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Featured Article

# Debriefing: The Most Important Component in Simulation?

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## KEYWORDS

debriefing;  
nursing education;  
simulation;  
research simulation

## Abstract

**Background:** Simulation is a time- and cost-intensive teaching modality that consists of both hands-on experience with a lifelike manikin and a debriefing session. While many educators believe that both simulation components are important for learning, the impact of the individual components is unknown.

**Objectives:** The purpose of this study was to determine where in a simulation experience greater knowledge gains occurred.

**Methods:** With a 2-group, repeated measures, experimental design, this study examined the impact of simulation components (hands-on alone and hands-on plus debriefing) on heart failure (HF) clinical knowledge in 162 prelicensure nursing students (age:  $M = 25.7$  years,  $SD = 6.6$  years; 85.5% women) from 3 nursing schools who were at the same point in their curriculum. Parallel HF knowledge tests were given at baseline (Pretest) and after the hands-on (Posttest 1) and debriefing (Posttest 2) stages of the HF simulation.

**Results:** HF knowledge scores decreased from the pretest to the first posttest (after the hands-on component of the simulation;  $M = -5.63$ ,  $SD = 3.89$ ;  $p < .001$ ), whereas they dramatically improved after debriefing ( $M = +6.75$ ,  $SD = 4.32$ ;  $p = < .001$ ).

**Conclusion:** Gains in HF knowledge were achieved only after debriefing. This study suggests that the debriefing experience should be emphasized in a standardized simulation learning experience. Further investigation is needed to evaluate the impact of debriefing and intensive teaching without the hands-on simulation component.

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## Background

High-fidelity simulation (HFS) is a time- and cost-intensive teaching modality that consists of both hands-on experience with a lifelike manikin and a debriefing session. The hands-

on experience often consists of a mock clinical event. Debriefing, also referred to as *guided reflection*, is a planned session after the simulation and is led by the instructor, who provides students with the time to assess their decisions, actions, communication, and ability to deal with the unexpected (Decker, 2007). Although there are several models of debriefing techniques (Decker, 2007; Dismukes, Gaba, & Howard, 2006; Fanning & Gaba, 2007;

Rudolph, Simon, Dufresne, & Raemer, 2006), debriefing is generally considered to be a time for the participant to reflect on the event, discuss it with others, learn, and modify behavior as a result (Decker, 2007; Fanning & Gaba, 2007).

While many educators believe that both simulation components are important for learning (Decker, Sportsman, Puetz, & Billings, 2008; Kardong-Edgren, Lungstrom, & Bendel, 2009; Thompson & Bonnel, 2008), others believe debriefing to be essential to the learning process (Fanning & Gaba, 2007; Rudolph et al., 2006; Shinnick, 2010; Shinnick & Woo, 2010a, 2010b; Shinnick, Woo, & Evangelista, 2010; Smith, Jacob, Segura, Dilger, & Torsher, 2008). However, the impact of the individual components has not been established.

The contribution of these simulation components on gains in clinical knowledge is uncertain because previous studies of prelicensure nursing students and HFS have not evaluated the impact of the HFS components individually. Most studies have evaluated the influence of the entire HFS experience, and these studies have concentrated on descriptive and subjective outcomes, with little objective evaluation of gains in knowledge. However, both faculty and professional nursing organizations (American Association of Colleges of Nursing, 2008) emphasize clinical knowledge gains in students. Although such knowledge gains with HFS have been demonstrated in basic and advanced life support training (Monsieurs, De Regge, Vogels, & Calle, 2005; Palmisano, Akingbola, Moler, & Custer, 1994; Verplancke, et al., 2008), increases in other forms of clinical knowledge have rarely been reported.

A review of the nursing simulation literature reveals a paucity of research on knowledge acquisition in student nurses. A published, quantitative literature review by Ravert (2002) revealed a positive effect on knowledge and skill

acquisition from simulation in 76% of the cases she reviewed, but none of these were done on prelicensure nursing students. Of the few published studies to examine HFS and knowledge in prelicensure nursing students, Alinier, Hunt, Gordon, and Colin (2006) found knowledge gains higher in the simulation group using an objective structured clinical examination, while Hoffman, O'Donnell, and Kim (2007) used a one-group repeated measures design and found the Basic Knowledge Assessment Toll-6 (BKAT) scores to be significantly higher ( $p < .05$ ) in six subscale areas after simulation. Jeffries and Rizzolo (2006), in a large national study, found no significant knowledge gains between first exposure to high-fidelity manikin simulation, static manikin, and paper-and-pencil case study on a two-item National Council of Licensure Exam (NCLEX) –type test. Kardong-Edgren et al. (2009) found significant increases in knowledge immediately after an HFS exposure but significant decreases in knowledge 6 months later (Kardong-Edgren, et al., 2009). Despite these conflicting reports of knowledge increases in prelicensure students, there was no identification of where in the simulation experience the greatest gains occurred (Alinier et al., 2006; Hoffmann et al., 2007; Jeffries & Rizzolo, 2006; Kardong-Edgren et al., 2009).

Regardless of the lack of research in this area, there is a widespread desire to incorporate simulation into nursing curricula (Bandali, Parker, Mummery, & Preece, 2008; Seibert, Guthrie, & Adamo, 2004; Wilford & Doyle, 2006). Both educators and clinicians should take this issue seriously because the commitment to incorporating HFS into nursing education is not only a financial one but a time- and resource-intensive one as well (King, Moseley, Hindenlang, & Kuritz, 2008).

Advancement in simulation technology use has exceeded the evidence of its value in prelicensure nursing education although emerging research is building evidence in its support (Lapkin, Levett-Jones, Bellchambers, & Fernandez, 2010). Knowledge of its effectiveness and its greatest impact on knowledge should guide and influence its use. As acquisition of knowledge is fundamental in nursing education, this study sought to examine the impact of the simulation components (hands-on alone vs. hands-on plus debriefing) on clinical heart failure (HF) knowledge in prelicensure nursing students.

## Specific Aims

The specific aims of this study were (a) to determine whether HFS of a common adult clinical situation, HF, improves the HF knowledge of prelicensure nursing students and (b) to determine where in the process of HFS (hands-on alone vs. hands-on plus debriefing) knowledge is gained.

## Method

### Study Design

This study used a two-group, repeated measures, experimental design (Figure 1).

### Key Points

- Many educators believe both simulation components are important for learning.
- Previous studies have not evaluated the impact of the HFS components individually.
- Faculty should be adequately prepared in debriefing as it is a vital component of the simulation experience.

## Sample

For the study a convenience sample of four cohorts of prelicensure nursing students ( $N = 162$ ) was recruited from three schools of nursing. All schools used the same simulation equipment (SimMan<sup>®</sup>, Laerdal Medical, Wappinger Falls, NY). Institutional review board (IRB) approval was obtained from all three schools prior to the study. A power analysis indicated that a sample size of 128 participants would allow detection of moderate (0.25) effect sizes on a paired  $t$  test at a  $p$  value of .05 and power of 0.80. Inclusion criteria were prelicensure nursing students in the same course at each school who had successfully completed instruction in care of HF patients. This point in the prelicensure curriculum is the standard equivalent of a medical–surgical course, Level III (or advanced medical–surgical course), traditionally taken in the 3rd year of a 4-year nursing program. Exclusion criteria were students who either had heart failure or had family members with heart failure. Students were randomly assigned by blocks (all students at that school for the day were assigned to the same group) to experimental (participated in HFS prior to Posttest 1) or control (no HFS prior to Posttest 1) groups. Both groups received hands-on HFS and debriefing prior to Posttest 2.

## Scenario Development

The clinical situation of acute decompensated HF was chosen to be the focus of the simulation. Simulation of HF patients in the education of nurses in acute care is important because HF is the most common hospital discharge diagnosis in the United States in patients 65 years old and older (Schocken et al., 2008). In addition, in the United States there are more than 6 million Americans with HF, and more than 550,000 are newly diagnosed each year (Schocken et al., 2008). Thus, HF patients can be found in many hospital medical units. Simulating different scenarios for HF patients is an important component in the clinical training of nurses at all levels.

Three simulation scenarios of a clinical case of acute decompensated HF were created. They were identical to each other in design, with the exception of the patient history and gender. Parallel simulations were developed in order to decrease scenario predictability and cross talk between groups. Validity for HF scenario accuracy was done by three experts in the nursing care of patients with HF and by one cardiologist who practices at a large HF specialty clinic. Each scenario version had 100% agreement on the content by the panel of judges for this study.

The study scenarios were designed to elicit basic nursing responses such as elevating the head of the bed for a dyspneic patient, applying oxygen as appropriate, choosing the priority medication from physician's orders, and monitoring appropriate electrolytes in a patient receiving a diuretic. Simulation objectives, which are usually given to students prior to the experience, could not be given in

this case as the subject matter would have been revealed. However, students were told the simulation subject matter was on a topic they had studied in the present quarter of instruction.

## Data Collection Instruments

The evaluation of participant presimulation knowledge (Pretest), immediately after hands-on experience (Posttest 1), and immediately after both hands-on experience and debriefing (Posttest 2) focused on the symptom management of the HF patient and was a 12-item, multiple-choice questionnaire developed by the investigator (M.A.S.). Each version of the HF Clinical Knowledge Questionnaire is different but considered parallel to the others (Table 1). The questions focused on a patient showing signs of pulmonary decompensation, and HF was not named. As such, the participant was blinded to the topic of the simulation. However, the questions focused on desired nursing interventions for common issues associated with HF, which may be the same as or similar to the interventions for other pulmonary problems.

Content validation of the HF Clinical Knowledge Questionnaires was done by the same three experts mentioned above. Each version of the HF Clinical Knowledge Questionnaire had 100% agreement on the content by the panel of judges for this study.

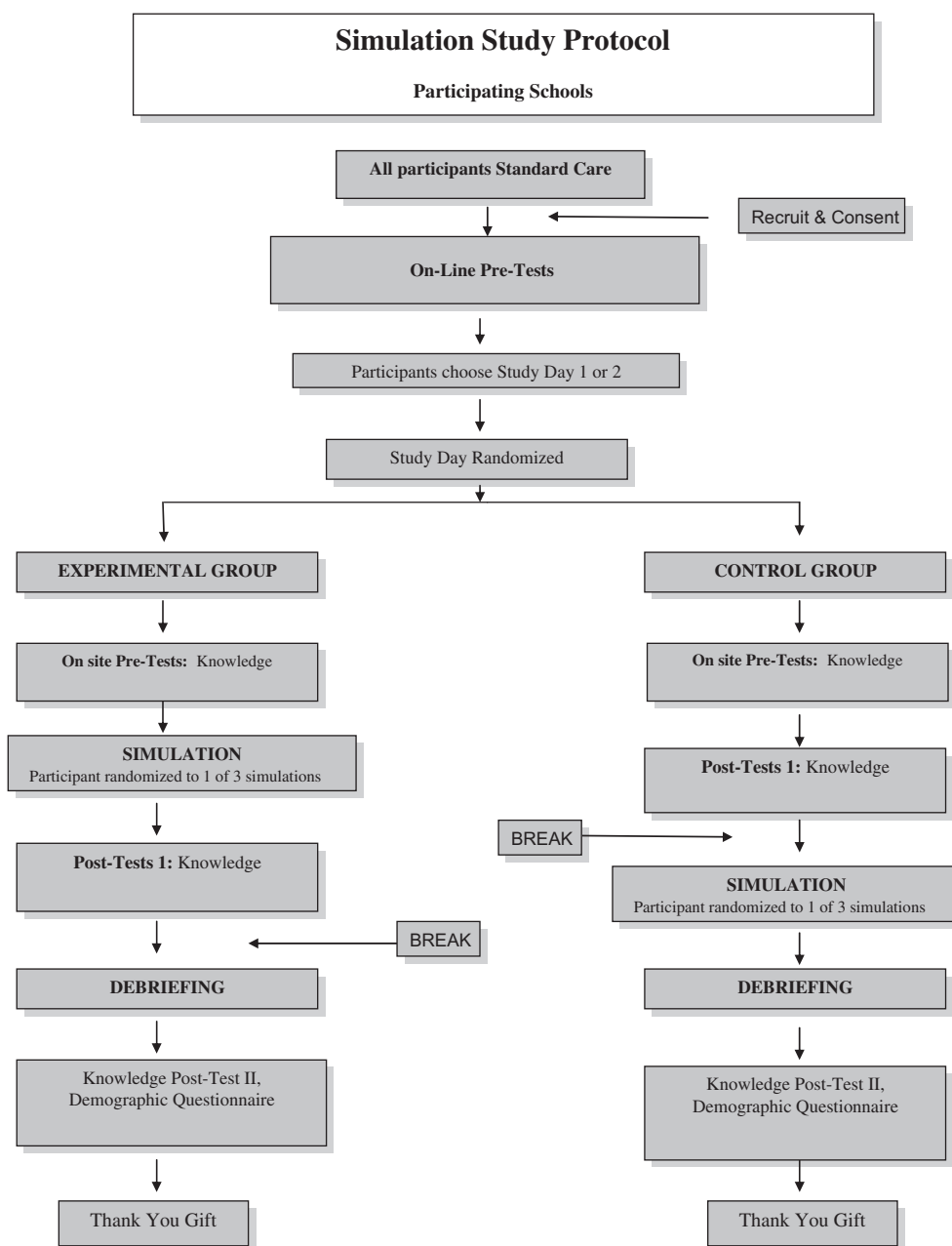
## Data Collection Protocol

“Standard care” for all participants included lecture on HF in the Med-Surg III (Advanced Medical Surgical) course and any accompanying clinical time in the same quarter. A 2-day data collection interval for this study was scheduled at each site within 2 weeks of the HF lecture.

A coin toss determined the study day to be experimental or control, with the subsequent day being the reverse. Participants in groups of 5 rotated together through testing, whereas simulations were done one-on-one, with a random numbers table used to determine scenario selection, and debriefing was done in groups of 5 once all had completed the simulation.

The experimental group completed the HF Clinical Knowledge Questionnaire (Pretest) prior to simulation. To determine whether HF knowledge improves with hands-on HFS experience alone, the next HF questionnaire was given immediately following the hands-on simulation and before the debriefing (Posttest 1). Following a group debriefing, the third Knowledge Questionnaire (Posttest 2) was given along with a demographic questionnaire.

The control group completed the same pretest questionnaire as the experimental group. Unlike the experimental group, the control group took Posttest 1 within 1 hour of the pretest and before the simulation. During the time between pretest and Posttest 1, control students stayed in the same



**Figure 1** Study protocol depicting randomization, experimental and control groups, testing completed, and the crossover of the control group to simulation.

room, without access to textbooks or a computer, and generally used this time for socialization while constantly monitored by a research team member. Posttest 1 was then followed by HFS (both hands-on experience and debriefing) and Posttest 2.

A 30-minute debriefing session was done with groups of 5 students who had just completed the HFS. The same research team member did all the debriefings at all the participating sites and did not have access to any of the instruments used in this study. Guided reflection was used to stimulate conversation among the participants. The debriefing sessions were not didactic in any way. In

addition, the sessions were taped and reviewed by the investigator (M.A.S.) for consistency. The study protocol is depicted in [Figure 1](#).

Testing of (HF) clinical knowledge was completed via Scantron. The item analysis and test scores were compiled in an Excel spreadsheet (Microsoft, Redmond, WA).

### Statistical Analyses

Data analysis was performed with SPSS version 16.0 (SPSS Inc., Chicago, IL) and included independent samples *t* tests and analysis of variance with post hoc *t* tests. Statistical

**Table 1** Examples of HF Clinical Knowledge Questions on Parallel Tests. Brief Patient Description Precedes Each Question

Knowledge Pretest	Knowledge Posttest 1	Knowledge Posttest 2
The reason Harold has crackles in his lungs is: Fluid volume overload Increased pressure in the pulmonary vasculature An upper respiratory infection Preexisting pulmonary edema	Harold's chest x-ray reveals pneumonia. How can the nurse determine the cause of his crackles in the lungs? Use percussion to assess the lungs Check for jugular venous distension Base assessment on his history of heart failure Check for weight gain	The reason Harold has crackles in his lungs is: Fluid volume overload Drinking too much An upper respiratory infection Preexisting pulmonary edema

significance was set at  $p < .05$ . The results presented here focus solely on the three points of HF knowledge testing (Pretest, Posttest 1, and Posttest 2).

## Results

A total of 162 prelicensure nursing students from three schools of nursing completed the study. The control and experimental groups ( $n = 72$  and  $n = 90$ , respectively) were not equal in size because of the variability in prelicensure cohort sizes for each day at the data collection sites. However, there were no statistically significant differences in age, gender (Table 2), or baseline knowledge scores between groups (Pretest; Figure 2).

## Comparison of Control Versus Experimental Groups

The experimental group had significantly higher scores than the control group had on Posttest 1 (Figure 2). At this measurement point, the experimental group had the hands-on component of the HFS and the control group had not. Moreover, the experimental group continued to have higher scores on HF clinical knowledge on their Posttest 2 scores compared with the control group's Posttest 1 scores ( $p = .009$ ). No significant differences were found between the groups at Posttest 2, which measured both groups after hands-on training and debriefing.

## Results for Both Groups

The maximum score on each of the HF knowledge tests was 100. It is interesting to note that HF knowledge decreased on Posttest 1 ( $M = -5.63$ ,  $SD = 3.89$ ) and increased on Posttest 2 (after both hands-on and debriefing;  $M = 6.75$ ,  $SD = 4.32$ ),  $p < .001$ , for both groups. Significant differences ( $p < .001$ ) were also found between the pretest and Posttest 2 scores ( $M = 6.75$ ,  $SD = 4.32$ ; Figure 2) for both groups. Effect size calculation for Posttest 1 was 0.42 (small to moderate effect), and for Posttest 2, 0.21 (small effect). In summary, knowledge decreased after the hands-on component of the simulation and increased only after both the hands-on component and debriefing.

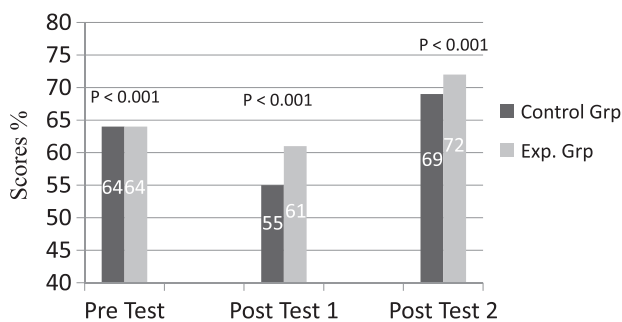
## Discussion

Simulation is an alternative for clinical experience although there is little evidence that HFS can replace human patient experience. However, simulation offers students a means to explore clinical problems while practicing clinical judgment and reasoning skills without putting patients at risk. Although further study is necessary to transfer these research findings to other simulation scenarios, this study is significant because it confirms what many have believed: Learning does not occur primarily or exclusively in the hands-on portion of the HFS experience, and the debriefing component is the most valuable in producing gains in knowledge. This is important information for all educators using simulation because it indicates that adequate attention to both the debriefing technique and the time spent performing the debriefing are essential for learning to occur.

Although it is not clear why debriefing is the most important component in this learning method, it is reasonable to suggest that the time spent by the students, with faculty guidance, in a form of guided reflection is the reason. This type of debriefing gives the student a chance to explore the events as they occurred, building on the hands-on component. Debriefing offers instructor feedback, the experiences of peers, and hindsight, all of which the hands-on simulation feature does not. The students also are given the opportunity to "problem solve" after the fact, without the overriding concern of harming a patient with their actions (or concern about performance anxiety). Although the simulations here were done 1 student at a time, the debriefing was done in groups of 5 students. The cumulative feedback and reflections of the group may have affected the learning gains seen here.

Other explanations for these findings could be related to the debriefer leading the students to the answers on the HF clinical knowledge questionnaire. In this study, this was avoided by the debriefer's not knowing about the question content on any of the tests, as well as one debriefer performing all of the sessions at each of the research sites. In addition, the tapes of the debriefing were reviewed for content appropriateness and consistency by the researcher.

Debriefing after simulation, shown here to be critical to the learning experience, may be easier for some and more



**Figure 2** Comparison of test scores between control and experimental groups. The columns represent the scores on the knowledge Pretest, Posttest 1, and Posttest 2 between the control and experimental groups.  $P$  values represent the difference between the groups at each time. Error bars indicate 1 standard deviation for each group. Analysis of knowledge scores postsimulation compared with presimulation revealed a mean improvement of 5.6 points,  $p < .001$ .

**Table 2** Demographic Data for Study Sample

Characteristic	Control	Experimental	$p$
$n$	72	90	—
Age $M$ ( $SD$ )	26 (7)	25 (6)	0.43
Gender			0.06
Women $n$ (%)	67 (93.1)	74 (85.5)	
Men $n$ (%)	5 (6.9)	16 (14.5)	

difficult for others. Many recommend a nonjudgmental and nonthreatening yet reflective style of debriefing (Billings, Jeffries, & Kammer, 1990; Decker, 2007; Dreifuert, 2009; Rudolph et al., 2006), which was used in this study. Learning to use simulation as a teaching method should include adequate preparation of faculty for debriefing because debriefing has now been shown to be a vital learning component. How much time should be spent in debriefing in relation to the hands-on component is not yet known. However, it appears from these data that significant emphasis should be placed on the debriefing, from both time and quality perspectives.

From this study's findings, it appears that the debriefing component of HFS has the greatest impact on HF knowledge in prelicensure students. While the randomization procedures for this experiment may have not resulted in completely equivalent groups, the fact that there was no statistically significant difference between the groups in relation to age, gender, or baseline HF knowledge appears to indicate that randomization procedures were adequate. In addition, although the experimental group consistently had higher HF knowledge scores than the control group did, this difference was not significant at Posttest 2, which occurred after simulation and debriefing. Much thought has been given to the finding of decreased knowledge scores in both groups on Posttest 1 despite the fact that the experimental group had had the hands-on component of the

simulation. In the control group, Posttest 1 scores may be a result of the students' questioning their answers on questions of similar nature on the pretest. For the experimental group, the drop in Posttest 1 scores may be because the simulation itself (without the debriefing) raised questions in the students' mind as to the correctness of their interventions at the bedside of a patient with problems similar to those described in the test questions. In any case, the Posttest 2 knowledge scores increased for both groups above pretest scores, with a mean gain of 5.6 points that was statistically significant,  $p < .001$ . The most likely explanation is the value of the debriefing component of HFS.

## Study Limitations

Efforts were made to minimize study limitations, although some were unavoidable. For the lecture component of the course at each research site, different resident faculty gave their usual cardiac lecture, which included HF. To eliminate study bias, the lecture at the home site of the principal researcher was done by a faculty member not involved with the study. In addition, the emphasis on HF may have varied from school to school as it was part of a larger, cardiac-focused lecture.

Students may have had different and unequal clinical experiences in heart failure. Attempts were made to control for this possibility by scheduling the study within 2 weeks of the lecture at each site. Because the study was done at each site over a 2-day period, contamination of the study content may have occurred through students' discussing content of the simulation among themselves (cross talk) despite confidentiality agreements. This was apparent only at the end of the last study day at one site, where some students entered the simulation seemingly knowing what to expect.

Previous simulation experience differed slightly among the groups as one of the four study cohorts had experienced simulation in other courses. This cohort seemed more comfortable in the simulation and did not need as many cues as the others though its members did not score the highest on the knowledge tests. All students were oriented to the manikin and the environment prior to the simulation in order to decrease the effect of this limitation.

## Conclusions

This study has demonstrated simulation to be an effective learning modality for prelicensure nursing students. Clear knowledge gains were found to be the greatest, not after the hands-on component of the simulation, but after the debriefing component of the simulation. This finding reinforces the position of simulation proponents that simulation of clinical experiences is a valuable learning method. In addition, it further strengthens the argument of many that the debriefing element of simulation is the most vital component of the experience. Since the knowledge

gains are greatest with debriefing, adequate attention and time should be given to this part of the simulation. In addition, further studies should be done to replicate these findings with other scenarios and other types of learners.

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