

Research results applied to the field of health: how experience impacts the classroom and society

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Introduction

The Health Sciences Faculty of the Universidad Tecnológica de Pereira has been advancing in the generation of new knowledge and has explored various fields of knowledge.

This book presents four pieces of research that have a lot to do with new trends, both in the training of human talent in health, and in the way in which knowledge and technology are applied to solutions to context problems.

In this case, it is important to mention the role that high-fidelity clinical simulation has been gaining in the training processes of our students, more specifically the use of theater and the “standardized patients” strategy, in the promotion of professional criteria. The positive impact of a focused training is evident, both in the conceptual development of the individual, and in the appropriation of his role as an agent of social change. The theater promotes an intentional interaction with which knowledge, skills and attitudes can be explored in a medical training process.

Likewise, theater has been used as a useful tool in the introduction of therapeutic elements in hospital spaces, such as pediatric, oncology or mental health wards, promoting various ways of interacting with medical staff, or exploring personal aspects. that can improve the clinical evolution of patients.

Clinical simulation also contemplates a series of technological elements that, when used for educational purposes, can also promote performance analysis of cognitive, technical, and dexterity skills. This

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is the case of the clinical simulation put to the service of a CPR skills analysis project, in which, through sensors and performance variables such as force, pressure or response time, they can account for advances in CPR training processes, both for university communities and for health professionals.

This book, then, proposes various ways of approaching our advances in clinical simulation, applied theater in physician training, new perspectives on classroom intervention in health, and novel ways of monitoring technical skills such as CPR.

This book evidence the effort of a community committed to the advancement of science and its application in solving context problems.



Giovanni Garcia Castro
Dean, Health Sciences Faculty
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**CHAPTER
ONE**

Project Jai Kazhirua: Actors for clinical simulation

Proyecto Jai Kazhirua: Actores para simulación clínica

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Andrés Felipe Ramírez Herrera³

Abstract

Clinical simulation with actors is a suitable methodology in health science education as it represents a way to faithfully reproduce clinical situations in a controlled environment that enables learning while minimizing possible harm to the patient. This methodology is being implemented in many schools of medicine and other health sciences worldwide. The success of this strategy depends on the fidelity with which the various cases are simulated. At Universidad Tecnológica de Pereira, the Jai Kazhirua project, which takes its name from the Embera language, was implemented. This project was conducted in collaboration with the group La Escafandra Teatro. The actors were trained in clinical simulation by a multidisciplinary team, and a methodology was designed to

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reproduce individual medical cases either with companions or in collective environments according to the needs of each subject in a variety of clinical areas. Each case was initially proposed by the teachers and academic coordinators working in each area and was later studied and adapted by the project's creative team, which was led by a doctor with the dual status of actor and theatre director. The acting experience of the members of the theatrical group was used to confer as much fidelity as possible on the cases, which were designed following previous academic programming. 537 patient cases were implemented between 2020 and 2022, 20% of which featured a companion alongside the actor playing the patient and 18 of which featured collective settings. The experience contributed significantly to the development of educational tools for medical training, helped overcome the patient access crisis resulting from isolation due to the COVID-19 pandemic, and facilitated the development of a new didactic tool for the Faculty of Health of the Universidad Tecnológica de Pereira. The strategy was largely accepted by teachers and students, who valued the safe environment that this approach created during the simulation with the actors, which allowed the cases to be discussed and analyzed with the ongoing guidance of teachers. Furthermore, this methodology minimizes the relevant risks, optimizes the use of teaching resources, and simultaneously facilitates reflection on humanization and empathy, which are critical favors in the process of providing comprehensive training to students in the health sciences.

Key words: simulated patient, simulated environments, didactic tools, medical education.

Resumen

La simulación clínica con actores es una metodología de gran utilidad en la educación en ciencias de la salud pues representa un camino para reproducir con fidelidad situaciones clínicas en un ambiente controlado que posibilita el aprendizaje minimizando el posible daño al paciente. Esta

metodología está siendo implementada en muchas escuelas de medicina y otras ciencias de la salud en todo el mundo. El éxito de la estrategia depende de la fidelidad con la cual se simulen los diversos casos. En la Universidad Tecnológica de Pereira se implementó el proyecto *Jai Kazhirua*, que toma su nombre del lenguaje Embera, el cual se realizó en conjunto con el grupo La Escafandra Teatro. Los actores fueron entrenados en simulación clínica por un equipo multidisciplinario y se diseñó una metodología para la reproducción de casos médicos individuales, con acompañantes o en entornos colectivos completos, de acuerdo a las necesidades de cada asignatura en las diversas áreas clínicas. Cada caso fue planteado inicialmente por los profesores y coordinadores académicos de cada área y luego fue estudiado y adaptado por el equipo creativo del proyecto, dirigido por un médico quien además tiene la doble condición de actor y director de teatro. Se aprovechó la experiencia actoral previa de los integrantes del colectivo teatral, para darle la mayor fidelidad posible a los casos, los cuales se llevaron a cabo según programación académica previa. Se realizaron en total 586 casos de pacientes, de los cuales el 40% fueron con acompañante y 8 entornos colectivos en el período comprendido entre 2019 y 2022. La experiencia aportó significativamente a las herramientas educativas en formación médica, ayudó a superar la crisis de acceso a pacientes motivada por el aislamiento por la pandemia de la COVID 19 y permitió el desarrollo de una nueva herramienta en la Facultad de Salud de la Universidad Tecnológica de Pereira, con gran aceptación por parte de docentes y estudiantes, quienes han valorado el entorno seguro creado por la simulación con actores que permite la discusión y análisis de los casos con la guía permanente de los profesores, minimizando los riesgos, optimizando los recursos docentes y permitiendo simultáneamente la reflexión en torno a la humanización del trato al paciente y el ejercicio del desarrollo de empatía, favores claves en el proceso de formación integral del estudiante en ciencias de la salud.

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Palabras clave: paciente simulado, entornos simulados, herramienta didáctica, educación médica.

Introduction

Jai Kazhirua: Spirit of disease in the Embera language.

The development of health professionals' clinical skills has been a challenge throughout the history of higher education institutions due to the need to rely on scenarios for practice, training alternatives, and patient access that facilitate the necessary training to achieve integral formation (1). The medical practice deals with humans, i.e., people suffering from a medical condition that demands humanistic and leadership skills in addition to clinical abilities. An essential aspect of medical attention is the ability of the doctor to engage in assertive communication and to view the patient as a human being, not merely as a subject with a sickness.

Access to patients in medical institutions is limited due to location-based restrictions and the number of students who are usually involved; access to patients is essential to the formative process by which students in medical programs develop the core competencies that enable them to deal with vulnerable people. This development is possible in a simulated situation featuring an actor or actress, a person who can recreate situations that are close to the reality of medical situations (2). Such simulations are an excellent tool in the teaching process because the student can live the experience of performing a medical act, make mistakes, and receive feedback with the support of their teachers and from a person who is not an actual patient, thus eliminating the possibility of causing damage (3). This process could help students feel more secure when they encounter an actual patient and minimize the occurrence of mistakes in that context (4).

A Simulated Patient (SP) is a person who is not sick but can act as if he or she were sick for teaching or demonstration. Accordingly, such a person should be trained to contribute to the process by playing the role of patient. When the SP has been trained to repeat his or her case several times while reproducing precisely the same circumstances, he or she is known as a standardized patient, although both terms are occasionally used as equivalents or summarized by the term trained patient.

Life can change at any moment, modifying the ways in which humans behave and establishing new ways of living, working, and communicating. For example, the COVID-19 pandemic focused collective consciousness on the tasks of taking care of each other, avoiding potentially communicable diseases, implementing social distancing measures, and highlighting the need for people to wear personal protection elements, thus leading to additional restrictions on access to medical institutions, a situation that remains salient (5). It is necessary to develop alternative pedagogical approaches to the formation of students that contribute to the development of human skills. The use of a clinical simulation program featuring actors is a solution to this problem (6). Additionally, this kind of program is an excellent tool for training medical students in a humanized context while they also develop their clinical skills (4). These benefits are the reason why many higher education institutions worldwide have implemented simulations with actors as an educational strategy in medical settings (7-16), including evaluations in the form of standardized exams (17-19). These kinds of programs have grown exponentially over the past decade (7, 9, 20).

For these purposes, protocols have been created for the design of strategies using simulated actors (21), which highlights the importance of implementing this process in collaboration with performing arts professionals to ensure fidelity (22), following the standards defined by the ASPE (Association of Standardized Patient Educators) (23).

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The present project designed and implemented a pedagogical strategy based on simulation with actors from the La Escafandra Group, the institutional theatre group associated with Universidad Tecnológica de Pereira, which has extensive experience and advanced acting skills. This project aimed to develop a methodology that enables the students to encounter different settings in which the protagonists are patients who are simulated by actors before they meet actual patients. This strategy makes it possible for students to acquire the competencies necessary to properly approach patients, thereby protecting both students and patients from harmful situations (24).

Methods

The program was designed in a protocol that was previously discussed and reviewed with teachers and academic directors, which consisted of the following steps:

1. Teachers received guidance concerning how to describe the medical cases for the simulated activity and to identify the key signs and symptoms of the actor's performance.
2. A team of actors from the La Escafandra theatre group received specific training for this project to emphasize the clinical characteristics of patients and simulation techniques for signs and symptoms.
3. Teachers designed the cases with guidance from the director of the area in question in accordance with the learning objectives. Every case was analyzed carefully to consider the need for laboratory tests and diagnostic imaging to support the individual case.
4. Cases were shared with the director of the theatre group, who has dual training as a doctor and theatre director, to model and adapt every case to the activity

5. Every case was assigned by the director of the collective to an actor or actress depending on the necessary characteristics of the character at hand.
6. Each actor or actress engaged in a construction process for his or her character based on the medical case provided by the teacher, including all relevant social, personal, and clinical characteristics. In addition, the actors created medical and personal histories and social environments for their characters.
7. Actors and actresses presented the character and thus created to the director of the theatre group with a proposal for wardrobe, makeup, and physical characteristics.
8. The director provided feedback concerning the proposal to ensure that it matched the original case as closely as possible.
9. According to the case at hand, paraclinical tests, imaging, forensic medicine requests, or additional support material were generated to ensure that the simulated environment maintained a high degree of fidelity to reality.
10. Medical appointments were scheduled on the day and time that was assigned for the academic coordination of the area or department in question and were listed in a weekly schedule.
11. On the corresponding day and hour, the actor arrived at the medical appointment, and the simulated environment was initiated. Occasionally, the actor playing the patient was required to attend the appointment alongside an accompanying actor in accordance with the characteristics of the specific case. It is necessary to clarify that the accompanying actor was required to undergo the same process as the actor playing the patient and also received mentoring from the group director.
12. When it was necessary to simulate a complete environment featuring the participation of several actors, the process described previously was applied to each of the actors who

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participated in the environment; after these processes had been completed, the staging of the environment took place.

Students could know or not know the simulated character played by the actor and the accompanying person to suit the specific objectives of the practice. The actors and actresses were treated at all times like actual patients by teachers and students; in other words, teachers did not address the actual persons at any moment during the simulated act. This schedule was maintained throughout the semester to satisfy the needs of every academic area, department, and subject area. The simulated activities were conducted in a place assigned by the area coordinator.

Results and discussion

The cases were conducted from Monday to Saturday between 6:00 am and 8:00 pm in accordance with a schedule that had previously been established by the academic coordinators of each area. The participating areas and number of cases are summarized in Table 1. Every actor playing a patient attended alongside the relevant accompanying person when required by the case in question.

Regarding completely simulated environments, 18 complete scenarios were recreated, as described in Table 2. Samples of photographic records are shown in Figure 1.

Although the implementation of this program was initially motivated by the limitations to patient access resulting from the isolation caused by the COVID-19 pandemic, the project continued after that situation had passed since the importance of this didactic tool had already been identified.

Simulation with actors in health teaching contexts facilitates the humanization process for medical staff. The process allows medical professionals to understand how a patient should be

treated, not only from a medical point of view but also from a human perspective, thus improving students' communicative abilities throughout the learning process (25-27). Additionally, the simulated patients may recreate actual patients with high fidelity, thus allowing teachers and students to perform the medical act in question in a way that is close to reality but nevertheless conducted in a controlled environment. This setting facilitates discussion of the components of the case in light of the teaching objectives without the limitations that emerge in situations with actual patients. This process aimed to improve the insight of medical students developing their medical attention and to inspire them to better understand the role that must be played by a physician is helping a vulnerable person who comes to a medical setting to entrust the physician with something as personal as his or her sickness, affections, and feelings (26, 27). Simulated patients facilitate reflection on every case and can help reframe the way in which health personnel considers the patient (28).

The actors and actresses employed as part of this strategy must have the necessary experience and abilities to impersonate each patient, including all the emotions, feelings, and characteristics that each case requires in accordance with the disease and the socioeconomic situation of the character in question (3). In addition, it is important to incorporate solid direction and guidance from a person who has both experience in theatre and familiarity with the medical language. For this reason, working with people in the context of an experimental theatre group is essential to the success of simulation experiences (6, 29-31). In our case, the mixed character exhibited by the director of the La Escafandra group, who was both an actor and a physician, was a beneficial factor since it facilitated communication among medical teachers, actors, and actresses.

The role of teachers is essential since they act as guides during this process (24). They must create a safe environment and help the students become involved in the simulated activity by establishing a proper learning setting in which the students feel confident to ask questions and

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engage in an open discussion. One of the main questions that emerge in this context refers to the moment in which it becomes necessary for the students to know whether they are working with a simulated patient. This moment depends on the goal of the specific practice. Occasionally, the students appreciate not knowing that the patient is simulated because this lack of knowledge helps them act in an appropriate manner for the situation at hand. At other times, it is preferable for the students to know this fact because it is necessary for the students to be more relaxed, which is helpful for encouraging them to ask questions and discuss dilemmas. This decision is entirely the responsibility of the teacher, but performance quality is an essential factor in making this choice, as became evident in our experience.

| Area | Subarea | Number of cases | | | | | | |
|-------------------|----------------|-----------------------------|------|--------------------------|------|------------------|---------------|-------|
| | | Without accompanying person | | With accompanying person | | Total by subarea | Total by area | Total |
| | | n | % | n | % | | | |
| Semiology | Cardiovascular | 51 | 82,3 | 11 | 17,7 | 62 | 142 | 537 |
| | Digestive | 20 | 83,3 | 4 | 16,7 | 24 | | |
| | Respiratory | 12 | 92,3 | 1 | 7,7 | 13 | | |
| | Neurological | 35 | 81,4 | 8 | 18,6 | 43 | | |
| Psychiatry | | 20 | 62,5 | 12 | 37,5 | 32 | | |
| Gynecology | | 121 | 84,6 | 22 | 15,4 | 143 | | |
| Forensic Medicine | | 42 | 97,7 | 1 | 2,3 | 43 | | |
| Internal Medicine | | 57 | 81,4 | 13 | 18,6 | 70 | | |

| | | | | | |
|-------------------------|----|-------|----|-------|----|
| Surgery | 10 | 100,0 | 0 | 0,0 | 10 |
| Orthopedics | 10 | 100,0 | 0 | 0,0 | 10 |
| Family Medicine | 33 | 66,0 | 17 | 34,0 | 50 |
| Pediatrics | 8 | 80,0 | 2 | 20,0 | 10 |
| Clinical pharmacology | 10 | 50,0 | 10 | 50,0 | 20 |
| Rehabilitation Medicine | 0 | 0,0 | 7 | 100,0 | 7 |

Table 1. Summary of medical appointments simulated, for every subject area and sub-area between October 2020 and May 2022.

The students value the possibility of learning in a safe setting in which their errors have no consequences for an actual patient. Furthermore, this approach offers them the possibility of reviewing the scene with their teachers to determine where they may have made mistakes, what questions were not asked, what symptoms were ignored, and ways of correcting their wrong actions. Simultaneously, in this context, it is possible to discuss humanity and empathy, which are elements that are not easy to address when interacting with actual patients.

Simulated patients can be helpful in all areas of clinical sciences (4, 12, 13, 15, 16, 25), as shown by our experience. However, each area has its own particularities, which must be identified beforehand through discussions with teachers and the review of curricular objectives. Furthermore, the ability of the group to simulate different situations, even collective situations, is essential to provide practical tools for each clinical subject. For instance, Family Medicine requires simulation of home visits (32) to teach and discuss the correct approach to take in family settings, while

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Prehospital Medicine and Reanimation require the recreation of disasters (16) to teach and discuss ways of dealing with situations requiring triage and first aid.

| Scenario | Description | Number of actors | Number of repetitions | Area |
|----------------|--------------------------------------------------------------------------------------------------------------------|------------------|-----------------------|-----------------------------------------|
| Bomb explosion | A bomb explosion in a bathroom at a commercial mall, with a dead person and different grades of affection or risk. | 14 | 1 | Basic Reanimation and First Aid Course. |
| Massive Attack | Attack with fire guns at a nightclub, with a dead person. | 16 | 2 | Basic Reanimation and First Aid Course. |
| Air Crash | An air crash was recreated in an open space, with all the passengers affected, and even a dead person | 16 | 2 | Basic Reanimation and First Aid Course. |

| | | | | |
|---------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------|----|-----------------------------------------|
| Traffic crash | A motorcyclist, who suffered a traffic crash, with a brain death diagnosis and typical family conflicts about organ donation. | 6 | 1 | Continuing education on organ donation. |
| Home visit | Family environment with different situations around a chronic patient with high cardiovascular risk. | Between 3 and 5 | 12 | Family Medicine course. |

Table 2. Summary of the complete simulated environment between October 2022 and May 2022.

In summary, simulation with actors is an excellent way of developing efficient training for students and allowing them to acquire communicative, human, and medical competencies. Furthermore, this methodology may increase empathy toward the patients due to the simulation's high degree of fidelity to real-life experiences.

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Figure 1. Photographic records of some of the simulation activities with actors.

Conclusions

Simulation with actors is an efficient tool for the integral formation of health professionals since it can facilitate a holistic patient vision. Simulated actors cannot replace actual patients, and programs of this sort do not pretend to do so. The main goal of a program based on simulation with actors is to contribute to medical teaching in all areas by offering an experimental setting in which the

students can learn from their mistakes and reflect on them, thus allowing them to explore various alternatives in a controlled environment with the guidance of their teachers. This strategy helps improve student-centered medical learning and thereby improves patient security and reduces medical mistakes. However, studies should be carried out to explore the effects of the strategy on the learning processes in medical students using qualitative and quantitative measurement instruments. Our experience may help improve medical education in the Faculty of Health at Universidad Tecnológica de Pereira.

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2

**CHAPTER
TWO**

Implementation of a flipped classroom methodology in the medical physiology course in the Faculty of Health Sciences

Implementación de una metodología de aula invertida en la asignatura de Fisiología Médica en la Facultad de Ciencias de la Salud

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Abstract

Physiology is a subject that is considered difficult; it is associated with academic failure and causes high levels of stress and anxiety in students. Alternative strategies have emerged with an emphasis on cooperative and active learning. The role of the educator needs to be reoriented from a lecture-based methodology in the classroom to a more interactive role with the students. The flipped classroom is an innovative strategy that can be used to transform courses to enhance motivation in students. Therefore, in this study, we report the experience of implementing a flipped classroom methodology in medical physiology courses in the Faculty of Health Sciences. Twenty-nine students were enrolled in the study during the first semester of 2019. The subjects considered were gastrointestinal and renal physiology, which were divided into 14 main topics. The bibliography was delivered to the students, and a time-limited daily challenge was proposed to stimulate permanent learning of the topics. A score-based ranking was designed to strengthen the students' sense of competition and to accomplish the challenge of achieving additional points to the course score. The challenges included crosswords, word searches, question-and-answer games, artistic creations, quizzes, and others, which were designed for each topic reviewed. The students' perceptions of the flipped methodology were positive; nevertheless, students reinforced the idea that traditional lecture-based methodology was relevant for specific topics and, therefore, must remain in the structure of the course, mixed with the flipped activities. Their motivation was consistent due to the daily review of the concepts and mechanisms with the teachers. A negative perception was that time was insufficient to complete the challenges correctly. From the teachers' perspective, it was difficult to design a different challenge for each day, which made the process challenging and time-consuming. In addition, the use of multimedia to maintain the attention of the students was demanding. In conclusion, the flipped classroom methodology is a demanding but

effective strategy that can be combined with traditional lectures to achieve a more stimulating course, especially in medical physiology courses, to decrease the dropout and failure of students.

Keywords: medical physiology, flipped teaching, implementation, medical students.

Resumen

La fisiología es una asignatura que se considera difícil y está asociada con el fracaso académico, ya que provoca altos niveles de estrés y ansiedad en los estudiantes. Han emergido estrategias alternativas con énfasis en aprendizaje activo y cooperativo, y el rol del educador ha sido reorientado a un rol más interactivo con los estudiantes, más allá de la metodología basada en la clase magistral en el aula. El aula invertida es una estrategia innovadora que puede ser usada para transformar las asignaturas y potenciar la motivación de los estudiantes. En este estudio se reporta la experiencia en la implementación de una metodología de aula invertida en el curso de fisiología médica en la Facultad de Ciencias de la Salud. 29 estudiantes fueron incluidos en el estudio durante el primer semestre de 2019. Los temas considerados fueron fisiología gastrointestinal y renal, divididos en 14 subtemas principales. A los estudiantes se le entregó la bibliografía al inicio del curso y un reto diario con tiempo límite fue propuesto para estimular la revisión permanente de los temas. Una escala basada en puntos fue diseñada para fortalecer en los estudiantes la competencia y el cumplimiento de los retos con el fin de lograr puntos adicionales para la nota final del curso. Los retos incluían crucigramas, sopas de letras, juegos de preguntas y respuestas, creaciones artísticas, exámenes cortos y otros, diseñados para cada tema revisado. Las percepciones de los estudiantes de la metodología invertida fueron positivas; sin embargo, ellos reforzaron la idea de

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que la metodología tradicional basada en clases magistrales era relevante para algunos temas específicos y por ello debería continuar en la estructura del curso mezcladas con las actividades de aula invertida. La motivación de ellos fue constante debido a la confrontación diaria con los conceptos y los mecanismos revisados con los docentes. Una percepción negativa fue que el tiempo era insuficiente para responder apropiadamente a los retos planteados. Desde la perspectiva de los docentes, fue difícil el diseño para cada día de los diferentes retos y fue demandante el uso de la multimedia para mantener la atención de los estudiantes. En conclusión, la metodología del aula invertida es una estrategia demandante pero efectiva, que puede ser combinada con clases magistrales para lograr un curso más estimulante, especialmente en los cursos de fisiología médica, en los cuales puede ayudar a disminuir la deserción y el fracaso estudiantil.

Palabras Clave: fisiología médica, enseñanza invertida, implementación, estudiantes de medicina.

Introduction

Physiology is a fundamental subject for all health sciences since it is a basis of biological knowledge in continuous development (1). For that reason, physiology represents a challenge to educators, who need to make an effort to effectively communicate this extensive and complex content to students and contribute to their commitment to the learning process, which is necessary to promote critical thinking and self-directed learning skills (2).

For these reasons, physiology courses are challenging, and thus they are associated with high levels of withdrawal and failure. In our medical school, physiology students have high rates of failure and repetition, leading to student frustration and loss of motivation which increase student dropout (3). In such a framework, it is a challenge to better understand the learning-teaching process as regards physiology and propose different methodologies that focus on students' active engagement to improve academic performance and motivation (4).

Traditional lectures continue to be the predominant instructional strategy for teaching physiology. However, this methodology has several issues: Students' attention diminishes quickly, they frequently feel disconnected, and the lecture rhythm cannot be individualized (5). Fortunately, options available to approach teaching and learning have evolved thanks to recent advances in technology, allowing teachers and students to find methods that suit their abilities and time availability. These innovative methods engage students more efficiently and allow them to optimize their time with teachers, who have greater resources for personalizing knowledge acquisition in their students (6). These features are essential, particularly in physiology, because learning in this area requires an evolution in reasoning, from more concrete to considerably abstract thinking, which is facilitated by more participative methods (7).

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A flipped classroom approach occurs when students prepare the respective topics using several pedagogical tools before class. In contrast, encounters with teachers are employed to discuss and solve the most critical issues. There is substantial interest in the flipped format in science teaching, particularly in fields with high levels of difficulty in learning, such as physiology (6). Moreover, there is a growing interest in the implementation of cooperative learning, which consists of students working together in groups to reach their learning goals through discussion and peer feedback under teacher supervision; students involved in cooperative learning show greater effort and sustained motivation to achieve their goals, in comparison to students trying to learn on their own. Cooperative learning could be incorporated into the flipped classroom methodology by encouraging students to form teams and by assigning homework to complete in groups (8).

Another essential component to consider is the incorporation of ludic methodologies since they may help students learn in a less hostile environment. Playing while learning can help students better understand concepts and create bonds between classmates, reinforcing cooperative learning in a fun environment. This project aimed to implement a flipped classroom methodology in a medical physiology course and explore students' perceptions of the process.

Methods

Subjects

The participants were all second-year medical students enrolled in the Medical Physiology course in the first semester of 2019 who agreed to participate. All of the students agreed to the implementation of the methodology and signed informed consent forms. Twenty-nine students were enrolled in the study.

General methodology

The methodology was focused on cooperative learning. The content was divided into 14 topics. For each topic, a 20- to 30-slide presentation was designed by the teachers, and a short review article about a relevant topic was selected from a high-quality journal. These materials were delivered to the students before the course began, and each topic was assigned to a specific scheduled date that students knew before the beginning of the study. The students were instructed to review the materials and the additional readings from the bibliography for further discussion with others before the assigned date. The students were encouraged to form teams during the 3-hour session in each class. Each team discussed the related topic and asked all of their questions to the teachers, who guided the discussions. The general structure of the methodology employed is summarized in Figure 1.

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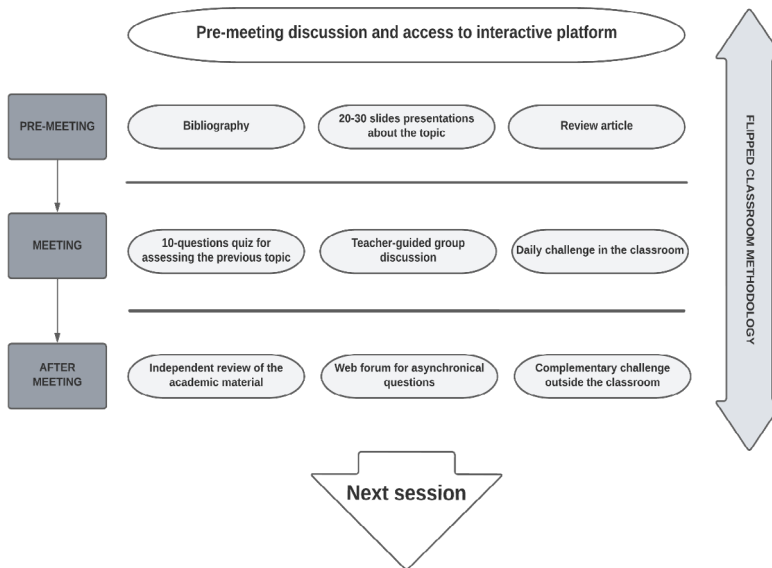


Figure 1. Structure of a flipped classroom session and description of the activities performed in each phase.

Score-based ranking

The scores obtained in each challenge or assignment inside or outside of the classroom were used to create a ranking among the group of students, and at the end of the course, the ten students with the highest scores obtained extra points in the final exam as a reward.

Games in the classroom

At the end of each session, the students were assigned an activity to assess their knowledge and facilitate complementary learning about the specific topic. The assignments involved games such as crosswords, word searches, and question and answer games that allowed all students to participate in the process in a ludic way. The crosswords and word searches were designed with clues describing the definition of relevant concepts to find a specific term or word to fill the spaces in the crosswords or to search in a group of letters organized in a frame. The "head and tail game" was the most used question-and-answer game modality, in which two-student teams answered emerging questions that allowed them to gain a rank-order position, which was initially determined by randomness. When a team failed to answer a question, they passed to the next position, and all the other teams consequently moved. Ultimately, only the first three positions obtained scores for the ranking. Other modalities employed included asking questions to eliminate those who did not answer correctly until three people remained, who were then assigned scores for the ranking. All of these activities were time-limited to enhance competition and strengthen the need to review the topic carefully to achieve better scores.

Quizzes

Every day, the students were assigned a quiz on the topic developed on the previous day. The quizzes were designed according to the day's topic and consisted of ten five-response multiple-choice questions. They were uploaded to the free game-based learning platform *Kahoot!* The platform's opening was time-limited and involved questions about the topic discussed in the classroom the day before. The first three scores gave punctuation for the ranking.

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Virtual communication

At all times, a virtual platform was available for the students to communicate with their teachers and classmates. They could use the platform to formulate questions, write reflections or express opinions about the different topics, which could be commented on or answered by everyone, particularly the teachers, although comments from classmates were welcomed and encouraged. This platform was freely accessible to all participants but restricted to them only, based on the freely available *Edmodo* platform. It consists of a very friendly environment, similar to other social networking sites, which are commonly used by young adults.

Challenges

A challenge related to the day's topic was posed to the students to be solved voluntarily outside the classroom after the daily encounter. These challenges involved interpretation of the literature, information searches about a related subject, development of a historical perspective, literary interpretations of physiological concepts, or completion of specific exercises that had to be answered in a limited amount of time. Additionally, artistic challenges were employed, which involved creating a novel-like history explaining a physiological process, comic-based storytelling, or drawings explaining a physiological route. All these challenges were time-limited with an asynchronous assessment. The three best scores in each daily challenge were included in the rankings.

Students' opinions

An instrument was designed to collect the participants' opinions about the main aspects included in the flipped classroom methodology, which included the following two open-ended questions:

1. What are your opinions (positive and negative) about all aspects of the flipped classroom methodology?
2. Do you have any suggestions?

Qualitative analysis

All of the qualitative information provided by the students was analyzed employing grounded theory. All of the information was processed by extracting the emerging themes and identifying categories based on the information supplied. This analysis was performed in Spanish first, and then the condensed information was translated into English.

Results and discussion

This study implemented a flipped-classroom methodology as a new approach in a gastrointestinal and renal physiology course. It assessed the students' perception of this scheme focused on cooperative ludic learning. A comparison with the traditional method is shown in Figure 2. This method has been more effective in helping students apprehend physiology, and one of the reasons for this performance is the interest in self-learning that this method triggers. At the same time, this methodology allows students to understand their own rhythms of learning and make changes in their individual processes accordingly while including a variety of aspects involved in active learning (9).

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One of the tools of this approach is access to a virtual platform that allows students to communicate and interact with teachers and peers, which helps them learn more effectively. In addition, students had previous contact with the academic material before the encounter with the teacher, which leads to a better understanding and more motivation with a better attitude toward learning. Therefore, for this method, adequate previous preparation is vital, as is an active process that leaves the teacher in the role of facilitator and lets students be more involved in the process by constructing opinions and raising questions concerning core concepts based on previous reviews of the available information (10).

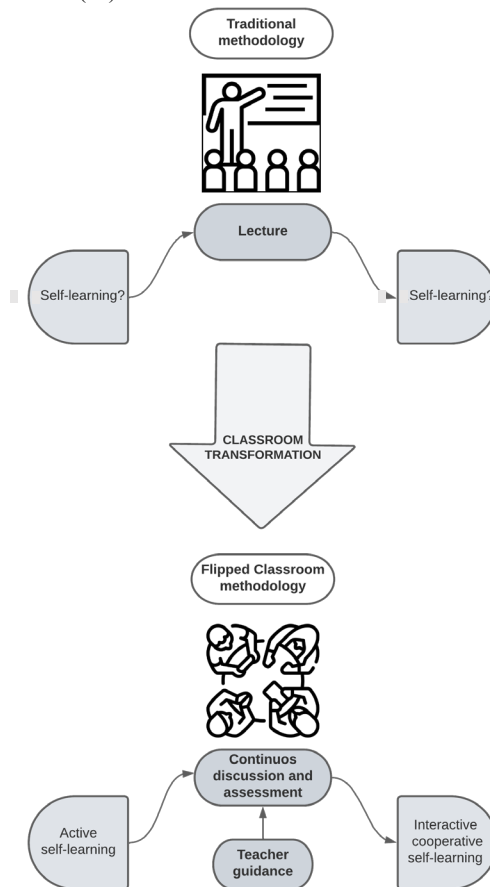


Figure 2. Comparison between the structures of the traditional methodology vs. flipped classroom methodology.

The inclusion of ludic activities makes the learning process more enjoyable. It contributes to the development of creativity in the students involved, which helps to improve communication and appreciation of learning (11). Discovering that academic activities may also be enjoyable is important for students. It contributes to their engagement in the process and facilitates interaction with their teachers.

The answers of the students through the open qualitative assessment were grouped according to three emergent topics: methodology, evaluation, activities, and challenges. Additionally, three dimensions were identified within each topic: negative opinions, positive opinions, and recommendations.

Regarding methodology, the students had positive views of the flipped classroom approach. They thought that it drove them to be active subjects by reading and informing themselves about the themes in advance. One student said, “The opportunity to develop the subjects every day allows us to build better knowledge and develop more solid concepts.” The students confirmed that the flipped classroom perspective trained them to manage their study time more efficiently and that, through that process, they acquired a higher level of understanding of the subject. In addition, they described the methodology as “demanding, creative, participative, and motivating.” One of the students expressed that “the methodology was very effective, encouraging the student and contributing to her or his independence.” This observation reaffirms the personalized aspect of the methodology, which motivates students to become active participants responsible for their own learning. Another positive opinion regarded the papers and bibliographic material employed, these were assessed as “current, interesting, useful, and appropriate”.

The negative opinions referred mainly to the inadequate amount of time available for some of the topics. One of the students mentioned, “the time we had for some of the most extensive topics, did not allow us to work on it properly”. Additionally, some students expressed that it was impossible to include all the topics in the period assigned and recommended not to exclude traditional lectures from the methodology because they considered these classes necessary, especially for some specific topics. The main suggestion was to have a class in which the teacher focuses on correcting mistakes, clarifying doubts, and avoiding incorrect interpretations of standard texts.

With respect to the evaluation system, the favorable opinions expressed in the evaluations noted that the daily short exams made the students invest more time reviewing the topics before the sessions with the teacher. In addition, they thought that the continuous evaluations promoted continuous study, which was beneficial to the process. One of the students explained that “the exams make it necessary to study all the themes daily”, and another expressed that “daily evaluations obligate students to be studying all the time to have all the topics fresh and updated” (5). Regarding the negative opinions, the students highlighted the short time available to complete the exams and the sense of competition that emerged among students to obtain better scores, which generated a negative environment and teacher subjectivity in some evaluations.

According to the students, the new activities and challenges contributed to a different and exciting environment to learn physiology and promoted teamwork through the stimulation of collaborative learning, which broke the routine (12). The students commented that “all the activities and challenges were nice and interactive.”

A negative aspect was concerned with the short time available to participate in the activities and challenges, which led to the students not solving some of the challenges. In addition, some

students said that the challenges were too many in number and too complex, requiring a long time to be completed, which did not allow students to adequately prepare the topics for the next day. It is worth noting that only an average of 40% of students performed the voluntary challenges, which can be attributed to a lack of time, according to the students (9).

Our experience with the flipped classroom is similar to other studies that explored such methodology. In a study by Rathner and Schier, students reported satisfaction with the flipped classroom in a physiology course. They enjoyed their level of responsibility, daily challenges, and ludic activities (13). However, they complained about the amount of content to review. Despite the generally good reviews received in that study, it was also reported that the level of participation in the different ludic proposals was low. Our study had similar outcomes, with some students complaining about the amount of content, others about the competitive nature of the challenges, and several students avoiding participating at all in the daily optional ludic activities.

Traditional methods have been the canonical strategy for achieving higher education learning goals. Nevertheless, the spotlight on technology and emerging tools for using multimedia in daily activities have forged a different type of prospective student (14, 15). Goal-oriented motivation is the central element of current prospective students, not personal success or the financial goal of a professional career. Additionally, these students have grown in an environment of multimedia and unlimited access to information in a broad, diverse fashion (16). Therefore, traditional methodology (lecture-based classes) can be perceived as "plain" and "dull," especially when there is no invitation from the teacher/lecturer to the student to explore and apprehend knowledge through different methods (2, 9).

Cooperative learning is not just an update on the strategies that students have explored to acquire knowledge and surpass academic challenges. It represents a profound change in the way in which the dynamics of a class need to be conceived (15). Moreover, education stakeholders must

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begin recognizing and incorporating cooperative learning and other pedagogical strategies to make the transition from traditional methods to multimedia-active-based learning modes. In our experience, accessing different types of multimedia resources with enough time to read and generate questions about the topic could be a strategy to adapt the content to our current prospective students. Additionally, the types of challenges, including games and artistic approaches to biomedical concepts, enhance the excitement of the cognitive process, thus achieving an experience of meaningful learning and active participation (17).

The transition from a traditional lecture-based methodology was a demanding experience for the teachers of the physiology course because this process required much time and dedication, even more than the traditional methodology (18). In contrast, the design of a daily challenge met the criteria to maintain the balance between the academic concepts and the innovative mark of the activity. This challenging experience probably constrains some educators from assuming the transformation of their classroom, especially where developing all these different types of activities with an exciting and stimulating approach requires a variety of skills in technology, visual media, arts, and other expertise areas that are not always supported by universities (19).

The flipped classroom methodology addresses the classroom as a meaningful scenario for discussion and allows access to core concepts through a dialog with the lecturer, not just through passively receiving information (20). Therefore, it is necessary to confront the paradigm that knowledge related to physiology and other biomedical sciences cannot be transferred in a ludic and alternative way (13). That is not only possible but also necessary, albeit challenging and demanding.

Nevertheless, future prospective students will be more demanding of innovative skills and activities from their teachers, especially for those subjects that convey complex cognitive demands,

such as physiology. This is particularly relevant for future prospective teachers who expect to manage medical and other science-related careers.

Conclusions

This experience is an opportunity to be attached to the curricular renewal in the learning-teaching process in biomedical sciences. This is a long-lasting discussion due to administrative barriers and educators' fears of the need for innovation. Although the strategy was well-received and had a high impact, it requires adaptations. The challenge is to expand this methodology to other modules of the medical physiology course.

This methodology opens the discussion about the abilities and skills that an educator requires to develop an active and cooperative learning class. Additionally, these results highlight the need for training teachers in the employment of audiovisual and digital tools. It also helps to emphasize the importance of solid support from institutions to achieve a meaningful experience with students. The flipped classroom methodology is a necessary tool in the renewal of pedagogical approaches in biomedical sciences, with the ultimate goal of stopping motivational drop-off and decreasing student dropout and failure by guaranteeing a more assertive educational process.

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3

**CHAPTER
THREE**

SANAR RIENDO (HEALING LAUGHTER): humor therapy for pediatric hospitalized patients

SANAR RIENDO: terapia del humor para pacientes pediátricos hospitalizados

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Andrés Felipe Ramírez Herrera³

Abstract

Mental health and well-being are essential in healing from any disease, especially in children who exhibit high sensitivity to their surroundings. Hospital environments generate uncomfortable situations for pediatric patients, and procedures and clinical situations constitute a condition that can significantly influence the clinical evolution of pediatric patients. Humor therapy performed by trained clowns has proven its effectiveness in reducing the negative impact of aggressive

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conditions in hospital environments. Clowns are able to establish an adequate level of communication with hospitalized children and allow them to channel their worries and concerns through play and playfulness, which positively influences the clinical evolution of patients. A team of actors trained in hospital clown techniques through a systematic and well-established methodology constituted the intervention group of the Sanar Riendo (Healing Laughter) program. The Sanar Riendo program was established in 2010 at the Hospital Universitario San Jorge and has been utilized at this institution intermittently since then, with interruptions due to administrative situations not dependent on the program. Activities were also carried out at the San Rafael Clinic in 2021 and at the Comfamiliar Clinic in 2022. During this time, 1,220 patients and their families were impacted, in addition to the hospital environment. The program's reception has been excellent in the institutions in which it has been implemented and has allowed research to be carried out to demonstrate its factual effects on patients. The program has positively influenced the children, their relatives, and the health personnel and has achieved a significant presence in the affiliated institutions. Hopefully, this program will continue, and health institutions will incorporate it as part of their permanent programs to benefit pediatric patients and contribute to humanizing health care.

Keywords: humor therapy, clowns, pediatrics.

Resumen

La salud mental es fundamental en la evolución de cualquier enfermedad, especialmente en niños, quienes exhiben una elevada sensibilidad al entorno. Los ambientes hospitalarios generan situaciones agresivas para los pacientes pediátricos y los procedimientos y situaciones clínicas constituyen una condición que pueden influir significativamente en la evolución clínica de los

pacientes pediátricos. La terapia del humor realizada por payasos entrenados ha demostrado su efectividad para reducir el impacto negativo de los condicionantes agresivos en ambientes hospitalarios, pues los clowns logran establecer un nivel de comunicación efectivo con los niños hospitalizados y permiten canalizar sus preocupaciones e inquietudes a través del juego y la lúdica, lo cual influye positivamente en la evolución clínica de los pacientes. Un equipo de actores entrenados en técnicas de clown hospitalario, a través de una metodología sistemática y bien establecida, constituye el grupo de intervención del programa Sanar Riendo. El programa Sanar Riendo fue establecido desde el año 2010 en el hospital Universitario San Jorge de Pereira y ha estado presente en esta institución en forma intermitente desde ese momento, con interrupciones por situaciones administrativas no dependientes del programa. En 2021 también realizó actividades en la Clínica San Rafael y en 2022 en la Clínica Comfamiliar. Durante este tiempo se han impactado 1220 pacientes y sus familiares, además del entorno hospitalario. La recepción del programa ha sido excelente en las instituciones en las cuales se ha implementado y ha permitido realizar investigación para demostrar sus efectos reales en los pacientes. Los niños, sus familiares y el personal de salud han sido influidos positivamente por el programa y este ha logrado tener una presencia importante y significativa en las instituciones correspondientes. Se espera continuar con este programa y lograr que las instituciones de salud lo incorporen como parte de sus programas permanentes para beneficio de los pacientes pediátricos y para contribuir al proceso de humanización de la atención en salud.

Palabras clave: terapia del humor, payasos, pediatría.

Introduction

Mental health is closely related to the pathophysiological processes of many diseases, and the influence of elements such as the attitude toward the disease and its treatment, the family and social environment in the evolution of diseases, and the response to treatments is established. Mental processes regulate the immune response. Furthermore, affection, well-being, and self-confidence can be important determinants of the individual's response to the disease and, therefore, can be critical in the recovery process and treatment, a situation still more marked in the pediatric population (1, 2).

A hospital is a hostile and stressful environment for the patient, an additional burden to that generated by the disease itself. In the pediatric population, this situation is magnified because the stressful environment becomes much more remarkable, which is explained by the fear of physical pain, procedures, unknown people, and separation from home (3). This aggressive surrounding is worsened by the absence of adequate spaces and an empathetic and playful environment necessary for the development and expression of the child (4, 5). Seventy-eight percent of hospitalized pediatric patients had anxiety, and 71-81.6% had preoperative anxiety (6-8). Anxiety is associated with the intensity and frequency of postoperative pain and complications such as anemia, myocardial infarction, acute renal failure, and infections due to immunosuppression (9). Stress triggered by levels of anxiety and pain increases cortisol secretion, which favors proinflammatory states and is associated with worse outcomes in patients, such as more extended stays and mortality (10, 11). Children's hospitalization has been associated with failure to achieve growth and development goals (4). Postoperative pediatric evaluation has shown that approximately 50% of children undergoing surgical procedures may present nightmares, separation anxiety, feeding problems, and increased fear of doctors. These situations constitute barriers to the care of the child

by health personnel, requiring immobilization and sedation measures that further increase stress (12).

Humor and laughter have been integral components of the development of humanity; humor has been analyzed and discussed for centuries in philosophical, anthropological, and psychological contexts (13). Freud defined humor as a means by which the individual can unconsciously release sexual and aggressive impulses, allowing the release of "psychic energy" and generating pleasure (14). Dixon stated that humor is the means that human beings use to be able to face situations that scare them, such as death or mourning, because by facing these situations with humor, the individual gains control over them, making them less severe (15). In other words, humor is a valuable means to face unpleasant situations for the individual and allows him to channel them toward the generation of well-being and his adaptation to the social environment (16, 17). The psychological function of humor, however, continues to be a source of controversy, although all theories agree that humor plays a fundamental role in the development of the individual from childhood (18).

Humor is a highly complex phenomenon involving intimately interrelated sensory, cognitive, emotional, and expressive elements, making it very difficult to define or measure (19). According to Fry, the essential elements in the humor process are the stimulus (a particular situation, a movie, a song), the emotional response (the subjective sensation of being amused by the stimulus), and the resulting behavior (for example, smiling, laughing aloud or simply expressing a better state of mind), all of which are associated with a pleasant subjective sensation (20). Each of these elements involves various physiological processes that have only begun to receive attention in recent years. However, most of these studies have focused on humor-stimulated laughter, which is only one of its components. It generates a feeling of internal well-being and has noticeable beneficial systemic effects. Neurological studies agree that responses to humor, involve

various areas in the frontal and temporal cortex and that the nondominant hemisphere is necessary for adequate perception of humor (21-23).

People with good humor get sick less often. Many specific pathologies, such as cardiovascular diseases, are more frequent in individuals without a sense of humor and who laugh very little in their daily lives (24). Since the time of Galen, the association between certain diseases, such as cancer, and "melancholic" personalities has been reported (25).

Humor is associated with immune system activation, since laughter increases killer lymphocyte activity and immunoglobulin levels (26-29). Individuals subjected to a humorous experience show remarkable physiological changes compared to those who have not been exposed. These changes are more pronounced in those who laugh more frequently and subjectively feel more amused. Laughing also produces beneficial systemic effects (30), such as muscle relaxation (20), increased oxygen saturation in peripheral blood (31), decreased postprandial glycemia (32), and multiple cardiovascular benefits (33).

Humor as a therapeutic experience has been used for five centuries. An ancient Chinese proverb says that every person has to laugh thirty times a day to be healthy. The French doctor and writer Rabelais is recognized as the first to use laughter therapy systematically on his patients and to report its great benefits. Henri de Mondeville, a famous medieval surgeon, pointed out joy as a fundamental element in the recovery of patients. Jesters in medieval times came to be considered true healers, and famous doctors always had a bedside jester to help them treat their patients. The therapeutic value of humor and laughter is recognized in all cultures and latitudes (34).

Dr. Adams's experience with laughter therapy and his Gesundheit Institute (35) is probably the best known worldwide after his story was made into a film. He and his work group have shown that making patients laugh and feel good is fundamental in treating any disease. Unfortunately, there are no scientific publications documenting the effects of Dr. Adams' experience, but the

testimonials over 30 years of work using laughter therapy as a strategy are widely known. In many hospitals worldwide, humor therapy is a common practice (36-40). Several scientific journals are dedicated exclusively to this topic, such as *Humor*, *Humor and Health Journal*, and *Journal of Nursing Jocularly*. Entities such as the Humor Project (The Humor Project Inc.) and the Association for Therapeutic Humor (AATH) promote humor as a therapy worldwide in hospitals and universities and hold regular congresses and conferences on the subject.

Similar experiences have also been carried out in our country. In Bogotá, the Doctora Clown Foundation has worked with laughter therapy in hospitalized patients in several institutions with good results, according to testimonies from health personnel and the directives of the hospitals in which they have intervened (41, 42). An intervention led by this group was reported to be effective in reducing biological and self-perceived stress in anesthetic induction (43), although most of their experience has remained testimonial. Other experiences have also been reported in Bogotá and other cities in the country (44). Again, most of these processes have not been scientifically documented, and their effects have not been systematically evaluated.

Humor therapy has been evaluated in different hospital settings, and there is accumulated evidence of its positive effects on patients' stress, anxiety, and pain levels. In addition, it has been a benchmark as a strategy to humanize health care (45). Humor therapy interventions improve mood, decrease pain, and reduce clinical complications (41). Furthermore, it has been reported to be positive for patients (46). It is associated with increased creativity, self-esteem, resilience, a decrease in negative thoughts and anxiety levels, and the attenuation of adverse immunological and hormonal events by regulating epinephrine and cortisol secretion. There is evidence of the need for health service providers to have a team of hospital clowns to accompany pediatric patients in procedures that generate fear, pain, or prolonged stays that increase the risk of complications, pain,

and stress. In addition, the impact on pain perception through a nonpharmacological intervention such as humor therapy is similar to that of topical analgesic treatments (47).

Children have been one of the populations with the best evidence of the effects of humor therapy (48, 49). There are reports of successful experiences of using humor therapy in hospitalized children (4, 48, 50-54). The incorporation of humor therapy as a strategy to address and care for patients by health personnel has been encouraged in various contexts (38, 40, 44, 54, 55). However, there is a lack of willingness and awareness about the importance of incorporating a humor therapy team into the therapeutic process in health institutions. Humor has also been used to prepare children for hospitalization since it reduces the stress that this situation generates and the complications that could arise from this condition (56). Patients who were treated with humor therapy showed favorable results due to decreased cortisol levels compared to patients who were not treated (57). The evidence suggests that humor can reduce anxiety, pain, and crying during painful procedures and is equivalent to using analgesics (58). That fact demarcates humor therapy as a strategy that must be implemented and evaluated in different clinical scenarios to enhance its inclusion in health institutions. This evidence supports the use of humor therapy to reduce pain and complications associated with stress in pediatric patients (59). The cost-effectiveness of this strategy should be considered in comparison with the consumption of analgesics. The effect of humor on the stress and anxiety of health personnel and hospital complications are variables for assertive decision-making by the administration of institutions.

Apart from the experience of reducing cortisol levels through mood therapy interventions, there is also evidence that these strategies increase oxytocin levels in hospitalized pediatric patients and those undergoing surgical procedures (60). Oxytocin is a mediator of well-being and empathy, which suggests a positive effect of humor therapy interventions not only as a factor for reducing stress and anxiety but also as an increase in well-being (61, 62). In Israel, they compared the

effectiveness of a humor therapy intervention versus the administration of a local anesthetic as a strategy for reducing pain during peripheral venipuncture, finding that although the local anesthetic reduced pain more, the intervention with hospital clowns further reduced anxiety levels and crying time (52).

Our group demonstrated humor therapy's effectiveness in reducing biological and self-perceived stress levels in the pediatric hospital population (57). Other experiences reported in Colombia demonstrate mood therapy's effectiveness in preanesthetic induction to reduce stress and anxiety (43). Since the interventions, learning, and examples that occur in early childhood will modify the adaptive responses in adulthood, humor therapy in hospitalized pediatric patients is an essential benefit for this population. These programs will increase the well-being of patients and reduce the hostile perception of the hospital environment, resulting in a more favorable clinical evolution and optimizing the use of the resources of the health institutions involved.

For this reason, it is necessary to implement and validate this kind of cost-effective strategy that reduces anxiety and pain levels in hospitals. The project HEALING LAUGHTER (SANAR RIENDO) implemented a humor therapy program for children in Pereira. The objectives were to improve the patient's well-being, reduce the negative impacts of procedures and hospitalization, reduce the frequency of postoperative complications, reduce the time spent performing painful procedures, and reduce the burden on the health care team, thus improving pediatric patient care.

Methods

The intervention group was composed of people trained in humor therapy with the tools and skills necessary for the intervention, which were acquired through specific training workshops in clown techniques. Furthermore, all the intervention group members had training in biosafety,

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humanization of care in health, and management of hospitalized patients according to their pathology. A physician who is also a trained clown directed the process of formation. The intervention group was composed of members of La Escafandra Teatro group from the Universidad Tecnológica of Pereira, which has extensive experience in interventions with clown techniques, theatrical techniques, and recreation.

Interventions with humor therapy are carried out in an itinerant way with a group of characters known as clowns, who have various strategies to establish playful communication with children, such as personalized recreation, puppets, bubbles, balloon twisting, children's rounds, music, painting, dance, and magic, among others. Each character is built from each actor's individuality, applying specific techniques that include a complete characterization with specific costumes and makeup, which will arise from experience and individual exploration directed toward the emergence of the clown. The clowns arrived at the pediatric hospitalization room. They went through the different areas of it, proposing a game and interacting with all the people they met along the way: patients, companions, service personnel, and health personnel, but focusing on children.

The strategies that clowns employ are always open to improvisation and adaptation to the actions of the others with whom they play, thus allowing the clown to enter the world that the child proposes. The clown characters establish interactions by respecting patient individuality and paying attention to the particular conditions of each one, thus achieving personalized communication and allowing a trusting relationship.

HUMOR THERAPY INTERVENTION STEPS

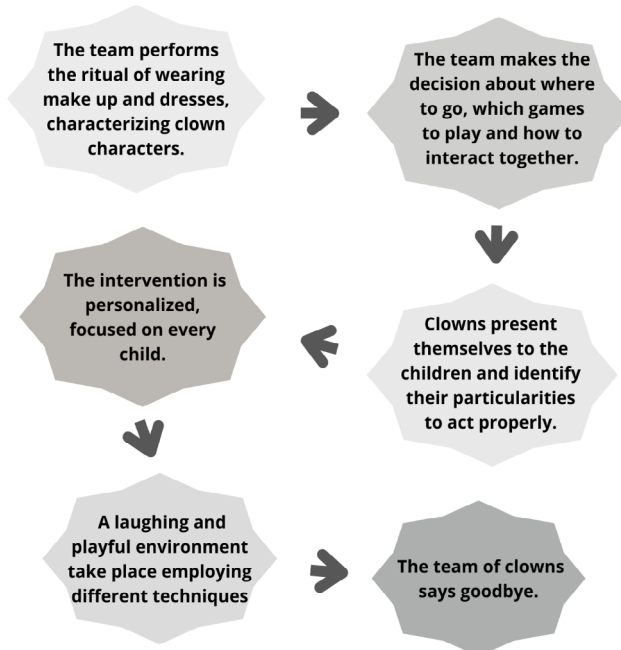


Figure 1. Steps to follow in each humor therapy intervention.

The members of the intervention group must conduct a review and preliminary analysis of the clinical history of each patient, consult with the health personnel about the pathologies of each

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patient and interview family members and companions to consider particular conditions at the time of the intervention.

The interventions were carried out on the days agreed upon by the institution's staff. Each intervention, with at least four clowns present, had a duration of 2 to 3 hours, which depended on the dynamics developed during each day. The group always took all necessary biosecurity measures to avoid putting at risk patients and other people involved.



Figure 2. Photographic records of some of the humor therapy interventions.

Results and discussion

The program has been held in the pediatric wards of three health institutions in Pereira. Most of the experience occurred in the Hospital Universitario San Jorge during different periods in the last ten years (February 2010 to October 2021). During this time, different periods of interruption of the activity occurred because of administrative reasons that were not under the program's control; in that period, 166 interventions were performed involving 988 children. In Clínica San Rafael, 11 interventions were performed between September 2021 and November 2021, influencing 84 children. The third institution was Clinica Comfamiliar, where 18 interventions involving 169 children were performed between February 2022 and August 2022. In all cases, patients came from different social backgrounds and had a great diversity of pathologies since the interventions were performed without distinction among all the hospitalized children at the moment of the intervention. The only patients who were not exposed to the intervention group were those who were isolated due to his or her clinical condition related to infectious diseases. In the case of oncologic patients, specific measures were taken to ensure health security for these patients, following the indications of the health personnel. The number of accompanies was not recorded but at least one person accompanied each child in most cases.

The health personnel received the program with excellent comments and perceptions, which is evidenced by the excellent reception of the intervention group. The program has allowed researchers to assess the effect of humor therapy on different clinical outcomes; some of these results have already been published, and others are currently being performed. This research has demonstrated the favorable effect of the interventions in the pediatric population. During this time, the program's team gained experience and efficiency. The institutions have allocated the team

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adapting a physical space to allow them to wear their costumes and make-up and leave their belongings, which is evidence of the institutional commitment to the program.

During these years, children subjected to the intervention showed complacency and satisfaction, which is evidenced by the pleasant environment that clowns and children achieved during the activities performed. Children wait for the clowns every day and participate actively in all the activities proposed, without limitations because of their diseases, which is facilitated because the clowns are trained to adapt to any circumstance due to any pathology.

Conclusions

The Sanar Riendo program has significantly impacted pediatric patients in the three health institutions in which the program has been implemented, especially in the Hospital Universitario San Jorge. The intervention team has adequate training and has gained experience and efficiency during its work over the years. This program has allowed research to support the effectiveness of this kind of strategy in promoting health humanization. It is necessary to implement and validate this type of cost-effective strategy that helps to reduce anxiety and pain levels in hospitalized patients, particularly in pediatric wards.

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4

**CHAPTER
FOUR**

CPR performance characteristics of emergency teams in the city of Pereira, Colombia

Características de desempeño en RCP de los equipos de emergencia de la ciudad de Pereira, Colombia

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Abstract

Sudden Cardiorespiratory Arrest (CRP) of cardiovascular origin continues to be an important cause of mortality in the world, becoming a public health problem, not only due to deaths but also due to the sequelae present in survivors. Cardiopulmonary Resuscitation (CPR) is a strategy focused on

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the early detection of CRP and its timely management, due to this, this strategy has adhere to a set of quality parameters in order to achieve positive outcomes. In Colombia, hospital and pre-hospital emergency teams must be able to perform CPR with proficiency and ensure its quality. The objective of the study was to describe the CPR performance characteristics of the emergency teams in the city of Pereira, Colombia and to determine new quality variables of CPR maneuvers, defined by the characteristics of the participants and their performance in the proposed tests, considering the effect of fatigue.

The study was of a descriptive correlational cross-sectional type. The study population was taken as the health professionals who are part of the emergency centers of the city of Pereira, including the SEM team of the Technological University of Pereira; Demographic, anthropometric data, and professional and training profiles were taken.

Subsequently, practical real-time CPR tests were carried out on clinical simulation mannequins for 2 minutes, following the AHA 2020 protocol where compressions and ventilations were alternated at a ratio of 30: 2 for 5 cycles, and start, pause and start times were measured completion of CPR maneuvers. The Chest Compression Quality Sensor in CPR SPeCTRe was used to determine the quality of chest compressions.

No differences were found in performance between men or women, nor in relation to body size; a difference was found between the paramedics and the first responders ($p < 0.05$). With respect to the second feeding, the percentage of correct compressions decreased ($p < 0.001$). An increase in compression frequency was evidenced in the control test ($p < 0.002$) when the participants were fatigued. Consequently, the total number of compressions increases ($p < 0.001$), although not their quality, showing less depth ($p < 0.05$) and less chest retraction ($p < 0.01$).

Considering the importance of response times in the face of cardiac arrest, special care must be taken in the formation of response teams, substantially improving the scope and quality of

training, not only for medical personnel and paramedic but in addition for the communities and first responders.

Additionally, the location of CPR equipment such as an Automated external defibrillator (AED) must be considered, so that there is optimal availability in terms of distances, which can drastically change the prognosis of the victims.

Key words: cardiopulmonary resuscitation, cardiac arrest, emergency medical system

Resumen

El paro cardiorrespiratorio (PCR) súbito de origen cardiovascular continúa siendo una causa importante de mortalidad en el mundo convirtiéndose en un problema de salud pública, no solo por las defunciones, sino además por las secuelas presentes en los sobrevivientes. La reanimación cardiopulmonar (RCP) es una estrategia que está enfocada en la detección temprana del PCR y el manejo oportuno del mismo, debiendo cumplir con una serie de parámetros de calidad, para que el desenlace pueda ser positivo. En Colombia los equipos de emergencia hospitalarios y prehospitalarios deben estar en capacidad de llevar a cabo una RCP exitosa y de calidad. El objetivo del estudio fue describir las características de desempeño en RCP de los equipos de emergencia de la ciudad de Pereira, Colombia y determinar nuevas variables de calidad de las maniobras de RCP, definidas por las características de los participantes y su desempeño en las pruebas propuestas, teniendo en cuenta el efecto de la fatiga.

El estudio fue de tipo de descriptivo correlacional de corte transversal. Se tomó como población de estudio a los profesionales de la salud que hacen parte de los centros de emergencia

de la ciudad de Pereira, incluido el equipo SEM de la Universidad Tecnológica de Pereira; se tomaron datos demográficos, antropométricos y perfil profesional y de capacitación.

Posteriormente se realizaron pruebas prácticas en tiempo real de RCP en maniqués de simulación clínica por 2 minutos, siguiendo el protocolo de la AHA 2020 donde se alternan compresiones y ventilaciones a razón de 30:2 por 5 ciclos y se midieron tiempos de inicio, pausas y finalización de las maniobras de RCP. Para determinar la calidad de compresiones torácicas se utilizó el Sensor de calidad de compresiones torácicas en RCP SPeCTRe.

No se encontraron diferencias en el desempeño entre hombres o mujeres, ni tampoco en relación a la contextura; sí se encontró diferencia entre los paramédicos y los primeros respondientes ($p < 0.05$). Con respecto a la segunda toma, el porcentaje de compresiones correctas disminuyó ($p < 0,001$). Se evidenció un aumento de la frecuencia de compresión en la prueba control ($p < 0,002$), cuando los participantes estaban fatigados. En consecuencia, el número total de compresiones aumenta ($p < 0,001$), aunque no así, la calidad de las mismas, evidenciando menor profundidad ($p < 0,05$) y menos retracción del tórax ($p < 0,01$).

Teniendo en cuenta la importancia de los tiempos de respuesta frente a un paro cardíaco, se debe tener especial cuidado en la conformación de los equipos de respuesta, mejorando de manera sustancial, el alcance y la calidad de las capacitaciones, no solo del personal médico y paramédico, sino además de las comunidades y primeros respondientes.

Adicionalmente se debe tener en cuenta la ubicación de los equipos de RCP como por ejemplo los desfibriladores automáticos externos (DEA), de manera que se cuente con una disponibilidad óptima en términos de distancias, lo cual puede cambiar drásticamente el pronóstico de las víctimas.

Palabras clave: reanimación cardiopulmonar, paro cardíaco, sistema de emergencias medicas

Introduction

The study of sudden cardiorespiratory arrest as an important cause of mortality has been gaining more relevance in recent years, which is related to its impact on mortality in the adult population worldwide, describing a direct relationship with cardiovascular disease and more precisely with the Acute Coronary Syndrome (ACS) and its consequences on the electrical conduction system of the heart (1).

The sudden cardiorespiratory arrest is defined as the arrest of effective circulation and ventilation, leading to irreversible organ damage and death in many cases (2). Among the direct causes of sudden cardiac death, acute rhythm disorders caused by coronary ischemic events are in large proportion responsible for the majority of deaths attributed to ACS (3).

Both myocardial ischemic syndromes and underlying arrhythmias are considered preventable since ACS has defined risk factors, a well-described clinical table, and fairly sensitive diagnostic tools (4,5). On the other hand, ventricular tachyarrhythmias secondary to ischemic events are described as one of the main causes of early death during the evolution of Acute Myocardial Infarction (AMI). However, this type of rhythm disorder is susceptible to intervention, through the implementation of Cardiopulmonary Resuscitation (CPR) measures and the timely use of electrical therapy, such as early defibrillation (6).

CPR comprises a set of strategies focused on mitigating the impact of cardiorespiratory arrests and it is applied to thousands of patients per year. High-quality CPR has a direct positive impact on neurological Outcomes following the event (7). There are minimum quality conditions regarding CPR maneuvers and these were considered in the latest American Heart Association (AHA) guidelines. These include maintaining a chest compression rate between 100 and 120 per minute, depressing the chest between 5 cm and 6 cm with each compression, allowing chest

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expandability between compressions, minimizing interruptions in CPR maneuvers, achieving adequate pulmonary ventilation, and performing early defibrillation (8,9).

In view of the large increase in coronary heart disease worldwide and considering the preventable causes associated with premature mortality, ACS and secondary CRP are considered major public health problems with high fatality rates (10). According to data from North America, approximately 450,000 people experience cardiac arrest annually, with about 80% of these cases occurring at home. The death rate for survivors is close to 90% and more than half of them have various degrees of brain damage (11). On the other hand, in-hospital PCRs have slightly better results than out-of-hospital ones, with restoration of circulation in 44% of patients and survival of 17%. In Latin America, although there are no exact statistics, studies on out-of-hospital cardiac arrests attended by emergency systems suggest a mortality rate close to 98% (12).

In Colombia, it is mandatory for emergency teams, including the ones in hospitals, prehospital services, and home care services, to undergo minimum training in CPR that guarantees a good performance in handling a cardiac arrest situation.

The acquisition of CPR skills for health personnel includes continuous training, not only in theoretical knowledge but also in the development of skills. This training must be guided by a standardized protocol and supported by scientific evidence (13).

Institutions for the training of healthcare professionals have implemented diverse educational strategies focused on training all health personnel with the necessary skills for performing high-quality CPR maneuvers. Consequently, various methodologies have been designed in search of a timely and effective response to a PCR (14). Scientific societies have proposed learning methodologies based on the formulation of clear protocols, teamwork, and staff training through simulated scenarios, associated with the continuous practice of skills. However,

despite frequent and applied training in the context of health professionals, the evaluation of acquired competencies remains as a challenge for rescuer training entities (15,16).

There are different ways of monitoring the quality of CPR maneuvers. On the one hand, there are physiological measures such as end-tidal carbon dioxide (EtCO₂) or invasive monitoring in patients undergoing resuscitation. However, this option would imply carrying out studies on critically ill people, where survival is compromised (17). On the other hand, there is the monitoring of the quality standards of the trained personnel. This could be accomplished through clinical simulation, where measuring devices are employed to determine if the maneuvers are being carried out correctly. This guarantees efficacy and better results for the patients receiving care from these healthcare professionals (18).

Materials and methods

The study was of a descriptive correlational cross-sectional type. The study population consisted of health professionals who belong to the emergency centers of the city of Pereira, including physicians, nurses, and prehospital care technologists. Specifically, the focus was on those professionals who work in the emergency or resuscitation area, regularly and by shift assignment (replacements or temporary personnel were excluded). The study also included members of the emergency systems of the Universidad Tecnológica de Pereira.

Initially, demographic data such as age, sex, lifestyle habits such as smoking, alcohol consumption, physical activity, and previous physical or emotional conditions were taken. Additionally, anthropometric data such as height, weight, body mass index, and body build were recorded. Finally, to complete the initial data, a professional profile was made for each participant, including the level of training, CPR certification, experience in CPR care, and Updating courses.

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Subsequently, a 2-minute practical CPR test was performed, following the American Heart Association (AHA) 2020 protocol where compressions and ventilations were alternated at a ratio of 30: 2 for 5 cycles.

The CPR tests were carried out on Little Anne ® -type medium fidelity clinical simulation mannequins that model the human thorax and allow participants to perform complete CPR maneuvers.

To Accurately measure the duration of various events, a detailed time record was maintained. This record included the activation of the emergency system, the initiation of CPR maneuvers, any pauses during CPR, and the completion of CPR. It also included the recognition of cardiac arrest and the exact start time of compressions.

To determine the quality of chest compressions, the SPeCTRe ® CPR chest compression quality sensor was used, designed, and validated by the GIRUS research group and the Universidad Tecnológica de Pereira. This sensor measures times, compression frequency, force, and pressure, managing to calculate the effectiveness of the maneuvers and the fatigue of the rescuer.

Once the information was obtained, a univariate analysis was carried out (frequency distributions, measures of central tendency, and measures of dispersion). Subsequently, bivariate analyses were performed to correlate demographic, anthropometric, and education and training data with performance in the practical test mediated by clinical simulation.

This study seeks to characterize the emergency teams in the city of Pereira, identifying their performance in CPR in terms of quality and compliance with the AHA 2020 protocols, seeking to identify relationships between the demographic, anthropometric, and training profiles with quality of CPR maneuvers and the effect of fatigue on participants. To see the process in a schematic way, Figure 1 is presented.

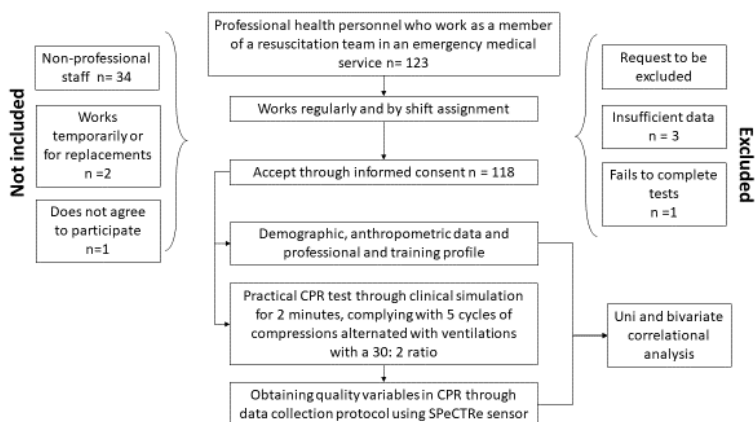


Figure 1. Methodological scheme of the research

The information obtained was used only to meet the objectives of the investigation, keeping them completely confidential; the names of the people and all information provided were treated privately and with strict confidentiality.

Results and discussion

The study included a total of 118 participants who entered the study and participated in the tests. Among the participants, 35% were women. Out of the female participants, the majority (67%) were classified as medium build.

Considering the professional distribution, 56% of the participants were prehospital care technologists, followed by 40% who were first responders, 30% was composed by nurses, and 11.8% were physicians.

Regarding the analysis of the participants' records, considering the variables of compression and recovery, the quality indices suggested that in the samples, individuals performed better in chest compressions compared to allowing for proper chest recovery (Figure 2).

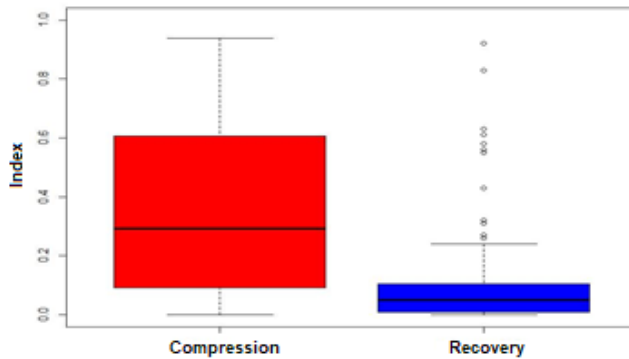


Figure 2. Boxplots of the compression and recovery indices

The red box, generated from the compression index results, shows a broader interquartile range than that obtained for the recovery indices. This implies that the majority of individuals did not obtain an adequate compression index. On the other hand, the recovery index results, represented by the blue box, show a lower interquartile range, given that the quality indicators were concentrated around a value close to zero.

In terms of population characteristics, sex was not a determinant for performing appropriate thoracic compressions. Figure 3 shows that the results of the quality indices did not vary significantly by sex.

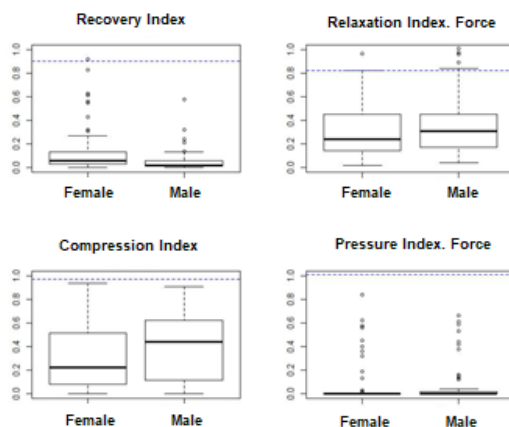


Figure 3. Boxplot of the compression and recovery quality indices according to depth and force for both sexes

The body frame of the individuals was also considered as a possible determining factor in resuscitation quality, as shown in Figure 4. Three categories were considered: medium, small, and large.

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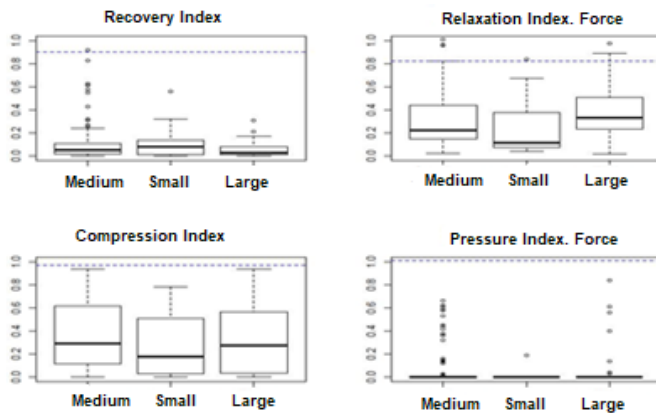


Figure 4. Boxplot of indices of compression and recovery quality according to the body frame.

Except for some individuals with medium frames, the results of the subdivision of the sample into these three groups did not suggest significant differences in the performance or quality indicators for thoracic compressions. This is because the quality indicators were concentrated around approximately equal values, and their maximum and minimum values were also similar across the groups. Therefore, frame size did not emerge as a determining factor in the quality indicators of thoracic compressions.

Additionally, figure 5 shows that body frame did not have a significant effect on the number of compressions per minute or the frequency of compressions.

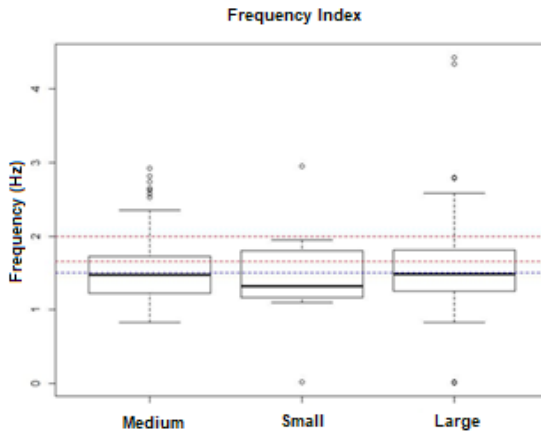


Figure 5. Boxplot of frequency quality indices according to the body frame.

Regarding response times, in the first and second shots, the recognition time of the stoppage was very similar (between 8 to 17 seconds with SD 2.8), the response time to the call was close to 3 seconds in all cases, and the dispatch time of 30-second response team (SD 7.6).

The time between the call and the first shock, was longer during the simulation exercises that implied greater displacements (8.3 minutes - SD 2.4 vs 11.4 - SD 4.5) ($p < 0.002$), evidencing the impact that fatigue has, not only on CPR performance but also on making the decision to use the AED. This time was shorter among the more trained personnel, which included graduate and experienced paramedical personnel ($p < 0.001$).

Regarding the quality of CPR maneuvers and especially chest compressions at the initial intake, no differences were found in CPR performance between men or women, nor in relation to texture, although a difference was found between doctors and technologists in Prehospital Care

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(PHC), showing a better performance compared to the first respondents ($p < 0.05$), which may be related to more training or more frequent practice of this type of procedure.

In the second intake, the percentage of correct compressions decreased in all groups ($p < 0.001$), showing an increase in compression frequency with respect to the control test ($p < 0.002$) when the participants were fatigued. Consequently, the total number of compressions increases ($p < 0.001$), although not so, their quality, finding less depth ($p < 0.05$) and less retraction of the chest ($p < 0.01$), which is more associated with male participants of large build ($p < 0.05$).

Conclusions

The quality criteria established by international guidelines (AHA) were included as conditions or criteria for determining the quality of recorded thoracic compressions. It was found that these criteria are difficult to satisfy, even by the experts considered in this study. For this reason, a series of alternative functions were constructed to classify the quality of recorded thoracic compressions while considering the criteria of international guidelines. These new functions generated quality indicators for compression, recovery, and frequency.

Although the proposed indicators independently evaluate the different characteristics of recorded thoracic compressions, it was observed that only 26.7% of the study participants performed successful compressions, and only 2% achieved successful recovery of the thorax.

In terms of the frequency of compressions as a quality indicator, 51.25% of the participants achieved adequate frequency, and individuals tended to compensate for the deficient depth of compressions with an increase in the frequency of compressions. The frequencies obtained showed a tendency to decrease slightly over time. The difficulty of maintaining an approximately constant frequency was also evident.

Considering the importance of response times in the face of cardiac arrest, special care must be taken in the formation of response teams, substantially improving the scope and quality of training, not only for medical personnel and paramedic but in addition for the communities and first responders.

Additionally, the location of CPR equipment such as DEA must be considered, so that there is optimal availability in terms of distances, which can drastically change the prognosis of the victims.

The EMS members in this study are effective in performing quality CPR at baseline. Fatigue induced by the response and physical effort negatively affects the quality of CPR, causing poor quality performance.

EMS must be permanently trained and updated, with which they could have a better performance in CPR. In addition, physical activity improvement programs should be thought about, with which they can perform adequately in the real context.

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The Health Sciences Faculty of the Universidad Tecnológica de Pereira has been advancing in the generation of new knowledge and has explored various fields of knowledge.

This book presents four pieces of research that have a lot to do with new trends, both in the training of human talent in health, and in the way in which knowledge and technology are applied to solutions to context problems.

In this case, it is important to mention the role that high-fidelity clinical simulation has been gaining in the training processes of our students, more specifically the use of theater and the “standardized patients” strategy, in the promotion of professional criteria. The positive impact of a focused training is evident, both in the conceptual development of the individual, and in the appropriation of his role as an agent of social change. The theater promotes an intentional interaction with which knowledge, skills and attitudes can be explored in a medical training process.

Likewise, theater has been used as a useful tool in the introduction of therapeutic elements in hospital spaces, such as pediatric, oncology or mental health wards, promoting various ways of interacting with medical staff, or exploring personal aspects. that can improve the clinical evolution of patients.

Clinical simulation also contemplates a series of technological elements that, when used for educational purposes, can also promote performance analysis of cognitive, technical, and dexterity skills. This is the case of the clinical simulation put to the service of a CPR skills analysis project, in which, through sensors and performance variables such as force, pressure or response time, they can account for advances in CPR training processes, both for university communities and for health professionals.