Multimodal Simulation in Stroke: A Standardized and Virtual Patient With Mobile Tracking App for Interprofessional Training

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Research article

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Abstract

Background: Ischemic stroke is a time-dependent disease, with early diagnosis and interdisciplinary and coordinated management between pre-hospital and in-hospital being key to patient management. Interprofessional training has incorporated various teaching technologies, such as simulation with standardized patients, virtual simulators, and telephone applications for tracking clinical processes. There are few publications regarding the impact of multimodal and interprofessional training on initial stroke management. The objective of this work was to evaluate the impact on confidence, perception of knowledge and satisfaction of the participants of a multimodal workshop for interprofessional training in the initial management of stroke.

Methods: A workshop was organized with pre-hospital and intra-hospital interprofessional groups, based on standardized patient simulation, virtual simulation and a telephone application for tracking clinical processes. A questionnaire was applied to the 26 participants to investigate the level of satisfaction with the simulation and the telephone application. Quantitative data was analyzed using descriptive statistics.

Results: The response rate was 67% (17/26). 100% reported a self-perception of increased confidence in their stroke management abilities, 100% feel that debriefing instances favor their learning and 93.4% believed that an app contributes to the improvement of prehospital management of patients.

Conclusions: The use of multimodal simulation tools and technologies for process monitoring fosters the learning process and confidence of trained personnel in the initial management of time-dependent diseases such as stroke.

Background

Stroke in adults represents one of the main causes of mortality and acquired disability in the world. (1)

Its effective treatment is time dependent, that is, the clinical outcomes depend on the time from the onset of symptoms to reperfusion/revascularization, either by intravenous thrombolysis or endovascular thrombectomy. (2) Early diagnosis and teamwork of health professionals are key to achieving better clinical results with fewer complications. (3)

Delays in treatment, handling errors or misunderstandings among the health teams are therefore risky situations for patients. (4) 3–4% of medical complications in stroke patients are supposedly due to human error, and 70% of them to team communication problems, misunderstandings, poor execution of orders or poor decisions.

There are multiple flow charts to manage patients with suspected stroke at optimal times. They cover various strategies to reduce inpatient care times, such as taking actions during the transfer, but many fail to mention the methods used to train these teams. (5)

Given the risk of hindering patient treatment, serious pathologies such as stroke offer fewer traditional training opportunities for young professionals. Given the natural ethical commitment of professionals to give timely treatment to patients, trainers must prioritize clinical care over the supervision of students or other members of the health team without achieving teaching objectives. (6)

Simulation and technologies applied to health education have emerged as valuable tools for the development of individual clinical skills and teamwork. They provide an environment of psychological security, without risk to patients and with the possibility of guaranteeing access to and opportunities for learning. Furthermore, they allow the delivery of specific feedback and the confirmation of achievements in areas not observable in the traditional models. (7)

There are reports of simulation programs to improve emergency care times based on the use of standardized patients (8) and on-site simulation programs that have reduced in-hospital times to thrombolysis. (9) In Latin America there are reports of simulation programs applied in Brazil, which have reduced door-to-needle times. (10)

There are also studies reporting multiple simulation programs at the undergraduate level. Some, aimed at nursing students for emergency management showed high satisfaction with simulation. (11) Other were interprofessional training programs based on the use of standardized patients that focus on rehabilitation and also proved to have high participant satisfaction.(12) In postgraduate neurology, it was shown that after the regular implementation of immersive simulation programs for handling stroke codes, door-to-needle times were reduced. (13)

The use of mobile communication systems associated with motion tracking has been reported as a useful technology to improve coordination between professionals from pre-hospital and in-hospital systems and thus reduce stroke care time from the onset of symptoms. (14)

We did not find reports in the literature of interprofessional training programs that use various simulation modalities combined; mobile communication systems associated with movement tracking technologies emulating the joint work of prehospital and hospital care levels.

The following study reports the self-perception of knowledge, self-confidence and satisfaction of an interprofessional group that used various methodologies in order to improve the training process of pre-hospital and in-hospital health teams in the initial management of stroke. Our hypothesis is that interprofessional training for the management of Stroke, through virtual simulation, simulation with standardized patients and a patient tracking application of clinical processes fosters both learning and confidence at the time of decision-making of health personnel.

Methods

An observational and cross-sectional study design was carried out. A six-station circuit was developed for the interprofessional management of stroke in the Chilean health system. It referred to the progression of

care of an adult male patient, at the prehospital and hospital care levels.

The educational resources used to implement the activity were: standardized patient simulation; virtual patient simulation, using Body Interact® software; virtual simulation of diagnostic images, using TC interpretation; procedural simulation of thrombolytic preparation and telephone application for monitoring the clinical process of initial stroke management, using the App® JOIN.

The stations were designed to train and evaluate the performances of the participating teams in the following specific competitions and educational resources (Fig. 1):

1. Prehospital 1: Carry out a directed anamnesis, identifying focal neurological symptoms, evolution time of the symptoms, and identification of formal contraindications for thrombolysis. Resource used: emergency telephone service and patient family simulation.
2. Prehospital 2: Perform stabilization and adequate transfer of the patient by notifying the hospital with a prehospital scale (FAST ED). Resource used: virtual patient and monitoring application, and follow-up application.
3. Hospital Emergency Room 1: Perform vital signs monitoring of the patient entering the emergency department, perform NIHSS, request laboratory tests and images. Resource used: standardized patient and follow-up application.
4. Hospital Emergency Room 2: Properly interpret CT, brain CT angiogram, calculate ASPECTS score and identify occlusion site. Prescribe thrombolysis, contact a thrombectomy ready center and an ambulance service. Resource used: CT simulator and monitoring application.
5. Hospital Emergency Room 3: Calculate thrombolysis dose, prepare thrombolysis, detect rise in blood pressure and manage it. Resources used: simulation of drug preparation procedure and follow-up application.
6. Hospital Emergency Room 4: Indicate and justify thrombectomy, leave medical indications for the first 24 hrs. Resources used: Standardized patient, thrombectomy room, and clinical record.

The workshop was facilitated by an interprofessional team made up of nurses and other professionals from the pre-hospital ambulance system, neurologists and experts in simulation and educational technologies.

The workshop was carried out over a period of two hours, divided in: pre-intervention knowledge assessment, provided initial information on the activity, group organization, sequential progress in the six stations, final debriefing of the activity, post-intervention evaluation and user satisfaction survey.

By random assignment, the participants were distributed in 6 work teams according to their professional profiles and clinical experience. To improve decision-making, each team was accompanied by a facilitator, who presented the clinical situation of the assigned station and guided the discussion among the members of each team. Each station had to be resolved within 15, before moving on to the next.

The monitoring application was used to inform the members of the other teams about the patient's condition and the management carried out by the previous team.

Each group was subsequently debriefed by a clinician with expertise in the stations' task, with a co-debriefing with simulation instructors.

Knowledge of the critical milestones of the comprehensive management of stroke requiring thrombolysis was evaluated, using self-report in pre and post intervention measurements. The satisfaction of the participants with respect to the multimodal program, the simulation stations and the telephone application was evaluated using a three-level likert-type scale supported on the SurveyMonkey platform. For the analysis, positive trend responses were grouped.

Results

The workshop had a total of 26 participants, divided in six groups of five people each. Of the total, 17 participants voluntarily agreed to answer the self-perception and satisfaction surveys, using the informed consent procedure administered through registration (67%).

The self-perception evaluation of confidence and security of the participants regarding the simulation as an integrated activity showed a high level of agreement in all items of confidence regarding the methodology used and management of the presented case (Table 1 and Table 2). The results were positive in the briefing, the clinical case and in the debriefing.

When facing patients with suspected stroke, as indicated by 100% of the participants, simulation scenarios increase self-confidence in decision-making capacity and in performing interventions. It also allows the development of communication and education skills towards patients, as stated by 100% of the participants (Table 1).

Table 1
Briefing and simulation scenario assessment

Regarding the simulation scenario	**Strongly agree**		**Agree**		**Do not agree**	
	Total	%	Total	%	Total	%
Increased your sense of readiness	6	35,3	7	41,2	1	5,8
Increased your confidence when making decisions	10	58,8	7	41,2	0	0
You developed knowledge about the pathophysiology and pharmacology of the cases	6	35,3	10	53,0	1	5,8
You developed more confidence when communicating with patients	10	58,8	7	41,2	0	0
You improved your patient education abilities.	11	64,7	6	35,3	0	0
Increased confidence in performing interventions that may threaten patient safety	8	47,1	9	52,9	0	0
Regarding the briefing prior to the simulation	**Strongly agree**		**Agree**		**Do not agree**	
	Total	%	Total	%	Total	%
Increased self-confidence	12	70,5	5	29,4	0	0
You consider the activity beneficial	13	76,4	4	23,5	0	0
(a total of 17 responses were obtained).						

Regarding the debriefing, it is of note that 100% of participants considered that this activity contributed to their learning and was a constructive activity for their knowledge (Table 2).

Table 2
Debriefing post simulation assessment

Regarding the debriefing	Strongly agree		Agree		Do not agree	
	Total	%	Total	%	Total	%
The activity contributed to my learning	11	68,7	5	31,2	0	0
you managed to verbalize your feelings before focusing on the clinical facts	11	68,7	4	25,0	1	6,2
You improved your clinical judgment	11	68,7	4	25,0	1	6,2
You managed to reflect on your own performance	11	68,7	5	31,2	0	0
You consider that the simulation was a constructive evaluation	12	75,0	4	25,0	0	0
(a total of 16 responses were obtained).						

The use of the follow-up or tracking telephone application was beneficial for the initial management of the patient with suspected stroke. It is worth mentioning that 93.4% of participants liked the idea of the application and believe it contributes to the pre-hospital management of stroke, and 80% consider it easy to use. Furthermore, 86.7% would recommend it as a prehospital communication system in this type of clinical situation (Table 3).

Table 3
Join App mobile assessment

Regarding the JOIN application	Strongly agree		Agree		Do not agree	
	Total	%	Total	%	Total	%
You liked the concept of the JOIN application	8	53,3	6	40,0	1	6,6
It was easy to use	6	40,0	7	46,6	3	20,0
You consider it contributes to prehospital management of Stroke	10	66,6	5	33,3	1	6,6
Image quality was adequate	11	73,3	4	26,6	1	6,6
Can be used by medical and non-medical personnel	11	73,3	4	26,6	1	6,6
You would like to incorporate it into daily clinical practice	8	53,3	6	40,0	1	6,6
You would recommend it as a pre-hospital communication system	8	53,3	4	26,6	2	13,3
(a total of 15 responses were obtained).						

Discussion

This study shows that multimodal training with simulation and a mobile tracking application has a beneficial effect on self-perception of confidence and knowledge in the trained group. As our results show, this multimodal teaching technique fosters learning and confidence when making decisions in time-dependent pathologies, such as stroke. Simulation training has reduced the time from hospital admission to the start of treatment in patients with suspected stroke in the centers where it has been implemented. An example of this is the Hospital Pró Cardíaco in Rio de Janeiro, where systematic interprofessional training shows a significant reduction in the time from entry to the emergency room until initial treatment. (10) Similar results are described in Norway by Ajmi. (8)

It is also important to highlight the benefit of interprofessional training to reduce treatment start times in patients with suspected stroke. In our study, the stations were managed by groups composed of different professionals, achieving greater resemblance to reality when facing this type of pathology. The importance of training for interprofessional work is reflected in a training study aimed only at neurology residents, which shows how training allows the reduction of treatment times when patients are left in charge of neurology residents, but maintaining the times from when the patient enters the hospital to the activation of the stroke code and until imaging, processes in charge of the emergency departments, which had not been trained. (13)

Finally, it is relevant to highlight the high acceptance of professionals when training with simulation techniques. Our results show that all the participants considered that the activity was beneficial for their professional practice. The use of simulation techniques is widely used, particularly in teaching, where studies show that nursing and health profession students have positively evaluated simulations. (11)(12) The acceptability of an educational methodology by the participants is a valuable measure to obtain considering that is a starting point in linear models to assess medical education programs and that is also part of models based on complexity theories. (15)

In our study the level of measurement only addresses satisfaction and self-perception, which we consider a limitation from the linear approach to programs evaluation. When used in a healthcare system, measurements should focus on changes in practice performance and patient outcomes, and we think that a program evaluation model that embraces the complexity of the educational process is a better election than a reductionist approach.

Conclusions

Regarding the projections of our work, this study explores the feasibility of implementing a training that connects the work of pre-hospital and in-hospital teams while being generally acceptable for most of the participants. It provides relevant information that can be useful to improve the integration of the different levels of care in order to achieve better efficiency in the processes and the subsequent improvement of

patients clinical endpoints. This methodology can be implemented as a continuing education program in a networked system, given its feasibility and acceptability by participants.

Declarations

Ethics approval and consent to participate

This study was approved by Universidad del Desarrollo ethics committee and all the participants signed an informed consent

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed 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

VN and PL organize the workshop, VN and SA conceptualized the methodology and implemented the workshop. RP, DA, SA performed the data analysis and were major contributor in writing the manuscript. All authors read and approved the final manuscript.

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Not applicable

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Figures

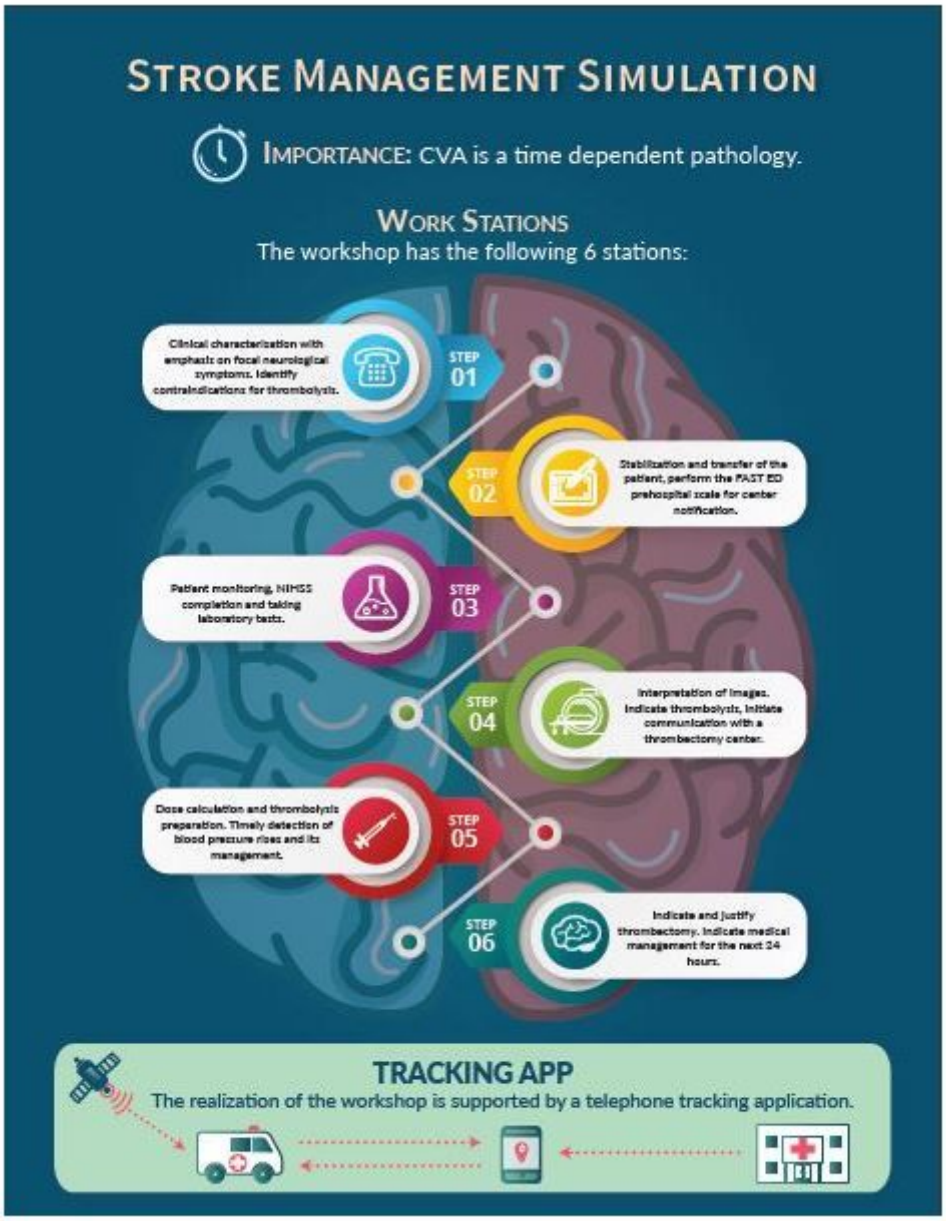

Figure 1

The stations were designed to train and evaluate the performances of the participating teams in the following specific competitions and educational resources