a direct impact on human life where error is intolerable. The projection of theoretical knowledge in a practical environment is an indispensable step in learning which requires the mobilization of innovative teaching methods. This paper reports impacts of hybrid simulation in prenatal consultation on the learning of midwifery students in initial training.

Materials and methods: In order to assess simulation's impact on the acquisition of technical and non-technical skills in initial training of midwives, A descriptive study was carried out using pre-tests, post-tests and evaluation grids during the hybrid simulation of prenatal consultation session, after dividing the sample into 2 groups; experimental and control group. All statistical analyzes for this study were done with SPSS software. The pair comparisons were carried out by the Wilcoxon test with a significance level $\alpha=0.05$.

Results: There was a significant improvement in the results of the post-simulation tests when compared to the results of the pre-simulation tests for both groups. It was noticed a significant increase in mean score from the first simulation session (25.23 $\pm$ 6.32) to a repeated simulation session (36.38 $\pm$ 3.77; $p<0.0001$).

Conclusion: Experiencing of a prenatal consultation hybrid simulation for first year midwifery students at the Higher Institute of Health Sciences in Morocco demonstrated its effectiveness and importance in midwifery learning. It is necessary to integrate simulation in Moroccan midwifery and nursing education in order to standardize their curriculum according to the international guidelines.

Background

The prenatal consultation is a primordial element in the preparation for childbirth; sometimes it constitutes the first contact of the woman with the health sector. The prenatal consultation helps to make pregnant women aware of warning and danger signs, and to detect and treat risk situations at an early stage. In Morocco, prenatal consultation is organized in the primary health care structures and is carried out by the midwife/nurse and the physician. Women with normal pregnancies receive four prenatal consultations and each consultation is structured and has a focused content adapted to the stage of pregnancy (1). Thus, the role of the midwife here is primordial as much as that of a counselor, and must be efficient in her acts. Hence the importance of a fairly solid training with global training.

Simulation is, more than ever, an essential educational method for all health professionals in initial and continuing training (2), it has become indispensable for preparing nursing and midwives students for clinical work (3). It includes a reproduction of the characteristics of a real-life situation or care environment (4). This reconstruction allows a contextualized learning: it allows, to the students and the health professionals involved the integrated learning of technical skills (gestures, decisional algorithms), and also non-technical skills (CRM: Crisis Resources Managements). In addition, it allows students to

learn from their errors without negative physical and psychological consequences for themselves or patients (5).

The Higher Institute of Health Sciences (Hassan 1st University of Settat, Morocco) started the integration of simulation in the training of nursing and midwifery students in 2013 and followed up on an important reflection on the need for this type of training and its impact. Indeed, simulation is an integral part of teaching modules according to a well-established educational program specifying the simulation techniques chosen, the educational objectives as well as the technical and non-technical skills sought.

The study carried out in this paper focuses on (i) the use of hybrid simulation for the teaching of prenatal consultation (ii) the evaluation of the impact of simulation on the learning of technical and non-technical skills of student midwives.

Methods

Sample and study design

Twenty one midwifery students have consented to experience the simulation scenario. The participants were first-year midwifery students who benefited from a theoretical course taught by their specialist teachers. Then, the students' theoretical knowledge was assessed in a written examination at the end of the course. Twenty-five students were enrolled in the research component of the study. They agreed to participate in (i) video recordings during their simulation exercise (ii) viewing of videos during debriefing sessions to describe and analyze the practices developed (iii) a knowledge questionnaire in the form of pre- and post-tests (Supplementary file 1), and (iiii) the evaluation grids (Supplementary file 2) that were mobilized during the simulation exercise. They were divided into 2 groups ; Experimental group (group1) who received a pre-test and then a simulation session followed by a post-test the same day and control group (group 2) received the same pre-test as group 1 then was invited to review their theoretical course and after a week they received a intermediate post-test , which was followed by a simulation session the same day and then, they received the simulation post-test. Towards the end of the experiment, all the students benefited from a simulation rehearsal session (**Fig.1**).

The simulation experience began with a prebriefing: the contextualization phase to present the simulation exercise site and the necessary equipment (Weight scale, measuring board, floppy disk, pinard stethoscope...) to accomplish the tasks.

The briefing: the launch phase of the clinical case that was simple, basic, and clear, *it was a case of a woman aged 25 years old, presented herself in a maternity unit for a second prenatal consultation, pregnancy well controlled; the biological and ultrasound examinations show a good evolution of the pregnancy; the woman is under treatment with iron as a preventive measure. She has no risk factors, no medical, surgical, obstetric or gynecological history, so the previous delivery took place in the best conditions with an inter-reproductive space of three years.* The objective of this case is to practice all the necessary gestures during this consultation (measurement of vital parameters, uterine height ...) without

forgetting the non technical skills (communication ...), so this step was also devoted to provide for students their roles and expectations, which were the ground rules of the simulation. Orientation to the simulation scenario included a description of the simulation process, an opportunity to experience the equipment and the space, and instructions for successful scenario completion.

Simulation Exercise: In this phase the student is inserted in the created scenario, during this scenario we adopted 2 types of simulation ; the hybrid simulation which results in an overlap of acts between a facilitator and dummy medium fidelity (Susie), and the roleplay to allow a fictional scenario that requires personal involvement and that builds on personal and professional knowledge all to give students the impressions of the patient and to increase realism by getting closer to stress conditions in the workplace.

The debriefing: firstly, it is the descriptive phase where the students were asked to express themselves freely and to tell their experiences during the simulation session, to express their opinions and impressions. Then we started the analysis phase with the help of the specialist teachers, a communication expert who evaluated the non-technical, and a professor who intervened for the technical evaluation from the display of some videos of the students, after having their consent. And lately it is the synthesis phase where we have assured the clarification and the correction of some acts without forgetting the crucial criterion during this phase is that the notion of failure does not exist, in valuing the error that opens the door to learn and improve, and most of the obstacles discovered during this phase are overcome thanks to the rehearsal session.

Data analysis

The study was carried out according to the model described above; Tests (pre- and post-test) consisted of 10 direct questions conducted during the study to assess students' knowledge, and scored according to the importance of each of them in relation to the technical act concerned by the study. Each participant in the study was evaluated individually through questions that deal with the course of the prenatal consultation with its existing standards in Morocco.

During the simulation exercise we used evaluation grids while respecting the scenario objectives and which detailed the actions required during the exercise, with a score varying between 0 and 2 for each item (done (2), not done correctly/not done at the right time (1), not done (0)). Data were analyzed using the statistical program SPSS version 17 (SPSS Incorporated, Chicago, IL, USA). To assess the performance of individual items, an item analysis was undertaken including item difficulty and item discrimination. The item difficulty and discrimination index according to Downing and Yudkowsky (6). All pair comparisons were carried out using the Wilcoxon test with a significance level $\alpha=0.05$.

Ethical considerations

This study is part of the research project; Simulation Pedagogy for Nursing Education and Patient Safety, which was approved by Hassan First University and the Higher Institute of Health Sciences. Twenty-five first year midwifery students were invited as volunteers to participate in this study; twenty-one (84%) of

them accepted the invitation. Oral consent was obtained from all participants and they were informed that the data collected during the simulation experiment will remain confidential and anonymous and that access is limited to researchers only.

Results

Assessment of skills through tests

Fig.2 summarizes the scores obtained from students in group 1 before simulation (pre-test) and after simulation (simulation post-test). The Wilcoxon test demonstrated after simulation the students had a significantly higher mean score in the simulation post-test (14.25 ± 3.38 ; $p=0.0003$) compared to the mean score of pre-test (11 ± 3.86). This means that the simulation improved the knowledge and skills (Fig.2).

For the group 2 (Fig.3), we found that the mean score for the intermediate post-test was slightly increased compared to the mean score of the pre-test. In addition, the knowledge/skills mean score was significantly increased after simulation (19.84 ± 4.75 ; $p<0.0001$) compared to the pre-test mean score (12.76 ± 3.39). Results obtained for both groups (1 and 2) showed that simulation had a positive impact in learning.

The discrimination and difficulty indices obtained from the items' analysis (Table 1) provided the information that items 4 and 9 were the most discriminant items to differentiate between students regarding their knowledge and skills. Indeed, the two items had a medium difficulty index and a high discriminant index. If one item relied on difficulty the second item should be rejected, it is successful by almost all respondents (92%), but its discrimination index is close to the maximum possible. It is not the item that needs to be reviewed, but rather the opportunity to include it. If we want to measure prerequisites considered essential or the achievement of minimum objectives, this item should be retained. However, it will not be able to differentiate all subjects, but it may be very useful in identifying the weakest subjects. On the other hand, items 3, 8 and 10 are difficult, but they have a high discrimination index. Items 6 and 7 discriminate little, but it must be taken into account that they are also very difficult items. In fact, we can say that these items allow us to discriminate as much as possible against what we can expect at this level. Similarly, items 1 and 5 are also difficult, but there is no discrimination.

Assessment of skills through the evaluation grid

The skills seen during the simulation sessions were assessed through evaluation grid that contained items including both technical and non-technical skills. For the first simulation session, the mean score was 25.23 ± 6.32 . Repeated simulation (session 2) improved significantly the grid mean score (36.38 ± 3.77 ; $p<0.0001$) (Fig.4).

Discussion

This pilot study explored the feasibility of a new educational methodology, simulation, to reproduce the real context of a prenatal consultation. An obvious advantage of simulation in midwifery education and training is that it allows the students to reflect on their own learning, while assessing medical parameters and performing advanced technical procedures. Simulation allows learners to mobilize their theoretical knowledge in a practical situation.

We have successfully developed and implemented a prenatal consultation simulation for first year midwifery students at the Higher Institute of Health Sciences in Morocco. The experience was designed as a formative learning situation for the students. The set of results obtained throughout the study clearly shows the positive impact of simulation on the learning of students in initial training, as well as its influence on the knowledges and skills. Thus, by exposing the student to numerous simulation sessions, the decision-making process can be improved. Giving students the opportunity to simulate practical skills related to the profession in a realistic environment, a critical approach and behavior is stimulated. It has been demonstrated that learning by doing provides a potential basis for the correlation between repeat training and acquired skills (7). These data, in correlation with our results, support the experiential side of simulation and its role in building skills. Simulation has proven to be an effective way to teach and assess the skills of midwifery students during prenatal consultations.

Also, our findings were similar to previously published results, the study conducted by Fisher et al. (8) shows that in the example of eclampsia and magnesium sulphate toxicity, the three modes of teaching (courses, courses plus simulation, simulation) demonstrated an overall improvement in the management of eclampsia. Shin et al. (9) found that simulation education was more effective than traditional learning methods. Crofts and Birch reported that simulation of the hemorrhage of delivery allowed better acquisition of knowledge even 6 months later (10, 11).

The choice of the hybrid simulation approach as well as the choice of the good practices (the repetitive practice, team learning, debriefing) contributed in the total immersion of the midwifery students in an environment closer to reality. The simulation sessions allow to reinforce and improve the knowledge and skills for both learners and teachers, which was confirmed by Lindssay et al. in their study on the evaluation of an hybrid simulation of emergency delivery situations in a midwifery graduate program (12). Also, hybrid simulation was reported to be an important approach for nursing care learning (13). The combination of simulation and theoretical training improves the skills of midwifery students. It also improves the learning capacity of students by projecting theory into practice. The learning process profits widely from the chance to operate in a mutual and joint group in an open environment (14).

With regards to item analysis, while the main objectives of an item analysis are to estimate the difficulty and discrimination of each item, it also provides useful feedback to the instructor regarding items that are not functioning properly and need to be revised or removed from the test in order to improve the overall level. In the case of pre- and post-simulation tests, it is important to analyze each item in order to improve the test and determine its relevance (15).

Conclusion

Simulation confirms its place as an active and innovative pedagogical method based on experiential learning and reflexive practice. It is essential in initial formation, since it constitutes an intermediate phase between theory and practice, and allows the learner to validate his achievements by practicing technical gestures with the possibility of immersing himself in a protected environment where the error is tolerable.

Students participated in our study appreciated the simulation sessions saying that it provided them an opportunity to practice frequent situations without any risk for patients. Simulation remains the main method to be integrated in the educational program for nurses and midwives in Morocco in order to standardize the curriculum according to the international guidelines.

Abbreviations

CRM: Crisis Resources Managements

Declarations

Ethics approval and consent to participate

This paper forms part of the objectives set out in institutional Project FP/2020/02, **"Simulation Pedagogy for Nursing and Midwifery Education and Patient Safety"** funded by Hassan First University of Settat to support scientific research. This study evaluates a standard education process and is classified as a project for improving the quality of teaching, evaluation and comparison of health education strategies. This study was exempt from review by the Ethics Committee.

Oral consent was obtained from all participants and they were informed that the data collected during the simulation experiments will remain confidential and anonymous.

Consent for publication

Not applicable.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

OC is the principal investigator and a major contributor to all aspects of this study and manuscript; she was involved in study design, study execution, data analysis, critical discussion, and drafting the article. SC helped in study execution, and critical discussion, AM contributed greatly to data analysis and critical discussion and drafting the article. AG contributed in study execution. ES and AH played a key role in critical discussion and revision of the paper. IYM supervised the study, she designed and followed-up the study, discussed results and drafting the article. All authors read and approved the final version of the manuscript.

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Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1
The items discrimination and difficulty indices

Items	Difficulty	Discrimination
1. What is the number of prenatal consultations recommended during pregnancy except for pathological situations in Morocco?	0% (Difficult)	0.0
2. When is the second prenatal consultation for the woman.	92% (Easy)	0.3
3. What is the uterine height corresponding to a five-month pregnancy?	20% (Difficult)	0.5
4. List three objectives of second prenatal consultation.	60% (Moderate)	0.5
5. List the equipment needed to perform an obstetrical examination.	4% (Difficult)	0.0
6. What is the purpose of the urine test strips?	8% (Difficult)	0.125
7. What is the benefit of the ultrasound examination during the second prenatal consultation?	16% (Difficult)	0.125
8. List three cases where the pregnant woman should be referred to a second level specialist consultation.	24% Difficult	0.625
9. List three biological examinations required for pregnant women during the second prenatal consultation.	40% (Moderate)	0.5
10. What is the purpose of each biological examination?	4% (Difficult)	0.4

Figures

Figure 1

Diagram of the sequence of the study

Figure 2

Score mean of the first group assessment test ** $p < 0.01$.

Figure 3

Score mean of the second group assessment test *p < 0.05, **p < 0.01 and ***p < 0.001.

Figure 4

Score mean of the prenatal simulation session *** $p < 0.001$.

Supplementary Files

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