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TECHNOLOGICA INNOVATION

CONSTRUCTION AND VALIDATION OF A CLINICAL SCENARIO AND CHECKLIST FOR ASSESSING CARDIOPULMONARY RESUSCITATION SKILLS*

HIGHLIGHTS
1. Validation of the technology for assessing cardiopulmonary resuscitation skills.
2. Construction of simulated scenario and checklist for assessment of unstable patient.
3. The technology can be applied nationwide.

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ABSTRACT
Objectives: to build and validate a simulated scenario and checklist to assess skills in the care of hemodynamically unstable patients with evolution to Cardiorespiratory Arrest, and to test applicability to the target population, assessing skills and satisfaction/self-confidence with learning. **Method:** methodological study carried out in three stages (development of the scenario and checklist, validation by judges and pilot test) between April 2020 and September 2021, in the state of Minas Gerais, Brazil. Fourteen judges and 24 nursing students participated. **Results:** the scenario and checklist achieved a Content Validity Coefficient greater than 90. The skills were adequately developed, with a mean of 4.71 ± 0.24 on the satisfaction-self-confidence scale, and 4.83 ± 0.25 for simulation design. **Conclusion:** The scenario may contribute to improving educational activities in undergraduate and health education and subsidize future studies to increase the quality of care and assistance to hemodynamically unstable patients with evolution to cardiac arrest.

DESCRIPTORS: Simulation Training; Nursing Education; Competency-Based Education; Cardiopulmonary Resuscitation; Employee Performance Appraisal.

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INTRODUCTION

Cardiorespiratory arrest (CRA) refers to the abrupt interruption of cardiac and respiratory activity, leading to inadequate blood perfusion to organs and tissues1. The event can be recognized by absence of pulse in large arteries, lowered level of consciousness, agonic breathing, or apnea[1-2].

Most cases of CRA are related to complications of cardiovascular diseases, especially ischemic heart disease (IHD)[3]. In Brazil, the IHD mortality rate affects 183.3 people per 100,000 inhabitants and is therefore among the highest in the world[3-5].

In 2015, about 350,000 US citizens suffered CRA in the out-of-hospital environment, of which less than 40% received Cardiopulmonary Resuscitation (CPR) maneuvers[2]. Despite the advances in recent decades in the care of patients in CRA, the reversal and survival rate is still low, denoting the need to intensify the training of professionals and lay people to use the best practices in CPR[4].

CPR involves a sequence of systematized maneuvers in the chain of survival to reverse CRA and maintain tissue oxygenation and perfusion[1-2]. To this end, the initial maneuvers, or Basic Life Support (BLS) involve identification of CRA, request for support, effective chest compressions, airway opening and ventilation (when appropriate), and early defibrillation until more complex actions are taken[2].

Research has shown the effectiveness of CPR teaching during undergraduate education but highlights that the content has been addressed late in the course, using methodologies that are not very stimulating[5-6]. In this sense, massive training, with realistic methodologies aimed at problem-solving and performance guidelines, has been highlighted in the literature.

An experimental study[7] conducted with 42 Portuguese nursing students used clinical simulation to examine knowledge retention, clinical reasoning, self-efficacy, and satisfaction with the learning experience. As a result, it was found that the experimental group progressed in knowledge after the intervention ($p=0.001$) and high levels of satisfaction with learning ($P<0.001$).

Another study[8] conducted in Saudi Arabia examined the clinical performance in cardiac arrhythmias of final year nursing students. The 36 participating students were divided into a control group (clinical-practical training) and an experimental group (simultaneous exposure to high-fidelity simulation with clinical-practical training). At the end of the educational intervention, the experimental group was found to have significantly higher levels of performance and safety than the control group.

Research has shown that traditional theoretical-practical teaching has been insufficient for nursing students to learn safely and establish appropriate conducts for hemodynamically unstable patients to progress to a CRA[9-11]. Therefore, the use of teaching methodologies that assist learning is necessary[7,9].

Considering this panorama, the present study is justified, which aims to build and validate a simulated scenario and checklist to assess skills in the care of hemodynamically unstable patients with progression to CRA, and to test its applicability to the target population, assessing skills and satisfaction/self-confidence with learning.

METHOD

This is a methodological study for the construction and validation of a clinical simulation scenario, developed at a public university in the interior of the State of Minas Gerais, from April 2020 to September 2021. The study was carried out in three consecutive stages: (1) development of the scenario and a checklist; (2) validation of the scenario and checklist by judges and (3) pilot test with nursing students. For the theoretical development stage of the scenario and checklist, the central recommendations contained in the national and international literature were used[2-3]. For the structural framework of the prototype, the recommendations of the International Nursing Association for Clinical Simulation and Learning (INACSL) and the model for clinical simulation were followed[11-12].

In the analysis and validation stage, the judges were initially selected, with non-random convenience sampling, using the adapted scale[13]. The following inclusion criteria were considered: being a professional with a degree in health sciences, with experience in clinical simulation and care of critically ill patients. For this, a curriculum analysis was carried out via the Lattes Platform regarding training, experience, and bibliographic production on the research topic and/or clinical simulation. Five points were established as the minimum score for the inclusion of judges.

Twenty judges who met the required criteria were selected and contacted via e-mail, social media and published scientific article. Judges who initially agreed to participate but did not respond to the second round of evaluation were defined as exclusion criteria. It should be noted that for validation to be effective, the literature recommends that the instrument be evaluated by at least five judges[14].

To enable the analysis and validation, an electronic form was prepared via Google Forms, with four sections referring, respectively: The Informed Consent Form (ICF); sociodemographic questionnaire; scenario script; and checklist. Based on the recommendations of the literature, for each item, the pertinence, relevance, and clarity of the content were verified, in addition to the possibility of comments and suggestions by the judges[14].

After validation by the judges, the pilot test was carried out with nursing students in the fourth year of undergraduate studies who had not yet studied the content on basic and advanced support in CRA, in the discipline Nursing in Adult and Elderly Health II, of a Public University. The course is completed in five years or ten semesters. All 24 students who attended the discipline and agreed to participate were included in the study, being distributed in groups of up to six people for the good use of the activity.

The simulated activity for the pilot test was carried out over three days, with classes lasting four hours for each group of six students. Therefore, it was necessary to repeat the activity four times, until all four groups of six students were covered.

The first day of the simulated activity was the day of sociodemographic data collection, followed by a dialogical lecture on basic and advanced life support in cardiology. On the second day of the activity, theoretical and practical training took place in the simulation laboratory and, on the third day, the application of the simulated scenario, evaluation by the checklist, followed by the application of the Student Satisfaction and Self-Confidence in Learning Scale (ESEAA, in Portuguese) and Simulation Design Scale (SDS)[15-16]. The ESEAA has 13 items and is made up of two domains, namely: the first refers to satisfaction (with five items), and the second, to self-confidence (with eight items)[15]. The SDS is composed of 20 items and subdivided into five factors: goals and information (with five items); support (with four items); problems solving (with five items); feedback/reflection (with four items); and realism (with two items)[16]. Both the ESEAA and the SDS have a scale with five possible answers on a Likert-type scale, ranging from strongly disagree to strongly agree[15-16].

For the execution of the scenarios, on the second day of activities, the hybrid simulation was used with a standardized patient, cardiopulmonary resuscitation simulator and equipment inherent to the emergency room. After the simulation, the debriefing was carried out, with an average duration of thirty minutes, to mediate and concretize the construction of knowledge with critical analysis of performance[17]. This moment provided notes of improvements, difficulties, strengths and performance of assistance and competencies built during the teaching and learning strategy.

For analysis, the data were entered into the Microsoft Excel® 2010 program and then transferred to the Stata® software version 15.0. The sociodemographic data of the judges and students were calculated based on absolute numbers and frequencies corresponding to the qualitative variables and measures of position and dispersion for the quantitative ones, calculating the mean and standard deviation.

The Content Validity Coefficient (CVC) was calculated to verify the similarity of agreement of the judges in the answers to each item of the instrument and the total item. For this purpose, in relation to the possibilities of answers, a Likert-type scale of four items was used: 1- totally disagree, 2-somewhat disagree, 3- partly agree and 4- totally agree. The CVC is obtained through the sum of "3" or "4" answers, divided by the number of total answers. It should be noted that each item of the instrument is only considered valid if it reaches a score greater than or equal to 0.80[18].

The results of the checklist were interpreted as adequate and inadequate, with subsequent calculation of frequencies for each category. Finally, the responses to the ESEAA and SDS were calculated by mean, and minimum and maximum standard deviation for factors and items.

This research was approved by the Research Ethics Committee of the Federal University of Juiz de Fora, under opinion No. 4.085.631.

RESULTS

In line with the objective of the study, according to the theoretical[2,4,11-14] and methodological[17-18] framework, the scenario and checklist script was built.

To guide the construction of the simulated scenario and the checklist, the authors conducted an initial literature search on good practices in the construction of simulated scenarios, choosing to follow the recommendations of the International Nursing Association for Clinical Simulation and Learning (INACSL)[11] and the model for clinical simulation[12,14]. The recommendations involve the domains that consider "previous components of the scenario" (focused on the learning objectives, base literature and previous knowledge of the student), "preparation of the scenario" (involves from the complexity of the scenario, description of the cases, human and material resources) to "final components of the scenario" (focused on skills assessment).

After defining the structural framework of the scenario, a literature search was conducted on the care of hemodynamically unstable patients with evolution to CRA, based on the main national and international recommendations[2,4,19-23] According to the recommendations related to the theme, for each domain of the scenario, items were established that guided the development of knowledge, skills, and evaluation.

Thus, the simulated scenario constructed has three domains and 44 items. The domain "previous components of the scenario" has five items. In the "scenario preparation" domain, 14 items stand out. Finally, the domain "final components of the scenario" has four items, and the last one, "evaluation" is formed by the checklist consisting of 20 items. This relates to the skills to be assessed during the development of students' activities in the scenario.

To evaluate the scenario, 20 judges were invited, however, 14 (70%) responded to the steps of the analysis in relation to the pertinence, relevance, and clarity of the construct.

Among them, 11 (78.6%) were male, with an average age of 37.5 years (±5.3), an average training time of 13 years (±3.6) and an average time of professional experience of 11.8 years (±3.5). All reported being nurses, and 10 (71.4%) reported having *stricto sensu* specialization (master's and/or doctorate). Regarding professional experience, all reported working or having worked in urgent and emergency services and approaching critically ill patients, 10 of them (71.5%) in an out-of-hospital environment. All were educators in higher education, and 1 (7.1%) of these participants declared to be responsible for the clinical

In the first round of evaluation by the judges, most of the items obtained a CVC value above 0.80, however, there were considerations for adequacy expressed by the evaluators. Thus, it was decided to proceed, after the adjustments, to a second round for all items. The content validation of the simulated scenario was concluded with CVC above 0.93 in all 44 items, and an overall CVC of 0.99 (Table 1).

Table 1 - Content Validity Coefficient of items and domains in the first and second evaluation rounds. Juiz de Fora, MG, Brazil, 2021

Items/domains	CVC 1 round	CVC 2 round
Previous components of the scenario	0.94	0.99
Contains learning objectives	1.00	1.00
Clear objectives	0.88	1.00
Coherent objectives	0.97	0.93
Adequate theoretical background	1.00	1.00
Prior knowledge	0.85	1.00
Setting the scene	0.96	1.00
Complexity	1.00	1.00
Logical sequence	1.00	1.00
Coherent case	1.00	1.00
Assists critical thinking and decision-making	0.97	1.00
Consistent interventions	1.00	1.00
Consistent outcomes	0.97	1.00
Fidelity	0.92	1.00
Appropriate case	1.00	1.00
Trainer information	0.85	1.00
Actor information	0.95	1.00
Accompanying actor information	0.97	1.00
Material resources	0.88	1.00
Realism	1.00	1.00
Physical space	0.97	1.00
Human resources	0.95	1.00

Final components of the scenario	0.97	1.00
Clues provided	0.97	1.00
Scenario provides knowledge	1.00	1.00
Debriefing	0.95	1.00
Evaluation:	0.97	1.00
Checklist (skills assessed)	0.99	1.00
Physical examination	1.00	1.00
Monitoring	1.00	1.00
Responsiveness	1.00	1.00
Pulse	1.00	1.00
Ventilation	1.00	1.00
Hard surface	1.00	1.00
DEA request	1.00	1.00
Position	1.00	1.00
Rhythm	1.00	1.00
Compression/ventilation	1.00	1.00
Airway opening	1.00	1.00
Positive ventilation	1.00	1.00
Ten second interval	0.97	1.00
Use of Defibrillator	1.00	1.00
Isolate shock	1.00	1.00
Restart compression	1.00	1.00
Compression rhythm	1.00	1.00
Need for shock	1.00	1.00
Route of administration	1.00	1.00
Drug	1.00	1.00
Complete instrument	0.97	0.99

Source: The authors, (2021).

Regarding the pilot test, 17 (%) of the 24 invited students participated in the entire process. Participants ranged in age from 22 to 37 years, with a mean of 25.1 years, 16 (94.1%) were female and all were in their eighth year of undergraduate studies.

The academics' self-assessment of prior knowledge related to the theme of the scenarios was small or none for 12 participants (70.6%). However, after the application of the scenario, 12 participants (70.6%) considered their knowledge as good, and five participants (29.4%) as perfect.

To evaluate the students in the scenario, the validated checklist was applied, considering the fulfillment of the skills as "adequate" or "not adequate". In this sense, for the 24 required skills, most academics fulfilled more than 70% of the activities, except for item 22 (Table 2).

Table 2 - Students' performance in the simulated scenario using the validated checklist. Juiz de Fora, MG, Brazil, 2021

Items/skills	Adequate n (%)	Inadequate n (%)
1. Perform targeted physical examination	16 (94.11)	1 (5.88)
2. Set up monitoring, oxygen, and vein	16 (94.11)	1 (5.88)
3. Check responsiveness	14 (82.35)	3 (16.64)
4. Check ventilation	13 (76.47)	4 (23.52)
5. Ask for help	16 (94.11)	1 (5.88)
6. Check carotid pulse	15 (88.23)	2 (11.76)
7. Position and place the victim on a hard surface	15 (88.23)	2 (11.76)
8. Position hands appropriately and compress with adequate depth	12 (70.58)	5 (29.41)
9. Perform rhythm of compressions	15 (88.23)	2 (11.76)
10. Perform compression/ventilation ratio 30:2	17 (100)	0
11. Perform airway opening	13 (76.47)	4 (23.52)
12. Administer ventilation maneuver	12 (70.58)	5 (29.41)
13. Restart compressions in less than 10 sec.	16 (94.11)	1 (5.88)
14. Install DEA, where available	16 (94.11)	1 (5.88)
15. Isolate the victim before delivering the shock	14 (82.35)	3 (16.64)
16. Restart compressions as soon as indicated	17 (100)	0
17. Assess and identify the cardiorespiratory arrest rhythm on the monitor	17 (100)	0
18. Identify need for electrical treatment	17 (100)	0
19. Know the routes of drug administration	15 (88.23)	2 (11.76)
20. Identify drugs required during cardiorespiratory arrest.	14 (82.35)	3 (16.64)
21. Assess the need for an advanced airway and intervene.	15 (88.23)	2 (11.76)
22. Assess blood pressure and intervene	10 (58.82)	7 (41.17)
23. Assess body temperature and guide care	17 (100)	0
24. Assess need for hemodynamic service	14 (82.35)	3 (16.64)
Complete instrument	356 (87.26)	52 (12.74)

Source: The authors, (2021).

When the ESEAA scale was applied to the domain "satisfaction with current learning", the mean was 4.92 (±0.19) with a minimum score of four and a maximum of five. In the "self-confidence in learning" domain, the mean was 4.5 (±0.29), with a minimum score of four and a maximum of five.

Regarding the SDS scale, in the "objectives and information" factor, the mean was 4.97 (±0.09), with a minimum score of four and a maximum of five; in the "support" factor, the mean was 4.83 (±0.29), with a minimum score of four and a maximum of five; in the "problem-solving" factor, the mean was 4.88 (±0.26), with a minimum score of four and a maximum of five; in the "feedback/reflection" factor, the mean was 4.98 (±0.06), with the same minimum and maximum score obtained in the previous items, and in the "realism" factor, the mean was 4.5 (±0.58), with a minimum score of three and a maximum of five.

DISCUSSION

This study built, validated, and tested the applicability of a simulated scenario and checklist to assess skills in the care of hemodynamically unstable patients with evolution to CRA. Simulated scenarios in the health area are developed to mobilize knowledge and skills that can be applied in the future to real clinical situations, in a safe and agile way[4-6]. In many emergencies, rapid decision-making, and the execution of a sequence of systematic commands become imperative[1].

Studies indicate that the recognition of CRA and the agile establishment of CPR have positive repercussions on the clinical outcome of the patient[2-4]. In this sense, the assessment and identification of a hemodynamically unstable patient who evolves to CRA in a simulated scenario is intended to mobilize future conduct in real situations of professional practice5. In addition, the simulated scenario allows repetition without compromising patient safety[7,14].

To obtain a good quality simulated scenario, capable of teaching and measuring what is intended, the first step, after structuring based on the literature, is to perform content validation by judges with mastery of the theme, followed by adjustments when necessary[17-18]. In the present investigation, the judges had more than a decade of training and had experience in urgency and emergency. Thus, even though the scenario and checklist reached an agreement of more than 80% among the judges, it was considered that because of their experience, all recommendations would be accepted. After the adjustments, the overall agreement for the instrument exceeded 90%.

In this direction, studies involving the construction and validation of simulated scenarios on BLS and Advanced Life Support in Cardiology (ACLS) have achieved variable global CVC between 80% and 95%[20-22]. According to the literature, the identification of agreements above 80% guarantees an adequate standard of instrument validity[18-19]. Therefore, a CVC higher than 80% reflects the rigor in planning, construction, case description and construct clues, which were ratified by experts in the field, based on judgments and suggestions for improvement[18,22].

In addition, the application of the simulated scenario to the target population, through a pilot test, allowed to improve the set of educational elements to the reality and needs of the students. Thus, according to literature recommendations, the simulated scenario and the checklist were evaluated by students at the time of debriefing, and through the scales used[15-17,19-22].

From the application of the ESEAA[15] and SDS[16], it was verified that the averages of positive responses achieved were compatible with other studies that used the scales, complementarity, in the validation process of simulated scenarios[10,23]. In addition to the debriefing, the application of the scales contributed to evaluate, from the student's perspective, the degree of satisfaction, self-confidence in the execution of the activities and whether the scenario had a realistic design.

It should be noted that satisfaction with the simulation can have repercussions on knowledge retention, skill acquisition and self-confidence to proceed with the development of activities safely. Thus, self-confident nurses are better able to articulate theoretical and practical knowledge to make decisions and provide effective care[15,23].

It is important to emphasize that, to produce knowledge and, consequently, satisfaction and self-confidence, it is essential that the scenario design is compatible with a real clinical situation. Through the perception of students who respond to the SDS[16], it can be verified that the objectives have been achieved, since the scenario is faithful to a clinical experience, the simulated environment enables the resolution of the clinical problem, and it is important to mention that a moment is reserved for feedback and discussion of all activities performed.

Clinical simulation has the potential to stimulate cognitive and metacognitive skills, such as critical thinking and clinical judgment, to make safe and effective decisions[5-7]. Considering the results achieved, the construction and content validation of the scenario on screen may help the development of specific skills for identification and intervention in CRA situations.

As a limitation of the research, we highlight the realization of the validation and pilot test only in the context of nursing, in addition to the establishment of convenience sampling for the pilot test.

CONCLUSION

The construct for assessing skills in the care of hemodynamically unstable patients with progression to cardiac arrest is valid in its content, with positive results in the pilot test and adequate in producing satisfaction/self-confidence with learning. It is believed that the simulated scenario can contribute to develop educational activities in undergraduate and continuing health education, as well as subsidize future studies, to increase the quality of care and assistance to hemodynamically unstable patients with progression to cardiac arrest.

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Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work - **Dias AA, Costa YCN da, Tony ACC, Carbogim F da C**. Drafting the work or revising it critically for important intellectual content - **Dias AA, Costa YCN da, Tony ACC, Alvim ALS, Santos KB dos, Carbogim F da C.** Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved - **Dias AA, Costa YCN da, Tony ACC, Alvim ALS, Prado RT, Santos KB dos, Carbogim F da C**. All authors approved the final version of the text.

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