Evaluation of the Effect of a 'Serious Game' on Cardiopulmonary Resuscitation in Reinforcing Knowledge and Confidence among Medical Students at Universidad de Concepción

Introduction

Cardiac arrest (CA) is one of the most critical health emergencies a person can experience, and cardiopulmonary resuscitation (CPR) is the most effective life-saving intervention in such cases [1], However, the effectiveness of CPR largely depends on how quickly and accurately the maneuvers are performed [2]. Despite the training received, many medical students—and even physicians—lack the confidence and skills necessary to perform CPR effectively [3,4].

In response to this issue, the present study explores the application of a "serious game," an innovative educational tool aimed at improving knowledge and confidence in performing CPR. The research focuses on second year medical students at Universidad de Concepción, evaluating the potential impact this serious game may have compared to a control group.

Serious games are increasingly used in medical education, and their integration into clinical simulation programs is considered a way to enhance the efficiency and effectiveness of educational initiatives [5,6]. Furthermore, game-based learning has been shown to support a comprehensive understanding of key CPR concepts [7].

Problem statement

One of the most severe situations threatening human life is cardiac arrest (CA), defined as the "sudden and unexpected cessation of heart activity confirmed by the absence of a detectable pulse, unconsciousness, or cessation of breathing" [8]. The most effective treatment for this critical event is cardiopulmonary resuscitation (CPR), a standardized and sequential set of maneuvers recognized internationally, aimed at restoring circulation to preserve the integrity of the central nervous system. The immediate initiation of CPR maneuvers at the onset of the event increases survival chances up to sevenfold, while the probability of survival decreases by 7% to 10% for every minute without resuscitation [9]. Only through timely intervention is it possible to recover without neurological sequelae [2].

Recognized organizations such as the American Heart Association (AHA), the International Liaison Committee on Resuscitation (ILCOR), and the European Resuscitation Council (ERC) regularly publish updated guidelines on proper CPR procedures, all of which emphasize the importance of recertifying as a rescuer every two years for healthcare personnel. Numerous studies highlight the relevance of continuous training, stressing

that, to perform high-quality CPR, skills and knowledge must be consistently reinforced over time [10,12]. As with most acquired skills, regular practice is required to achieve optimal mastery [7]. Anderson [12] suggests that CPR knowledge and skills are significantly retained immediately after completing a training course; however, these tend to decline substantially over time, along with confidence and willingness to perform CPR [13].

For this reason, the recommendation issued by the AHA, ILCOR, and ERC to recertify CPR training every two years for healthcare personnel is considered by many to be too long a period to ensure optimal retention of skills and knowledge. Despite this, there is no consensus in the literature regarding the ideal timing and format for reinforcing these acquired competencies [10,12], although it is well established that they progressively decline starting six months after training [4].

Despite this evidence, it remains challenging to provide all healthcare personnel with regular training or recertification opportunities, especially in countries with large populations or limited resources [7]. Authors such as Baldi and Jadidi [1,4] argue that most medical students and physicians do not feel confident performing CPR or are unable to perform these maneuvers effectively, even after previous training. Along the same lines, in Chile, Rojas [3] evaluated a group of physicians and medical students and concluded that “despite a high level of knowledge on key aspects of CPR, this group of 41 physicians and students demonstrated suboptimal practical skills when performing CPR in a simulated scenario”

This highlights the importance of periodically reinforcing CPR knowledge and skills to ensure their maintenance over time. However, this issue does not only affect students—experienced physicians have also shown substantial deficiencies in the necessary skills and knowledge [1,14].

While knowledge level is important when performing CPR, the degree of confidence to carry out these maneuvers is equally crucial. [15] states that only 25% of surveyed medical students feel confident performing CPR maneuvers—a figure that improves significantly after training. A proportional relationship has been observed between the level of acquired knowledge and the degree of confidence [16], especially considering that the main reported barriers to performing CPR include lack of knowledge, fear of causing harm, fear of infection or disease transmission, and potential legal consequences [13].

Given the above, the importance of periodically reinforcing CPR knowledge and skills becomes evident. However, there is currently a widespread lack of interest among students in learning, which may be explained by difficulty concentrating, academic overload, lack of interest in the subject matter, or insufficient pedagogical skills on the part of instructors [17].

In this context, it is crucial to develop instructional methods that help sustain student motivation during the learning process [18]. Authors such as Chu and Tan [19,20] suggest that game-based learning enables students to actively engage and enjoy the freedom to experiment and fail in a safe and enjoyable environment, where they can interact with new sensations that help keep them motivated. [21] argues that "serious games"—defined as games with a purpose beyond entertainment and fun—can increase student satisfaction and knowledge acquisition compared to traditional teaching methods. These games allow students to practice skills in a safe setting while incorporating interactivity and competition, a format highly valued by millennial students. As digital natives, they tend to show greater confidence in technology and a strong preference for learning through electronic resources [22]. Over the past decade, medical education has sought a more interactive, student-centered approach, and has successfully developed and implemented many serious games to support the development of both technical and non-technical skills [6]. For example, *Staying Alive* is a serious game used to pre-train medical students in managing cardiac arrest before in-person training [23]. *LA-VIE* was designed to teach CPR to students not related to the healthcare field [24]. "Resus Days" has been developed as preparatory training for the advanced life support course for medical students [25]. MOBICPR has demonstrated a positive impact in reinforcing theoretical CPR knowledge among nursing students [26]. These games not only serve to complement formal training but also introduce new scenarios to strengthen understanding of CPR maneuvers [27].

In this way, the use of technology becomes an enhancer of teaching, transcending traditional instructional methods in both theoretical and practical classes. It fosters the development of clinical reasoning and promotes the construction of diverse knowledge and skills by generating simulated environments that offer students an initial approach to real-world clinical practice [22, 28]. This study aims to compare the effect of applying a serious game on reinforcing knowledge and increasing confidence in performing cardiopulmonary resuscitation (CPR) among second-year medical students at Universidad de Concepción. The hypothesis is that the use of this didactic resource will significantly reinforce CPR knowledge (H1) and increase confidence in its execution (H2) compared to those who do not receive the intervention.

At the operational level, it is expected that students exposed to the serious game will obtain significantly higher post-test scores on the knowledge assessment compared to their pre-test scores and to those of students in the control group. Likewise, it is anticipated that self-reported confidence—measured using a Likert scale—will be higher in the post-test than in the pre-test for the intervention group, in contrast to the control group. This research seeks to provide evidence on the effectiveness of innovative methodologies such as serious games for health in teaching essential clinical skills, particularly within undergraduate training contexts.

Cardiac arrest

Out-of-hospital cardiac arrest (OHCA) is a critical medical emergency, defined as the sudden cessation of breathing and cardiac activity outside of a hospital setting, evidenced by the absence of circulatory signs [29]. It represents one of the leading causes of death in high-income countries, with survival rates ranging from 3% to 10%. According to the European Resuscitation Council, the incidence in Europe reaches 84.0 cases per 100,000 inhabitants, with a survival rate of 10.3% [30]. A rapid community response is crucial: if CPR is performed immediately, the likelihood of survival can increase by 50% to 70%. Globally, the World Health Organization (WHO) reported in 2021 that OHCA caused approximately 18.6 million deaths annually among individuals aged 35 to 45, occurring twice as often in men. The most affected regions include North America, Europe, Asia, and Africa. In Latin America and the Caribbean, the Pan American Health Organization (PAHO) estimated over 2 million deaths from OHCA in 2021. The countries with the highest rates were Argentina (60%), Chile (50%), Venezuela (45%), Ecuador (43%), Colombia (42%), and Peru (40%).

In Chile, the Department of Health Statistics and Information (DEIS) reported that cardiovascular diseases are one of the leading causes of death. Risk factors such as obesity, smoking, dyslipidemia, hypertension, and diabetes increase the likelihood of cardiac arrest. In 2019, a total of 28,079 deaths were attributed to cardiovascular causes, representing more than 25% of the national total.

Basic Cardiopulmonary Resuscitation (CPR)

Cardiopulmonary resuscitation (CPR) is a set of maneuvers aimed at maintaining oxygenation of vital organs when blood circulation ceases, in order to prevent tissue hypoxia and cellular failure [30]. According to the American Heart Association (AHA), CPR is not indicated in terminal cases of incurable diseases, irreversible brain damage, or in disaster situations where it is not an immediate care priority.

The European Resuscitation Council (ERC, 2020) guidelines emphasize the role of the community in improving survival after cardiac arrest. In Europe, only 47% of CPR cases are performed by individuals outside the healthcare setting. The main reasons for not intervening include fear of causing harm, fear of infection, legal concerns, and a perceived inability to perform CPR [13,31]. Various studies confirm that CPR education improves community willingness and performance [2,13]. Regions with community training programs show higher survival rates [30] supporting Bohn's [32] assertion that even training schoolchildren can save lives. For this reason, the ERC, with support from the World Health Organization, promotes CPR education for schoolchildren starting at age 12 throughout Europe [30]. A study by Baldi [30] conducted among final-year medical students revealed

significant knowledge gaps: only 46.4% correctly identified the incidence of cardiac arrest in Europe, and 35.4% knew that survival decreases by 7% to 10% for every minute without CPR. Regarding practical skills, 90.2% knew the correct compression-to-ventilation ratio, 69.7% knew the appropriate compression depth, and 57.8% the correct compression rate. Additionally, 49.3% recognized the signs of cardiac arrest (lack of responsiveness and abnormal breathing), and 91.3% identified myocardial infarction as its most common cause. As for the automated external defibrillator (AED), 69.7% knew it should be used immediately. However, the results varied by country, highlighting the need to improve CPR training even among senior medical students.

Teaching CPR: Different Approaches to the Same Process

The CPR maneuvers recommended by the AHA and ERC consist of a sequence of interrelated steps, beginning with the assessment of the environment and the victim, followed by treatment steps including chest compressions, rescue breaths, and the use of an automated external defibrillator (AED). The traditional CPR training methodology currently in use includes workshops that combine face-to-face theoretical and practical activities, allowing for direct interaction that facilitates knowledge transmission [33]. Since all activities are supervised by instructors, they explain the procedural steps and ensure mastery of skills. However, this methodology requires a considerable investment of time and financial resources [7, 33, 2]. Today, CPR learning methods offer a wide range of alternatives. For instance, self-training with manikins has had a significant impact on knowledge dissemination, as students can share what they learn with their families and social circles by using a small manikin and a short instructional video at home.

Training with simulators has shown substantial progress in CPR education, as it strengthens the role of the student as the first responder at the scene, enhancing their skills and providing a safe and effective environment for practice [10]. Lastly, online or e-learning modalities have gained significant importance in recent years due to their ease of distribution and suitability for new generations. This has led to a growing number of technological solutions for instruction, such as interactive mobile apps, virtual reality, and gamification techniques, among others. The main advantages of these tools, besides low cost and broad accessibility, are their ability to offer real-time feedback and immediate correction, which has proven effective in improving students' skills [6].

ICTs in Medical Education

Information and communication technologies (ICTs) have revolutionized the way we communicate, enabling the creation of virtual learning environments. The COVID-19 pandemic accelerated a rapid and massive transition to online education, particularly in medical education, and prompted the development of effective content tailored to student needs, marking a significant shift from the traditional educational model [34]. This

change has compelled universities to redesign their curricula, focusing on competencies and applying new technologies that are more appealing to students shifting the teaching-learning process from the teacher to the learner [35]. To achieve this, teaching practices must implement innovative and efficient strategies not only for the development of theoretical knowledge but also for practical skills essential to professional practice, providing students with experiences that equip them with tools for appropriate application in real or simulated situations [6]. The use of ICTs in education should be understood as an evolution of the teaching-learning process, expanding the learning space beyond physical presence.

This is possible only if educators understand and recognize the usefulness of technology in their teaching experiences, such as in the preparation of materials, management of digital information, content delivery, and communication with students [36].

The academic program for medical education faces the challenge of integrating both theoretical and practical competencies. Through virtual classrooms, it has become possible to incorporate academic content and resources that reinforce acquired knowledge, while avoiding task overload. However, there are barriers such as poor internet connectivity, home distractions, lack of ideal learning spaces, and digital fatigue, all of which hinder online medical education [37]. Despite these challenges, students appreciate the flexibility of these tools, which enable self-directed learning and allow them to review material without time or location constraints—optimizing learning in suitable environments and saving commuting time [35, 30].

The Importance of Play in Learning

Among the many definitions of play, one of the most recognized is that proposed by Johan Huizinga [38]. This author describes play as a voluntary and recreational activity characterized by its freedom, separation from everyday life, and adherence to its own rules. One of its main features is spontaneity, along with the unpredictability of outcomes and the emotional involvement of the players. Although there is no single definition of what constitutes a game in literature, the core characteristics are generally consistent. Consequently, for an activity to be considered a game, it must include a rule-based system, measurable outcomes, scored rewards, and variable results based on the player's effort. Additionally, all players should feel emotionally connected to the outcomes achieved during the game [28]. When game elements are incorporated into education, the concept of gamification emerges. Alaa et al [39] defines gamification as a technique that involves transferring the mechanics of games and video games into educational settings. Its aim is to create engaging and meaningful learning experiences that increase student motivation, commitment, and content mastery, as well as enjoyment of academic

tasks—always through the use of game-based motivational elements. Due to its fun and playful nature, gamification can be an effective solution to address student engagement and participation challenges in the classroom. It helps students focus on and enjoy the learning process, rather than studying solely to pass an exam [39]. In the educational field, gamification includes a branch dedicated to the study of using game components within learning processes, known as Game-Based Learning. This approach allows students to test their retention and knowledge through more dynamic and challenging activities compared to traditional education (Khan et al., 2017). Chu [19] argues that game-based learning enables students to participate and build a learning community, enjoying the freedom to experiment and fail within a safe and enjoyable environment, and providing opportunities to interact with different sensations that help keep them motivated. In this context, [41] states that students engaged in gamified environments improve their learning and increase both motivation and engagement.

Serious Games and CPR

Serious games are games designed with a purpose beyond entertainment, characterized by having a predetermined educational objective [20]. Generally, *serious games* guide the user in the construction of specific knowledge, depending on how the game was designed [19]. Findings by Olszewski [21] have shown that *serious games* increase student satisfaction and knowledge acquisition when compared to traditional teaching methods. The gaming aspect introduces motivational factors and cognitive structures that promote learning and help keep students engaged and motivated.

Additionally, *serious games* can incorporate adaptive learning functions, adjusting difficulty and content according to the student's competence, thereby ensuring personalized learning based on varying levels of skill and knowledge [20]. Scoring and immediate feedback enable knowledge acquisition while also reducing the instructional burden on teachers [42].

Serious games are increasingly used in medical education, covering both theory and practice—for instance, in training clinical skills, cognitive rehabilitation exercises, and patient health education. Integrating *serious games* into medical simulation programs is considered a way to enhance the efficiency and effectiveness of educational programs [5,6].

Otero-Agra [41] used *serious games* to teach CPR to high school students and found that 61.7% correctly acquired CPR techniques. Along the same lines, authors such as Creutzfeldt [43] demonstrated the effectiveness of gaming technology as part of a pre-CPR course training program for medical students,

improving knowledge levels and performance after 90 to 120-minute sessions. Cheng [7] notes that game-based learning helped students develop a comprehensive understanding of key CPR concepts. These findings support the use of *serious games* as effective tools for acquiring knowledge and mastering CPR skills.

To optimize their use as an educational strategy, *serious games* must contain solid content and be designed for a specific target audience [6]. Integrating learning theory with game requirements enhances student engagement and ensures the game's educational effectiveness—an essential factor, especially for medical students. The knowledge and skills acquired through *serious games* could be applied in clinical practice with real patients, helping to close the gap between gaming scenarios and reality, and increasing confidence and self-efficacy in emergency situations [20]

The inclusion of *serious games* in CPR training aims to make the learning process more engaging, interactive, and effective compared to traditional methods, which rely heavily on lectures, videos, and practice sessions [20]. In particular, *serious games* for CPR training are user-centered and offer immediate training opportunities, flexible learning schedules, and detailed real-time feedback on CPR performance [25, 26]. In contrast, traditional teaching models often limit training opportunities and provide delayed feedback, especially in large-group settings where individualized feedback is frequently overlooked [8].

A systematic review by Lim [14] highlights that the lack of regular retraining and effective feedback in traditional CPR education can negatively affect knowledge retention. *Serious games* address these deficiencies by offering continuous opportunities for practice and immediate feedback. They also support collaborative learning by allowing students to respond jointly to virtual CPR scenarios and develop communication and teamwork skills. Additionally, they offer a wide range of emergency situations with different causes of cardiac arrests, something unachievable through traditional instructional formats [22]. This multifaceted approach not only compensates for the limitations of traditional methods but also fosters a dynamic and engaging learning environment in CPR education.

Given the advantages outlined above, the AHA Guidelines [43] recommend incorporating *serious games* into CPR training and education to complement teaching methods and improve instructional quality [7]. However, authors such as Dankbaar [5] and Sena [45] conclude that *serious games* have limitations in their ability to provide students with sufficient knowledge acquisition and the development of complex skills, showing lower performance in both theoretical and practical CPR assessments. Nevertheless, students expressed a clear preference for using games over other methodologies.

Methodology

A quasi-experimental quantitative pre-post design was used, involving an experimental group and a control group. The intervention consisted of the implementation of the serious game *"ReanimaUdeC";* an interactive film developed in accordance with the 2020 AHA guidelines. The objective was to evaluate whether this tool supported the reinforcement of knowledge and self-perceived confidence in performing CPR among medical students.

Population and sample

The target population consisted of 118 second-year medical students from Universidad de Concepción (2024). Of these, 96 agreed to participate and completed the pre-test. Using random assignment via the R software, two groups were formed: an experimental group (n = 48) and a control group (n = 48). In the post-test, a total of 48 students participated (21 from the experimental group and 27 from the control group), all of whom completed every stage of the study.

Inclusion and Exclusion Criteria

Students who had passed the course “Introduction to Medical Practice” during the first year of the program and who signed the informed consent form were included in the study. Students were excluded if they had a diagnosed mental health condition indicating vulnerability, moderate to severe visual impairments, or prior work experience in cardiopulmonary resuscitation (CPR).

Instruments

Two instruments were used for data collection. The first was a CPR knowledge questionnaire developed based on the 2020 AHA guidelines, which was validated by experts using Aiken’s V coefficient, with all values equal to or greater than 0.8. The second instrument was a five-point Likert scale designed to assess self-perceived confidence across various aspects of CPR, including the recognition of cardiac arrest, performance of chest compressions and ventilations, use of the automated external defibrillator (AED), and execution of the complete CPR sequence.

Procedure

Initially, a pre-test assessing knowledge and confidence was administered. Five days later, the experimental group received the intervention through the serious game, while the control group did not receive any intervention. Ten days after the pre-test, both groups completed the post-test using the same instruments, which included an additional question regarding the perceived increase in confidence.

Description of the Serious Game

ReanimaUdeC is an interactive movie-style video game with an audiovisual narrative, set in an emergency scenario. The player is required to make clinical decisions that directly affect the patient's outcome. Incorrect or delayed choices reduce the chances of survival, thereby promoting learning through error. The game was designed for students aged 18 to 21 and is hosted on the platform www.reanimaudec.cl.

Data Analysis

Descriptive statistical methods and non-parametric tests (Wilcoxon and Mann-Whitney U) were used for data analysis due to the non-normal distribution of the data. Additionally, robust regression models and bootstrap procedures were applied to assess the effect of variables such as age, sex, prior knowledge, self-confidence, and interest in video games on post-intervention knowledge. In these models, the main dependent variable was the post-intervention knowledge score (*POST_CONOC*), while prior knowledge (*PRE_CONOC*) was included as a covariate due to its relevance in explaining variance in the outcomes.

Ethics declaration

This study was approved by the Scientific Ethics Committee of the Faculty of Medicine (CEC 15/2024) and by the Committee of Ethics, Bioethics, and Biosafety of Universidad de Concepción (CEBB 1754-2024).

Results

A significant improvement was observed across all evaluated dimensions within the overall group after the intervention with the serious game. The mean scores for CPR knowledge and confidence increased post-intervention ($p < 0.01$). Specifically, there were significant gains in confidence to identify situations requiring CPR, perform effective chest compressions, carry out ventilations, use an AED, and complete a full CPR sequence. A significant increase in the total knowledge score was also recorded (Table 1).

Table 1

Pre and Post Intervention Results (Total Group)

Evaluated Variable	Pre-Test Mean	Post-Test Mean	p (Wilcoxon)
CPR identification	3.52	3.98	0.002
Cardiopulmonary ventilations	2.79	3.17	0.009
Chest compressions	3.38	3.88	<0.001

Evaluated Variable	Pre-Test Mean	Post-Test Mean	p (Wilcoxon)
Use of AED	3.52	4.02	0.001
Complete execution of CPR	3.15	3.63	0.001
General knowledge (score)	11.79	12.63	0.003

However, when comparing the experimental and control groups, statistically significant differences were found in only two dimensions: confidence in identifying the need for CPR ($p = 0.021$) and execution of the complete CPR sequence ($p = 0.013$). No significant differences were observed in general knowledge or in other confidence dimensions, such as ventilation or use of the AED (Table 2).

Table 2

Comparison Between Experimental and Control Groups

Compared Variable	U de Mann-Whitney	p-value
CPR identification	385.5	0.021
Cardiopulmonary ventilations	248.0	0.414
Chest compressions	353.5	0.132
Use of AED	350.5	0.141
Complete execution of CPR	396.5	0.013
General knowledge (score)	297.0	0.784

On the other hand, the robust regression and bootstrap analysis revealed that prior knowledge was the only significant predictor of post-intervention knowledge (bootstrap coefficient = 0.283; 95% CI: 0.051 to 0.593). Other variables such as age, gender, self-perceived confidence, and interest in video games did not have a significant impact (Table 3).

Table 3

Regression for Post-Intervention Knowledge

Independent Variable	β (Robust)	p-va	β (Bootstrap)	95% CI Bootstrap
Age	0.121	0.750	0.056	[-0.716, 0.734]
Gender	0.828	0.094	0.717	[-0.045, 1.487]
Prior knowledge	0.252	0.113	0.283	[0.051, 0.593]
Confidence (self-perceived)	-0.174	0.472	-0.130	[-0.544, 0.350]
Interest in video games	0.010	0.985	-0.307	[-1.481, 0.711]

Discussion

The findings indicate that the use of a serious game may be effective in reinforcing confidence and knowledge in CPR among medical students. At the intragroup level, the observed improvement was consistent across all dimensions, suggesting a positive impact of the intervention. This aligns with previous studies [46, 47] that highlight the effectiveness of game-based learning environments in fostering active learning, promoting student engagement, and enhancing content retention through immediate feedback.

However, the absence of significant differences between the experimental and control groups raises questions about the magnitude of the effect attributable solely to the serious game. It is possible that the students' baseline knowledge related to their prior academic training may have diminished the differential impact of the intervention. In this context, the serious game may have served more as a reinforcement tool rather than a primary learning resource, as also suggested by Dankbaar [5] and Sena [45].

Improvements in confidence were more evident in cognitive or conceptual dimensions, such as the ability to identify a CRA, whereas skills requiring direct practical execution such as cardiopulmonary ventilations or AED use did not show significant differences between groups. This may be explained by several factors: (1) limited emphasis on these techniques in the game's design; (2) the perception of ventilations as less

relevant or uncomfortable due to infection risk [18] and the highly automated and user-friendly nature of AEDs, which may reduce the perceived difficulty or need for training [43].

It is also noteworthy that improvement in knowledge was more closely associated with baseline levels than with the intervention itself, reinforcing the need to tailor these strategies to the characteristics of the target group. Among populations with no prior experience, students from other disciplines, or members of the general public, the serious game could have a more significant impact on both confidence and knowledge [25]

Conclusions

The applied serious game proved to be effective as a complementary educational tool in CPR training. Significant improvements in knowledge and confidence were observed within the experimental group, particularly in cognitive dimensions such as the identification of CRA and the sequential execution of CPR maneuvers. However, no significantly superior effect was observed when compared to the control group in most variables. These results suggest that serious games may be especially useful as a reinforcement tool in contexts with limited prior knowledge or during early stages of training. As proposed by Cheng [28] and Donoghue [27], we recommend its integration as a complement to traditional methods, particularly in non-medical populations.

Limitations

This study presented several limitations. The sample size was small, which affects statistical power and the ability to generalize the findings. Additionally, psychosocial variables such as motivation or acceptance of the game-based format were not explored, even though they could influence the effectiveness of the serious game. Learning retention was not assessed in the medium or long term, nor was the effective transfer of skills to real-life scenarios.

Finally, cultural bias toward the use of video games as educational tools may have influenced participants' engagement or perception of the resource [39]. Future research is encouraged to include larger sample sizes, longer follow-up periods, and implementation in diverse educational contexts. It is also recommended to explore the inclusion of new clinical scenarios, such as pediatric care, and to apply the game in general or non-healthcare populations to assess its potential impact on CPR literacy at the community level.

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