TESIS DOCTORAL

APRENDIZAJE Y ADQUISICIÓN DE COMPETENCIAS EN SOPORTE VITAL BÁSICO Y AVANZADO EN ESTUDIANTES DE ENFERMERÍA A TRAVÉS DE LA SIMULACIÓN CLÍNICA

Universidad de Almería

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Alba García Viola

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LEARNING AND ACQUISITION OF SKILLS IN BASIC LIFE SUPPORT AND ADVANCED LIFE SUPPORT IN NURSING STUDENTS THROUGH CLINICAL SIMULATION

Universidad de Almería

Programa de Doctorado en Salud, Psicología y Psiquiatría

Autora: Alba García Viola

Directora: Verónica Victoria Márquez Hernández

Codirectora: Lorena Gutiérrez Puertas

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A todas las personas que han hecho posible la culminación de esta tesis,

A mi familia, en especial, a mis padres y a mi hermana,

a mis profesores, amigos y compañeros;

por su amor, comprensión y apoyo.

"Todos los triunfos nacen cuando nos atrevemos a comenzar"

Eugene Fitch Ware

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ÍNDICE

ABREVIATURAS 1

RESUMEN 3

ABSTRACT 7

1. INTRODUCCIÓN 13

1.1. Soporte Vital Básico y Avanzado 13

1.1.1. Conceptos generales 13

1.1.1.1. Parada Cardiorrespiratoria 13

1.1.1.2. Reanimación Cardiopulmonar 14

1.1.1.3. Reanimación Cardiopulmonar Básica 14

1.1.1.4. Reanimación Cardiopulmonar Avanzada 14

1.1.1.5. Soporte Vital Básico 15

1.1.1.6. Soporte Vital Avanzado 15

1.1.2. Globalización de la Reanimación Cardiopulmonar 16

1.2. Metodologías de enseñanza-aprendizaje en el Grado en Enfermería 19

1.2.1. Importancia de la formación de los alumnos de enfermería en Soporte Vital Básico y Avanzado 20

1.3. Simulación clínica en el grado de enfermería 23

1.3.1. Simulación: conceptos generales 23

1.3.2. Clasificación de la simulación 24

1.3.3. Ambiente en la simulación 26

1.3.4. Simulación como metodología docente en el grado de enfermería 29

1.3.5. Simulación enfocada a la adquisición de competencias en Soporte Vital Básico y Avanzado 30

1.4. Justificación 32

2. PREGUNTA DE INVESTIGACIÓN Y OBJETIVOS 37

2.1. Pregunta de investigación 37

2.2. Objetivos 38

2.2.1. Objetivo general 38

2.2.2. Objetivos específicos 38

3. METODOLOGÍA 43

3.1. Diseño, participantes e instrumentos 43

3.2. Procedimiento 45

3.3. Consideraciones éticas 50

3.4. Análisis de datos 51

4. RESULTADOS Y DISCUSIÓN (PUBLICACIONES) 55

4.1. Using a Mobile Phone Application Versus Telephone Assistance During Cardiopulmonary Resuscitation: A Randomized Comparative Study 57

4.2. Are you prepared to save a life? Nursing students' experience in advanced life support practice. 67

4.3. Time out! Pauses during advanced life support in high-fidelity simulation: A cross-sectional study 81

5. IMPLICACIONES PARA LA PRÁCTICA Y FUTURAS LÍNEAS DE INVESTIGACIÓN 89

6. CONCLUSIONES 93

7. REFERENCIAS 97

8. OTRAS APORTACIONES CIENTÍFICAS DERIVADAS DE LA TESIS DOCTORAL 123

9. ANEXOS 131

ABREVIATURAS

AHA - American Heart Association

ANZCOR - Australian and New Zealand Committee on Resuscitation

APP - Aplicación móvil

DEA - Desfibrilador Externo Automático

ERC - European Resuscitation Council

GF - Grupo focal

HSFC - Heart and Stroke Foundation of Canada

IAHF - Inter-American Heart Foundation

ILCOR - International Liaison Committee on Resuscitation

INACSL - Nursing Association for Clinical Simulation and Learning standards

PCR - Parada Cardiorrespiratoria

RCA - Resuscitation Council of Asia

RCP - Reanimación Cardiopulmonar

RCP- A - Reanimación Cardiopulmonar Avanzada

RCP-B - Reanimación Cardiopulmonar Básica

RCSA - Resuscitation Council of Southern Africa

SEM - Servicios de Emergencia Médicas

SVA - Soporte Vital Avanzado

SVB - Soporte Vital Básico

RESUMEN

Introducción: La reanimación cardiopulmonar es una maniobra muy importante, ya que su correcta y precoz aplicación en una parada cardiorrespiratoria ha demostrado que salva la vida de la víctima. El personal de enfermería debe estar capacitado en esta técnica, es por ello que un adecuado aprendizaje durante su formación académica en el grado de enfermería es fundamental. La simulación clínica surge como una metodología innovadora que facilita la consecución de las competencias necesarias para el desarrollo de su carrera profesional.

Objetivos: El objetivo general de la presente tesis fue analizar el aprendizaje y adquisición de competencias en Soporte Vital Básico y Avanzado en estudiantes de enfermería a través de la simulación clínica. Para alcanzar este objetivo se establecieron los siguientes objetivos específicos:

(1) Comparar la utilización de una aplicación móvil frente a la asistencia telefónica en reanimación cardiopulmonar en entornos simulados.

(2) Explorar las experiencias y percepciones de los estudiantes de enfermería tras aplicar técnicas de Soporte Vital Avanzado a un paciente hospitalizado que sufre una parada cardiaca en un entorno simulado.

(3) Determinar las pausas realizadas en una situación de Soporte Vital Avanzado en escenarios de simulación de alta fidelidad.

Metodología:

(1) Se llevó a cabo un estudio con un diseño descriptivo observacional correlacional. La muestra estaba formada por 128 estudiantes del grado de enfermería de la Universidad de Almería (España) que fueron seleccionados de forma aleatoria en dos grupos de intervención. La recogida de datos se realizó mediante *checklist* de observación de

reanimación cardiopulmonar, *checklist* de parámetros de reanimación cardiopulmonar y la aplicación móvil AsistenteRCP®. Los datos se analizaron utilizando el programa estadístico SSPS considerando valores significativos para $p < 0,05$.

(2) Se trata de un estudio cualitativo fenomenológico descriptivo donde participaron 54 estudiantes del grado de enfermería de la Universidad de Almería (España). Se llevaron a cabo un total de 6 grupos focales, compuestos por 9 participantes cada uno y seleccionados a través de un muestreo intencional por conveniencia. Se utilizó un guion de preguntas abiertas para la recogida de datos. Los datos se analizaron utilizando el software Atlas-ti 8.0.

(3) Estudio descriptivo observacional transversal, constituido por una muestra de 142 estudiantes del grado de enfermería de la Universidad de Almería (España). La selección de la muestra se realizó mediante un muestreo por conveniencia. La recogida de los datos se llevó a cabo a través de un *checklist* para medir las pausas en una situación de Soporte Vital Avanzado. Los datos se analizaron utilizando el programa estadístico SSPS considerando valores significativos para $p < 0,05$.

Resultados:

(1) El grupo que utilizó la aplicación móvil obtuvo mejores resultados que el grupo de asistencia telefónica en 5 ítems durante la observación de la reanimación cardiopulmonar: reconoce si la zona es segura, pide ayuda, apertura de la vía aérea, comprobar respiración y llamar a emergencias. En cuanto al nivel de reanimación cardiopulmonar, no se encontraron diferencias estadísticamente significativas al comparar los dos grupos de intervención. Con respecto a los parámetros medidos, solo se observaron diferencias estadísticamente significativas en el ítem fracción de compresiones obteniendo mejores resultados el grupo que utilizó la aplicación móvil.

(2) Se identificaron tres temas principales y seis subtemas que ilustraron las experiencias y percepciones de los estudiantes de enfermería sobre la realización de Soporte Vital Avanzado. Los temas principales fueron: analizando la actuación como parte del proceso de formación, enfrentando la realidad y la experiencia como elemento clave para integrar el Soporte Vital Avanzado en el entorno asistencial.

(3) Los estudiantes realizaron la actuación de simulación en una media de tiempo de 8.32 minutos. La mayoría de las actuaciones se encontraron dentro del tiempo establecido por las guías de resucitación. Sin embargo, el tiempo de las pausas entre las compresiones torácicas fue superior al recomendado. Se encontró una fuerte correlación positiva entre la identificación de la arritmia y el inicio de la desfibrilación.

Conclusiones:

(1) Los estudiantes que utilizaron la aplicación móvil realizaron mejor las acciones de reconocimiento de la seguridad de la zona, pedir ayuda, apertura de la vía área, comprobar la respiración y llamar a emergencias. No obstante, los resultados indican que no hay diferencias en los parámetros de reanimación cardiopulmonar cuando se utiliza una aplicación móvil o es guiado por asistencia telefónica.

(2) Los estudiantes de enfermería identificaron el proceso de entrenamiento en una situación de emergencia a través de la simulación como una parte fundamental de su formación. Además, consideran la experiencia un elemento clave para integrar el Soporte Vital Avanzado en el entorno asistencial.

(3) Los estudiantes de enfermería realizaron la simulación en Soporte Vital Avanzado adhiriéndose en la mayoría de las actuaciones a los tiempos recomendados por las guías de resucitación. La identificación temprana de los ritmos desfibrilables conduce a una desfibrilación precoz por enfermería. Deben de implementarse estrategias para acelerar

la identificación de las arritmias con el fin de minimizar las pausas previas a la desfibrilación y mejorar los resultados del Soporte Vital Avanzado.

Palabras clave: Aplicación Móvil; Aprendizaje; Estudiantes de Enfermería; Parada Cardiorrespiratoria; Reanimación Cardiopulmonar; Simulación Clínica

ABSTRACT

Introduction: Cardiopulmonary resuscitation is a very important maneuver, since its correct and early application in a cardiorespiratory arrest has been shown to save the life of the victim. Nursing staff must be trained in this technique, therefore, adequate learning during their academic training in the nursing degree is essential. Clinical simulation emerges as an innovative methodology that eases the achievement of the necessary skills for the development of their professional career.

Aims: This thesis aimed to analyze the learning and acquisition of skills in Basic and Advanced Life Support in nursing students through clinical simulation, with the following specific aims:

(1) To compare the use of a mobile application versus telephone assistance in cardiopulmonary resuscitation in simulated clinical.

(2) To explore the experiences and perceptions of nursing students after applying Advanced Life Support techniques to a hospitalized patient suffering from cardiac arrest in a simulated clinical.

(3) To determine the pauses made in an Advanced Life Support situation in high-fidelity simulation scenarios.

Methodology:

(1) A cross-sectional, correlational study was carried out. The sample consisted of 128 undergraduate nursing students from the University of Almería (Spain) who were randomly selected into two intervention groups. Data collection was performed using cardiopulmonary resuscitation observation checklist, cardiopulmonary resuscitation parameter checklist and the Assistant RCP® mobile application. Data were analyzed using the SSPS statistical program, considering significant values for $p < 0,05$.

(2) A phenomenological qualitative study was performed in a sample of 54 undergraduate nursing students from the University of Almería (Spain). A total of 6 focus groups were carried out, containing 9 participants each and selected through intentional convenience sampling. An open question script was used for data collection. Data were analyzed using Atlas-ti 8.0 software.

(3) Cross-sectional study on a convenience sample of 142 nursing degree students at the University of Almería (Spain). Pauses in an Advanced Life Support situation were assessed using a checklist developed by the researchers. Data were analyzed using the SSPS statistical program, considering significant values for $p < 0,05$.

Results:

(1) The group that used the mobile application obtained significantly results than the telephone assistance group for 5 items during the observation of cardiopulmonary resuscitation: recognize whether the area is safe, ask for help, open the airway, check breathing and call to emergencies. No statistically significant differences comparing intervention groups were found regarding the level of cardiopulmonary resuscitation. The group that used the mobile application showed significantly better scores for the item compression fraction than the telephone assistance group.

(2) Three main themes and six sub-themes that illustrated the experiences and perceptions of nursing students about performing Advanced Life Support were identified. The main themes were: analyzing performance as part of the training process, facing reality and experience as a key element to integrate Advanced Life Support in the care environment.

(3) Nursing students performed the simulation scenario in an average time of 8.32 minutes. Most of the actions fall within the time established by the resuscitation guidelines. However, the pause time between chest compressions was higher than

recommended. A strong positive correlation between identification of the arrhythmia and initiation of defibrillation was found.

Conclusions:

(1) The students who used the mobile application performed better in the actions of recognizing the safety of the area, asking for help, opening the airway, checking breathing and calling emergencies. However, the results indicate that there are no differences in the parameters of cardiopulmonary resuscitation when using a mobile application or guided by telephone assistance.

(2) Nursing students identified the training in an emergency situation through simulation as a fundamental part of nursing education. In addition, they consider such experience as a key element to consolidate the Advanced Life Support into the healthcare environment.

(3) Nursing students performed the simulation in Advanced Life Support adhering in most of the actions to the times recommended by the resuscitation guidelines. Early identification of shockable rhythms leads to early defibrillation by nursing. Strategies should be implemented to accelerate the identification of arrhythmias in order to minimize the pauses before defibrillation and improve the results of Advanced Life Support.

Keywords: Cardiopulmonary Resuscitation; Cardiorespiratory Arrest; Clinical Simulation; Learning; Mobile Application; Nursing Students

I. INTRODUCCIÓN

1. INTRODUCCIÓN

En este apartado, en primer lugar, se van a describir los conceptos generales sobre Soporte Vital Básico (SVB) y Avanzado (SVA), así como la globalización de la reanimación cardiopulmonar (RCP). A continuación, se abordarán las metodologías de enseñanza-aprendizaje y simulación clínica en el Grado en Enfermería. Por último, se presentará la justificación que ha motivado el desarrollo de la presente tesis.

1.1. Soporte Vital Básico y Avanzado

1.1.1. Conceptos generales

A continuación, se describen los principales conceptos relacionados con la temática principal de este trabajo.

1.1.1.1. Parada Cardiorrespiratoria

La Parada Cardiorrespiratoria (PCR) se define como la situación clínica que cursa con la interrupción brusca, inesperada y potencialmente reversible de la respiración y/o de la circulación (Pallás Beneyto et al., 2012). En Europa se sitúa como la tercera causa principal de muerte (Andersen et al., 2019; Gräsner et al., 2016; Kiguchi et al., 2020), situándose con una incidencia anual entre el 67 y 170/100.000 habitantes (Gräsner et al., 2021).

En España se estiman unas 50.000 PCR anuales, de las cuales alrededor de 30.000 ocurren en medio extrahospitalario y 20.000 en el ámbito hospitalario, con un número de fallecimientos en torno a unas 45.000 personas. Estas cifras suponen un grave problema de salud pública, ya que superan las muertes anuales producidas por accidentes de tráfico o la mortalidad por diferentes tipos de cáncer (Consejo Español de Resucitación Cardiopulmonar, 2021).

1.1.1.2. Reanimación Cardiopulmonar

La RCP se define como el conjunto de maniobras estandarizadas y secuenciales realizadas con el objetivo de restaurar la circulación y la ventilación espontánea (Pallás Beneyto et al., 2012). El objetivo principal de la RCP es disminuir las secuelas, mejorar el pronóstico neurológico y revertir la muerte clínica, aumentando las oportunidades de supervivencia de la víctima (Harris & Kudenchuk, 2018; Pallás Beneyto et al., 2012).

1.1.1.3. Reanimación Cardiopulmonar Básica

La Reanimación Cardiopulmonar Básica (RCP-B) agrupa un conjunto de conocimientos y habilidades que permiten identificar a las víctimas con posible parada cardiaca y/o respiratoria, alertar a los Servicios de Emergencia Médicas (SEM) y realizar una sustitución de las funciones respiratoria y circulatoria hasta el momento que la víctima pueda recibir tratamiento médico (Nodal Leyva et al., 2006; Olasveengen et al., 2021; Perales Rodríguez de Viguri et al., 2007; Perkins et al., 2015). La RCP-B se caracteriza porque no requiere disponer de material específico para su realización, tan solo es necesario las manos y la boca del reanimador, aunque sí es recomendable la utilización de un dispositivo de barrera para realizar las ventilaciones boca a boca (Brennan et al., 2016; Greif, 2015; Perkins et al., 2015). Cabe destacar que esta técnica puede ser llevada a cabo tanto por personal sanitario como por rescatadores legos (Monsieurs et al., 2015; Olasveengen et al., 2021; Perkins et al., 2015, 2021).

1.1.1.4. Reanimación Cardiopulmonar Avanzada

La Reanimación Cardiopulmonar Avanzada (RCP-A) agrupa el conjunto de conocimientos, técnicas y maniobras dirigidas a proporcionar el tratamiento definitivo a la situación de PCR, realizando una sustitución de la función respiratoria y circulatoria

hasta el momento en que estas se recuperen (Nodal Leyva et al., 2006; Perales Rodríguez de Viguri et al., 2007; Soar et al., 2021). El objetivo de la RCP-A es el tratamiento inmediato de la PCR por personal sanitario especializado y entrenado en el manejo de esta situación con el fin de mejorar la supervivencia de la víctima (Gómez Antúnez et al., 2011; Perales Rodríguez de Viguri et al., 2007; Soar et al., 2021).

1.1.1.5. Soporte Vital Básico

El SVB es el conjunto de maniobras que permiten identificar si una persona está sufriendo una PCR y si se confirma, realizar la sustitución temporal de las funciones circulatoria y respiratoria mediante la realización de compresiones torácicas de alta calidad y la insuflación de ventilaciones de rescate; también se incluye dentro del SVB el uso del desfibrilador externo automático (DEA) (Navarro-Vargas, Matiz-Camacho, & Osorio-Esquivel, 2015; Olasveengen et al., 2021; Perkins et al., 2015, 2021). Además, abarca la llamada a los SEM y la actuación ante otra situaciones clínicas emergentes que se puedan presentar, tales como obstrucción de la vía aérea y/o pérdida de conciencia (Olasveengen et al., 2021; Perkins et al., 2021).

1.1.1.6. Soporte Vital Avanzado

El SVA abarca el concepto de RCP-A y se define como el conjunto de medidas terapéuticas encaminadas a realizar el tratamiento definitivo de la PCR, aumentando la supervivencia de la víctima (Perkins et al., 2021; Soar et al., 2021). El objetivo del SVA no sólo consiste en diagnosticar la causa de la PCR, sino en tratarla, para ello necesita de material adecuado y personal cualificado (Link et al., 2015; Lockey, Lin, & Cheng, 2018; Perkins et al., 2021; Soar et al., 2021). Incluye todas aquellas intervenciones avanzadas que se realizan después de que se haya iniciado el SVB (Kim et al., 2019).

Las compresiones torácicas de alta calidad con el mínimo tiempo de interrupción posible son fundamentales durante cualquier intervención específica de SVA. Además, se debe asegurar un correcto manejo de la vía aérea, la desfibrilación precoz, la canalización de accesos venosos para la administración de fármacos y la búsqueda y corrección de las causas reversibles que estén causando la PCR (Kim et al., 2019; Perkins et al., 2021; Soar et al., 2021, 2015; Takei et al., 2015; Williams & Bacon, 2017).

En las últimas recomendaciones publicadas en el 2021 por el *European Resuscitation Council* (ERC) no hay cambios sustanciales en las pautas de actuación de SVA en adultos. En estas guías se hace un mayor énfasis en que los pacientes en parada cardiaca tanto extrahospitalaria como intrahospitalaria presentan signos premonitorios, y que muchas de estas paradas se pueden evitar. Además, se reconoce el aumento del empleo de la ecografía por personal experimentado para el diagnóstico en la peri-parada y se refleja la creciente evidencia de la RCP extracorpórea como terapia de rescate en aquellos pacientes en los que fallen las medidas convencionales de SVA o para facilitar intervenciones especificas (Perkins et al., 2021; Soar et al., 2021).

1.1.2. Globalización de la Reanimación Cardiopulmonar

En Europa se han formado y dado a conocer los verdaderos pioneros del desarrollo de la RCP, entre ellos destacan: Vladimir Negovsky, Peter Safar y Fritz Ahnefeld. Este último se encargó de introducir el concepto universal de la Cadena de Supervivencia (Ahnefeld et al., 1967). El verdadero desarrollo de la RCP comenzó en 1961, a partir de las investigaciones llevadas a cabo por Kouwenhoven, Jude y Knickerbocker, en las cuales describieron las compresiones torácicas (Acosta et al., 2005). En 1966, estas técnicas de reanimación se hicieron internacionales y se fueron adoptando según las recomendaciones que indicaban los profesionales sanitarios. La *American Heart*

Association (AHA) desempeñó un papel clave en todo este proceso, publicándolas y convirtiéndolas en el estándar internacional a seguir en las siguientes dos décadas (Bossaert & Chamberlain, 2013).

En numerosos países europeos se crearon distintos grupos de trabajo en reanimación, lo que facilitó el avance en este campo. En 1986, Lars Mogensen propuso que la Sociedad Europea de Cardiología crease un grupo de trabajo específico de RCP (Chamberlain et al., 1987), pero finalmente fue rechazado (Bossaert & Chamberlain, 2013; Raffay, 2013).

En 1988, durante el Congreso de Cardiología en Viena, un grupo de cardiólogos entre los que se incluían: Douglas Chamberlain, Leo Bossaert, Lars Mogensen, Hugh Tunstall-Pedoe, Paul Hugenholtz, Stig Holmberg y John Camm, decidieron la creación de una organización dedicada a la RCP, donde se reuniesen profesionales, organizaciones y sociedades europeas interesadas en el avance y difusión de las técnicas de reanimación (Bossaert & Chamberlain, 2013). El nombre elegido fue "*European Resuscitation Council* (ERC)", y en él se reunían representantes de todas las disciplinas europeas más importantes. Los objetivos del ERC fueron: salvar el mayor número de víctimas de parada cardíaca mediante la elaboración de protocolos asistenciales y programas docentes en el campo de la RCP, y coordinar las actividades de las organizaciones europeas interesadas en reanimación (Bossaert & Chamberlain, 2013; Raffay, 2013).

En 1992, se creó el *International Liaison Committee on Resuscitation* (ILCOR), un comité donde se desarrollan las recomendaciones universales de RCP y, así, evitar que las distintas instituciones y/o países las adapten según sus intereses (Kleinman et al., 2018). El ILCOR está formado por representantes de la AHA, el ERC, la *Heart and Stroke Foundation of Canada* (HSFC), la *Australian and New Zealand Committee on Resuscitation* (ANZCOR), la *Resuscitation Council of Southern Africa* (RCSA), la *Inter-*

American Heart Foundation (IAHF), y la *Resuscitation Council of Asia* (RCA) (Kleinman et al., 2018; Navarrete Espinosa, 2016; Perkins et al., 2017).

Además, en 1992, el ERC presentó las primeras directrices a seguir para SVB (Holmberg et al., 1992) y SVA (Chamberlain et al., 1992) en un congreso celebrado en Brighton. Posteriormente, en 1994, publicó las directrices para Soporte Vital Pediátrico (Zideman et al., 1994) y para el tratamiento de las arritmias (Chamberlain et al., 1994); y en 1996, divulgó las directrices para el manejo básico y avanzado de la vía aérea y las ventilaciones durante la reanimación (Baskett et al., 1996). Desde el año 2000, los investigadores que forman parte de los distintos consejos que constituyen el ILCOR se encargan de analizar y valorar la mejor evidencia científica sobre resucitación, realizando este proceso cada 5 años (Morley et al., 2015). Las últimas recomendaciones a seguir son las publicadas en el año 2020 (American Heart Association, 2020) y 2021 (European Resuscitation Council, 2021), las cuales han sido elaboradas por los diferentes grupos de trabajo que integran el ILCOR.

1.2. Metodologías de enseñanza-aprendizaje en el Grado en Enfermería

En 1999 tras la implementación del plan Bolonia se llevó a cabo una reforma universitaria impulsada por las directrices europeas (Espacio Europeo de Educación Superior, 1999). Este hecho supuso un cambio en la formación del alumnado, orientando las metodologías docentes hacia el aprendizaje autónomo del estudiante, utilizando para ello métodos de aprendizaje más activos e impulsando metodologías que permitan alcanzar las competencias académicas y profesionales de cada titulación (Falcó Pegueroles, 2004; García-Carpintero Blas et al., 2017). El problema radica en que los programas educativos tradicionales están enfocados frecuentemente a la consecución de las habilidades técnicas dejando de lado las competencias genéricas, que son las que consiguen que el profesional no solo sea un experto en su área, sino, que sea un profesional de excelencia (Durá Ros, 2013).

Este cambio, no solo afecta a la forma de adquirir los conocimientos teóricos, sino que también influye en la renovación de las metodologías didácticas así como en los procesos de evaluación del aprendizaje (Agencia Nacional de Evaluación de la Calidad y Acreditación, 2003; Falcó Pegueroles, 2004; García-Carpintero Blas et al., 2017). Por todo ello, los programas de educación del Grado de Enfermería requieren de la aplicación de metodologías docentes orientadas a fomentar el desarrollo de los conocimientos, las habilidades y las actitudes necesarias dentro del contexto clínico, consiguiendo así profesionales competentes en conocimientos teóricos y prácticos, y desarrollando aptitudes esenciales para superar los retos que la profesión les plantea (Jack et al., 2017; Martínez-Clares et al., 2008). De tal forma que se logre un perfil profesional que integre tanto competencias específicas como competencias genéricas (Durá Ros, 2013).

1.2.1. Importancia de la formación de los alumnos de enfermería en Soporte Vital Básico y Avanzado

La parada cardíaca súbita es la tercera causa principal de muerte en Europa, siendo una de las causas más importantes de mortalidad y morbilidad en todo el mundo (Andersen, Holmberg, Berg, Donnino, & Granfeldt, 2019; Gräsner et al., 2016; Kiguchi et al., 2020).

Los enfermeros son generalmente los primeros en responder a una PCR e iniciar el SVB mientras esperan la llegada del equipo de SVA, por ello resulta primordial poseer los conocimientos y las habilidades básicas en maniobras de RCP y, además, disponer de la confianza necesaria para realizar una RCP de calidad (Adekola et al., 2013; Heng et al., 2011; Roh & Issenberg, 2014). Todo ello contribuye a solventar estas situaciones con éxito, siendo un factor importante para determinar la supervivencia de un episodio de PCR (Hernández-Padilla et al., 2014; Nasr-Esfahani et al., 2019). Por cada minuto que transcurre sin que a la persona que ha sufrido una PCR se le realicen técnicas de reanimación, se reduce un 10% las probabilidades de vida para esa persona; por tanto, el pronóstico de una PCR es proporcional a la preparación del personal sanitario que se encarga de atender al paciente e inversamente proporcional al tiempo que pasa entre la PCR y el comienzo de una reanimación eficaz (Peláez Sánchez, 2016).

A través de la Fórmula de Supervivencia de Utstein se puede predecir la supervivencia de una víctima ante una PCR. Este modelo utiliza tres componentes claves para pronosticar las tasas de supervivencia: ciencia médica, eficiencia educativa e implementación local. Por tanto, puede ser una herramienta de gran utilidad para comprobar las fortalezas y debilidades que presentan los enfoques metodológicos (Søreide et al., 2013).

Según las recomendaciones publicadas en el año 2015 por el ERC, las probabilidades de supervivencia de la víctima dependen de 3 factores relacionados entre sí: 1) La aplicación de la cadena de supervivencia, 2) La actualización de las recomendaciones y guías de RCP y 3) El entrenamiento en técnicas de SV (Greif et al., 2015). Así pues, previamente el ERC en sus recomendaciones de 2010 sentó las bases del entrenamiento en RCP, poniendo especial énfasis en la adaptación de los programas de entrenamiento en función del entorno en el que se aplicasen, de los participantes y de la probabilidad de ocurrencia del acontecimiento a practicar (Nolan et al., 2010). No obstante, actualmente persisten ciertos vacíos en torno a los modelos educativos empleados para la adquisición y mantenimiento de competencias en SVB y SVA (Cordero Torres & Caballero Oliver, 2015).

El ILCOR enfatiza que los estudiantes de enfermería deben estar formados y capacitados en SVB antes de finalizar sus estudios académicos, sin embargo, a través de una revisión de la literatura se puede comprobar que actualmente los enfoques que se utilizan para enseñar el algoritmo de SVB y el uso del DEA tanto a los estudiantes de enfermería como a los enfermeros, no siempre garantizan la adquisición o la retención de estas habilidades (Anderson et al., 2012; Ettl et al., 2011; Mäkinen et al., 2010; Meaney et al., 2012; Mokhtari Nori et al., 2012; A. M. Nielsen et al., 2010; Oermann et al., 2011; Roh & Issenberg, 2014; Saraç & Ok, 2010; Saramma et al., 2016; Sutton et al., 2011; Vural et al., 2017; Yeung et al., 2011).

Cabe destacar la importancia del nivel de la enseñanza de los conocimientos y las habilidades del alumnado del grado de enfermería, garantizando la adecuada adquisición y retención de dichas competencias (Akhu-Zaheya et al., 2013; Moon & Hyun, 2019). Todo esto tiene gran importancia ya que durante su desempeño profesional tendrán que aplicar técnicas de reanimación de forma rutinaria, por tanto, se les debe exigir una mayor

cualificación en este ámbito y un manejo efectivo de los algoritmos de SVB y SVA (Moon & Hyun, 2019).

Además, estos estudiantes requieren del aprendizaje de habilidades técnicas para aplicar los conocimientos teóricos, y de habilidades no técnicas, tales como, la toma de decisiones, el liderazgo, el trabajo en equipo, la gestión de tareas, la conciencia situacional y técnicas de comunicación para desenvolverse ante estas situaciones (Andersen, Jensen, Lippert, & Østergaard, 2010; Daniel Guerrero, Domínguez Quintero, Andrade Osorio, & Morales López, 2021; Flin & Maran, 2015; Rosell Ortiz et al., 2013). Por todo ello, resulta necesario reenfocar las estrategias utilizadas en la enseñanza de RCP, de forma que se mejore la calidad de las maniobras, traduciéndose en mejores resultados (Kim, Ahn, & Jeong, 2018; Reed-Schrader, Rivers, White, & Clemency, 2018).

1.3. Simulación clínica en el grado de enfermería

1.3.1. Simulación: conceptos generales

La simulación ha sido un método de enseñanza conocido durante siglos (Zoltán et al., 2020). En la década de 1960 se comenzaron a usar los primeros simuladores en educación médica para reanimación y, posteriormente, para el entrenamiento en habilidades clínicas (Bradley, 2006). La popularidad de la simulación clínica ha ido creciendo exponencialmente durante los últimos años, teniendo un papel imprescindible en los planes educativos de Ciencias de la Salud (Maran & Glavin, 2003; Zoltán et al., 2020) y utilizándose cada vez con mayor frecuencia en los programas de educación en enfermería (Akselbo et al., 2019).

La simulación es una técnica educativa que permite interactuar en el tiempo recreando una experiencia clínica controlada sin exponer a los pacientes a los riesgos asociados del procedimiento o técnica (Kim, Park, & Shin, 2016; Maran & Glavin, 2003; Schiavenato, 2009). La simulación clínica según Jeffries (2005), una de las pioneras de su utilización en el ámbito de la práctica en enfermería, es definida como *"una actividad que imita la realidad de un entorno clínico y que está diseñada para demostrar procedimientos, toma de decisiones y el pensamiento crítico a través de técnicas tales como juegos de rol y el uso de legados como vídeos interactivos o maniquíes"*. Por otro lado, Gaba (2004) define la simulación como *"una técnica, no una tecnología, para sustituir o ampliar las experiencias reales a través de experiencias guiadas, que evocan o replican aspectos sustanciales del mundo real, de una forma totalmente interactiva"*.

1.3.2. Clasificación de la simulación

Revisando la literatura se pueden observar diferentes clasificaciones de la simulación atendiendo al concepto de "fidelidad". Este término define el grado de realismo de los diferentes modelos empleados y de la experiencia en la que se usan, diviéndose en 3 niveles: baja, intermedia y alta fidelidad (Maran & Glavin, 2003; Martínez-Castillo & Matus-Miranda, 2015).

- **Simulación de baja fidelidad**

Suelen ser modelos de bajo coste y sencillos que aportan escasa sensación de realismo a los participantes (Durá Ros, 2013). Se caracterizan por ser simuladores estáticos, sin ningún tipo de parámetro fisiológico ni complejidad tecnológica (Dávila-Cervantes, 2014).

Por lo general simulan sólo un segmento anatómico (Corvetto et al., 2013; Dávila-Cervantes, 2014) y generalmente se emplean para la adquisición de habilidades motrices básicas (Basak et al., 2016; Corvetto et al., 2013; Durá Ros, 2013; González Melero & García Ramiro, 2016; Jansen et al., 2009), practicándose en ellos ciertos procedimientos y maniobras tanto invasivas como no invasivas (Dávila-Cervantes, 2014). La simulacion de baja fidelidad resulta muy recomendable como primera toma de contacto del alumno con la práctica (Argullós & Sancho, 2010). Entre los ejemplos de este tipo de simulación se encuentran la auscultación cardiaca básica, la canalización de un acceso venoso, la aplicación de inyecciones intramusculares, la toma de la tensión arterial o el sondaje vesical, entre otras (Corvetto et al., 2013; González Melero & García Ramiro, 2016).

- **Simulación de fidelidad intermedia**

Se combina el uso de zonas anatómicas del cuerpo humano o maniquíes, que incorporándoles un software informático permiten al instructor manejar alguna variable fisiológica para el entrenamiento y adquisición de la competencia (Corvetto et al., 2013; Dávila-Cervantes, 2014; González Melero & García Ramiro, 2016). La simulación de fidelidad intermedia está destinada a la práctica de aquellas habilidades técnicas más complejas, aportándoles al estudiante una mayor sensación de realismo tanto visual como táctil (Aldridge, 2012; Motola et al., 2013). Como ejemplos dentro de esta simulación se encuentran los maniquíes más realistas para el entrenamiento de RCP, provistos de sonidos respiratorios, cardíacos y/o pulso (Corvetto et al., 2013; González Melero & García Ramiro, 2016).

- **Simulación de alta fidelidad**

Según la *Society for Simulation in Healthcare* (2021), la simulación de alta fidelidad se define como "*experiencias de simulación que son extremadamente realistas y proporcionan un alto nivel de interactividad y realismo para el alumno*". Estos modelos integran múltiples variables fisiológicas manejadas mediante tecnología avanzada para la creación de escenarios clínicos realistas (Dávila-Cervantes, 2014; González Melero & García Ramiro, 2016). Aporta mayor sensación de realismo a los participantes y proporciona un entorno de alta calidad que permite poner en práctica tanto habilidades técnicas como habilidades no técnicas, incluyendo el pensamiento crítico, reflexión, liderazgo, trabajo en equipo multidisciplinar y la capacidad de toma de decisiones (Aldridge, 2012; Lewis et al., 2012).

Dentro de esta simulación se incluyen escenarios de prácticas clínicas complejas para la adquisición de competencias avanzadas y la resolucion de casos clínicos (Dávila-

Cervantes, 2014; González Melero & García Ramiro, 2016). Cabe destacar que el uso de estos tres niveles de simulación no es excluyente entre ellos. Cada uno de ellos se utilizará en función de la experiencia del alumno (Figura 1). Es por ello que un alumno novato se beneficiará más de la simulación de baja fidelidad que tiene la capacidad de enseñar habilidades genéricas que de un entorno de alta fidelidad, ocurriendo al revés con el profesional cualificado que requerirá de un perfeccionamiento de la técnica alcanzándolo con mayor seguridad a través de la simulación de alta fidelidad (Aggarwal et al., 2010).

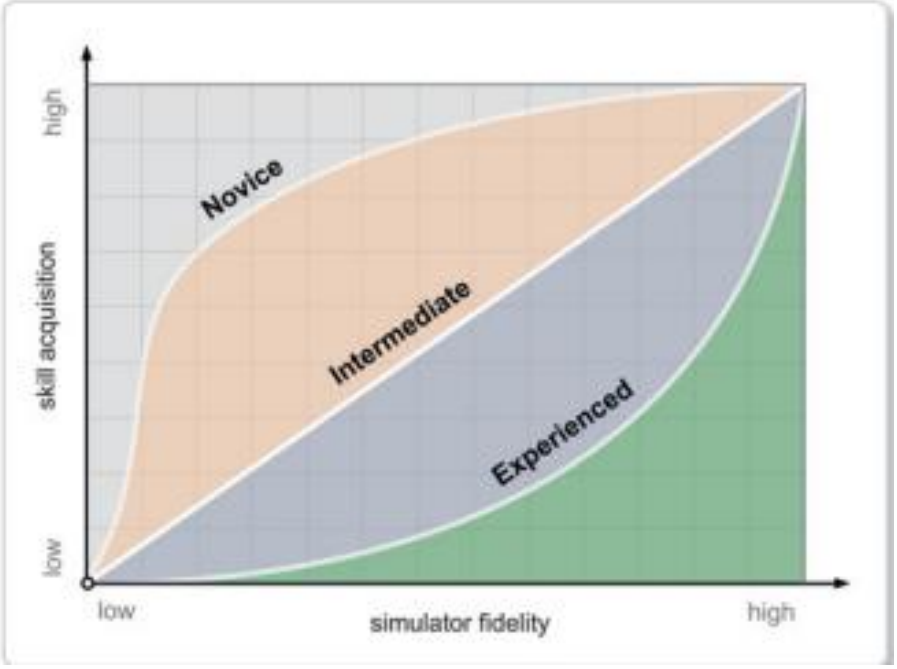

Figura 1. *Relación entre el nivel de experiencia y el tipo de simulación* (Aggarwal et al., 2010).

1.3.3. Ambiente en la simulación

El ambiente de simulación se define como *"todas las actividades que reúnen gente en el tiempo y espacio alrededor de un simulador"*. Cada ambiente de simulación es una práctica social, en la que los participantes interactúan entre sí, con el simulador y con otros equipos de acuerdo a ciertas normas, tratando de alcanzar objetivos individuales o compartidos (Dieckmann, 2009).

El ambiente de simulación puede dividirse en varias fases, las cuales deben estar interconectadas entre sí, pero no es necesario que estén todas presentes. A continuación, se describen cada una de ellas (Dieckmann et al., 2009):

1. **Sesión informativa previa**

Se lleva a cabo antes del inicio de la actividad de simulación. En esta sesión los participantes obtienen una especie de información previa acerca del curso y la simulación en general que influirá en sus expectativas. La información acerca del curso puede facilitarse mediante un programa, carta de invitación, enviando material de consulta y/o mediante diversas fuentes de información.

2. **Introducción al ambiente**

Llegan los participantes y reciben información acerca del curso. Es importante crear una atmósfera positiva, ya que hará que los participantes estén más activos durante el desarrollo del curso. Este es un momento clave para el instructor, puesto que puede investigar las expectativas previas de los participantes y corregir las suposiciones equívocas.

3. **Reunión informativa sobre el simulador**

Consiste en la presentación del simulador y del entorno donde se va a llevar a cabo la simulación. Esta fase es esencial para ayudar a los participantes a familiarizarse con el equipo, tomándose el tiempo necesario para ayudarles a perder el miedo con el simulador y, así, aprovechar al máximo la experiencia de simulación.

4. Introducción teórica

Las actividades de simulación requieren de una base teórica, para ello los instructores deben explorar distintas metodologías de enseñanza para brindarles el contenido teórico a los participantes.

5. Reuniones informativas sobre el escenario

Los participantes reciben información relacionada con el caso simulado en el escenario. Además, se le asigna y se le explica el rol que va a llevar a cabo cada uno de ellos y el de los otros compañeros con los que va a compartir escenario.

6. El escenario

Forma la base del aprendizaje basado en la experiencia. Cada ejercicio de simulación requiere de la elaboración de un escenario donde recrear situaciones reales.

El diseño de un escenario es de gran importancia, pues facilita el desarrollo del mismo, evitando las improvisaciones y fijando los objetivos docentes a conseguir.

7. Debriefing

Consiste en una reunión para la puesta en común de lo ocurrido en la simulación. Incluye las reflexiones sobre la experiencia vivida en el escenario y los comentarios posteriores de los participantes, observadores e instructores.

El “Debriefing” es un elemento clave en simulación y distingue el ambiente de la simulación de muchos ambientes de aprendizaje clínicos y la práctica clínica.

8. Finalización del curso

En esta fase se cierra el curso, se realiza un resumen de la actividad y se destacan los objetivos alcanzados para que puedan llevarlos a cabo en la práctica clínica.

1.3.4. Simulación como metodología docente en el grado de enfermería

El desarrollo tecnológico global ha permitido una mayor innovación en los métodos de enseñanza en el grado de enfermería, es por ello que la simulación ha demostrado tener un gran potencial como estrategia docente en la formación de estos profesionales (Martins et al., 2012; Sittner et al., 2015). Esta metodología permite a los estudiantes relacionar la teoría y la práctica en una amplia gama de contextos profesionales (Bevan et al., 2015; Gillan et al., 2013).

Los programas de formación basados en simulación han sido considerados una parte importante dentro de los planes de estudio del programa de enfermería, permitiendo a los estudiantes practicar procedimientos específicos en ambientes controlados antes de llevarlos acabo en la práctica real (Hicks et al., 2009). Por todo ello, el personal docente debe de implementar estrategias de enseñanza basadas en la simulación, ya que promueven las habilidades de pensamiento crítico de los alumnos y la resolución de problemas, muy necesarios para el desarrollo de su práctica profesional (Carvalho et al., 2017; Vacek, 2009). Ayudándoles a resolver problemas y emitir juicios clínicos dentro del entorno sanitario (Smith-Blair & Neighbors, 2000).

El uso de la simulación presenta numerosas ventajas en la formación académica de los estudiantes, entre las que se incluyen: el aumento en la sensación de seguridad, el desarrollo de habilidades motoras y sensoriales, la mejora de la visión espacial y de las habilidades de comunicación (Bradley, 2006; Brewer, 2011; Issenberg et al., 1999;

Jeffries, 2005; Ker et al., 2003; Kuznar, 2007; Schiavenato, 2009). También se produce un mayor desarrollo de las habilidades de gestión (Hagen & Molnes, 2013) y trabajo en equipo (Paige et al., 2015), potencia las habilidades de psicomotricidad y ayuda a fomentar las habilidades cognitivas que hacen que los alumnos reflexionen en sus actitudes, traduciéndose en una mayor seguridad para los pacientes (Abe et al., 2013; Liaw et al., 2011). Además, la simulación favorece el desarrollo de competencias para la práctica profesional, promoviendo el razonamiento clínico y las habilidades de pensamiento reflexivo, lo que contribuye al proceso de toma de decisiones (Shinnick et al., 2011; Thidemann & Söderhamn, 2013). En la esfera emocional, esta metodología mejora el desarrollo de la autoconfianza individual al transferir los conocimientos teóricos al entorno simulado (Almeida et al., 2015; Jeffries, 2008).

1.3.5. Simulación enfocada a la adquisición de competencias en Soporte Vital Básico y Avanzado

La simulación clínica ofrece al docente la oportunidad de adaptación en función de la técnica a realizar y del nivel de formación de los participantes (Greif et al., 2021). Para ello, brinda diversas alternativas que pueden variar desde el empleo de simuladores de baja fidelidad hasta el desarrollo de entornos de simulación de alta fidelidad, con el objetivo de representar escenarios clínicos más avanzados (Corvetto et al., 2013; Fernández-Ayuso et al., 2018; Hunziker et al., 2013; Partin et al., 2011; Roh & Issenberg, 2014; Sancho et al., 2010).

La simulación de alta y baja fidelidad en el campo de la reanimación se usa cada vez con mayor frecuencia debido a su capacidad para desarrollar habilidades técnicas como no técnicas en el alumno, siendo un componente clave en la mejora de las competencias asociadas y la confianza durante el entrenamiento en RCP (Greif et al., 2021). Esta

metodología permite el desarrollo de habilidades cruciales en este campo, fomentando el desarrollo de habilidades prácticas y favoreciendo las habilidades de liderazgo (Alhaj Ali et al., 2020), comunicación, confianza y pensamiento crítico, las cuales les conceden al alumno la capacidad de ser competentes ante estas situaciones de urgencia extrema (Aebersold, 2018; Rushton et al., 2020; Stroup, 2014). Durante el proceso de simulación, destaca la fase de reflexión sobre la experiencia de simulación (Debriefing), ya que es en ella donde se produce el aprendizaje profundo (Greif et al., 2021).

Además, se ha demostrado que los estudiantes que vivieron una experiencia de simulación de alta fidelidad en SVA empleaban con mayor frecuencia las habilidades de trabajo en equipo, ya que la falta de coordinación del equipo ante esta situación podría restar eficacia a la RCP y, por tanto, ocasionar graves consecuencias en la víctima (Creutzfel et al., 2013; Rushton et al., 2020). Sin embargo, a pesar de que los estudiantes son conscientes de encontrarse ante una situación simulada, esta metodología puede generar efectos emocionales no deseados en ellos, provocándoles altos niveles de estrés y ansiedad, lo que conlleva a resultados negativos en el entrenamiento en RCP (Fernández-Ayuso et al., 2018; Fernández Ayuso, Campo Cazallas, & Fernández Ayuso, 2016; Hunziker et al., 2013; Leblanc et al., 2012; Nielsen & Harder, 2013; Weidman, Bell, Walsh, Small, & Edelson, 2010).

1.4. Justificación

Las muertes por PCR constituyen la principal causa de muerte prematura a nivel europeo (Kashef & Lotfi, 2021). La formación en esta técnica y la capacitación para ofrecer una asistencia sanitaria inmediata es una estrategia fundamental para disminuir el número de fallecimientos.

Los profesionales de enfermería son uno de los pilares fundamentales de la salud, debido a su gran campo de actuación que es el "cuidado". La actuación ante una RCP es una de las maniobras más importantes a las que se enfrentan estos profesionales, ya que en numerosas ocasiones son los primeros en llegar al lugar del acontecimiento y actuar ante esta situación de urgencia extrema, es por ello que esta profesión juega un papel muy significativo dentro de las maniobras de SVB y SVA (Bhanji et al., 2015; Porter et al., 2014; Provencal Levesque et al., 2021). Por este motivo, es necesario contar con personal sanitario enfermero que esté formado y capacitado para poder responder con éxito ante estas situaciones, para ello resulta fundamental una preparación académica de calidad.

Es importante que los alumnos del grado de enfermería adquirieran los conocimientos y las habilidades necesarias para ponerlas en práctica en su día a día, mejorando así la calidad asistencial y, por tanto, aumentando las probabilidades de supervivencia y mejorando el pronóstico neurológico de la víctima (Rushton et al., 2020; Sullivan et al., 2015). Sin embargo, los conocimientos adquiridos en los programas de formación se deterioran con facilidad si no se usan con frecuencia, por ello es necesario un reciclaje frecuente para evitar el deterioro de las maniobras de RCP (Abella et al., 2005; Kim et al., 2012; Madden, 2006).

Las nuevas tendencias hacia una educación de calidad incluyen nuevas estrategias tecnológicas, tales como la simulación, jugando un papel fundamental como elemento

clave en la adquisición de conocimientos y habilidades de los alumnos (Alconero-Camarero et al., 2021; Rossler et al., 2019). Por ello, y cada vez con mayor frecuencia, su uso se está implementando en los programas educativos del grado de enfermería, ya que permite practicar en una emergencia sin poner en riesgo la vida de la víctima (Kim et al., 2016; Maran & Glavin, 2003; Schiavenato, 2009).

En este trabajo se escoge la formación en SVB y SVA, ya que existe la necesidad de seguir investigando y buscando estrategias metodológicas que garanticen a los alumnos estar correctamente formados en este campo. Puesto que uno de los principales problemas que presenta su enseñanza es la dificultad de practicar esta técnica sobre los pacientes, es necesario buscar alternativas metodológicas, siendo una gran elección la simulación.

Se busca la excelencia en la enseñanza de estas maniobras, ya que la actuación de estos profesionales ante una parada cardiaca debe ser protocolizada, rápida y segura, puesto que una indecisión o mala actuación en esta situación provocaría un retraso en la intervención y, por consiguiente, ocasionarle consecuencias muy graves a la víctima. Todo ello se consigue a través de la simulación clínica, ya que no reemplaza la práctica real pero sí consigue un ambiente seguro para el estudiante y la víctima, promoviendo la adquisición de competencia técnicas y no técnicas.

II. PREGUNTA DE INVESTIGACIÓN Y OBJETIVOS

2. PREGUNTA DE INVESTIGACIÓN Y OBJETIVOS

2.1. Pregunta de investigación

En la presente tesis doctoral, se formuló la siguiente pregunta de investigación:

¿Cómo influye la simulación clínica en el aprendizaje y adquisición de competencias en Soporte Vital Básico y Avanzado de los estudiantes de enfermería?

2.2. Objetivos

2.2.1. Objetivo general

- Analizar el aprendizaje y adquisición de competencias en Soporte Vital Básico y Avanzado en estudiantes de enfermería a través de la simulación clínica.

2.2.2. Objetivos específicos

Objetivo específico 1:

- Comparar la utilización de una aplicación móvil frente a la asistencia telefónica en reanimación cardiopulmonar en entornos simulados.

Este objetivo se ha conseguido con el desarrollo de la publicación 1:

Márquez-Hernández, V. V., Gutiérrez-Puertas, L., Garrido-Molina, J. M., García-Viola, A., Granados-Gámez, G., & Aguilera-Manrique, G. (2020). Using a Mobile Phone Application Versus Telephone Assistance During Cardiopulmonary Resuscitation: A Randomized Comparative Study. *Journal of Emergency Nursing*, *46*(4), 460-467. doi.org/10.1016/j.jen.2020.03.015

Objetivo específico 2:

- Explorar las experiencias y percepciones de los estudiantes de enfermería tras aplicar técnicas de Soporte Vital Avanzado a un paciente hospitalizado que sufre una parada cardiaca en un entorno simulado.

Este objetivo se ha logrado con la publicación 2:

Gutiérrez-Puertas, L., Márquez-Hernández, V. V., Gutiérrez-Puertas, V., Rodríguez-García, M. C., García-Viola, A., & Aguilera-Manrique, G. (2021). Are you prepared to save a life? Nursing students' experience in advanced life support practice. *International Journal of Environmental Research and Public Health*, *18*(3), 1–13. doi.org/10.3390/ijerph18031273

Objetivo específico 3:

- Determinar las pausas realizadas en una situación de Soporte Vital Avanzado en escenarios de simulación de alta fidelidad.

La consecución de este objetivo se ha alcanzado con la publicación 3:

Márquez-Hernández, V. V., Gutiérrez-Puertas, L., García-Viola, A., Garrido-Molina, J. M., Gutiérrez-Puertas, V., Rodríguez-García, M. C., & Aguilera-Manrique, G. (2021). Time out! Pauses during advanced life support in high-fidelity simulation: A cross-sectional study. *Australian Critical Care*. (In press). doi.org/10.1016/J.AUCC.2021.07.001

III. METODOLOGÍA

3. METODOLOGÍA

3.1. Diseño, participantes e instrumentos

En la Tabla 1 se puede observar el diseño, los participantes y los instrumentos utilizados para la recogida de datos en cada uno de los estudios.

Tabla 1. Diseños, participantes e instrumentos utilizados en los estudios

Diseño del estudio	Participantes	Instrumentos
Descriptivo observacional correlacional (Publicación 1)	La muestra estuvo constituida por N=128 estudiantes de enfermería de la Universidad de Almería (España). La selección de la muestra se realizó de forma aleatoria en dos grupos de intervención.	✓ *Checklist* de observación de RCP. Recoge información sobre reconocimiento de la seguridad de la zona, nivel de consciencia, pedir ayuda, apertura de la vía aérea, comprobar respiración, llamar a los SEM, solicitar un DEA, iniciar masaje cardiaco, masaje cardiaco adecuado y ventilaciones adecuadas (Anexo 1). ✓ *Checklist* de parámetros de RCP. Basado en los parámetros recogidos en el SimPad PLUS con SkillReporter de la marca Laerdal® (Anexo 1). ✓ Aplicación móvil AsistenteRCP®. Consiste en una guía descriptiva, a través de mensajes visuales, auditivos y textuales, de las maniobras y pasos recomendados para la realización correcta de las técnicas de RCP.

Cualitativo fenomenológico descriptivo (Publicación 2)	La muestra estuvo constituida por N=54 estudiantes de enfermería de la Universidad de Almería (España). Se llevaron a cabo un total de 6 grupos focales (GFs), constituidos por 9 participantes cada uno. La selección de la muestra se realizó a través de un muestreo intencional por conveniencia.	El equipo investigador desarrolló un guion de preguntas abiertas, previamente desarrollado por un panel de expertos, constituido por docentes con amplia experiencia en simulación clínica y profesionales sanitarios con experiencia en SVA. (Anexo 2). Este guion se utilizó durante el desarrollo de los GFs.
Descriptivo observacional transversal (Publicación 3)	La muestra estuvo constituida por N=142 estudiantes de enfermería de la Universidad de Almería (España). La selección de la muestra se realizó a través de un muestreo por conveniencia.	*Checklist* de 10 ítems para medir las pausas en una situación de SVA (Anexo 3). Desarrollado por un panel de 12 expertos.

3.2. Procedimiento

- **<u>Publicación 1:</u>**

Se realizó una distribución de forma aleatorizada de los alumnos matriculados en la asignatura de SVB y SVA, en dos grupos de intervención: 1) aplicación móvil (app) y 2) asistencia telefónica.

- ✓ App

En el grupo de la app se utilizó la app AsistenteRCP® con el objetivo de realizar la RCP guiada a través de la misma. Antes de la intervención, se le ofreció al estudiante un teléfono móvil con la app descargada. Para la realización de las maniobras de RCP se utilizó un maniquí Little Anne QCPR® y a través de SimPad PLUS con SkillReporter se recogían los parámetros de RCP descritos en el apartado de instrumentos.

En primer lugar, todos los estudiantes se reunieron en una sala donde se les explicó el objetivo principal del estudio y firmaron el consentimiento informado. A continuación, cada participante fue a una habitación donde se encontraban a una víctima en PCR en el suelo y a su lado un teléfono móvil con la app descargada para guiarlo. El investigador principal estaba en una habitación contigua desde donde podía observar la intervención y tomar nota de la actuación del alumno.

- ✓ Asistencia telefónica.

Todos los estudiantes se reunieron en una sala donde se les explicó el objetivo principal del estudio y firmaron el consentimiento informado. A continuación, cada participante fue a una habitación donde se encontraban a una víctima en PCR en el suelo y a su lado un teléfono móvil para llamar a los servicios de emergencias. Un investigador capacitado

en la asistencia en RCP telefónica se ubicó en una habitación contigua desde donde contestó la llamada telefónica y fue guiando al participante, mientras tanto otro investigador se encargaba de anotar los datos acerca de la actuación.

En ambos grupos de intervención la actividad fue realizada por todos los participantes el mismo día para garantizar las mismas condiciones a todos y se asignó un tiempo de 5 minutos para la ejecución de las maniobras de RCP a cada participante.

- **Publicación 2:**

La recopilación de los datos incluyó seis GFs. La recogida de datos se realizó a través de un guion de preguntas abiertas, previamente desarrollado por un panel de expertos, constituido por docentes con amplia experiencia en simulación clínica y profesionales sanitarios con experiencia en SVA. Cada GF estaba constituido~~s~~ por nueve estudiantes de enfermería que aceptaron discutir y compartir sus experiencias de simulación tras aplicar SVA a un paciente hospitalizado que entraba en PCR.

El escenario simulado se desarrolló de acuerdo con las recomendaciones del *International Nursing Association for Clinical Simulation and Learning Standards* (INACSL) (INACSL Standards Committee, 2016). Antes de participar en la simulación los participantes asistieron a seis sesiones formativas sobre procedimientos de SVA y recibieron pautas para atender a un paciente que sufría una PCR en el entorno hospitalario. El pre-briefing incluyó una orientación a las expectativas de los estudiantes, se les informó que el objetivo de la simulación era formativo, a pesar de ser evaluados, ya que esa evaluación formaba parte del proceso de formación. Antes de que los estudiantes comenzaran la simulación, se llevó a cabo una discusión grupal sobre los protocolos de actuación en SVA.

El investigador principal realizó la exposición de la situación hospitalaria actual del paciente. El escenario se enfocó al desarrollo de habilidades de SVA. Los actores asumieron el papel de la voz del paciente, después de haber sido instruidos en una sesión de orientación estandarizada para sus roles. La asignación de los equipos de trabajo, así como de los roles de los estudiantes de enfermería en el equipo, se establecieron por los docentes de la asignatura.

El escenario consistió en un estudiante de enfermería que estaba en una habitación de hospital con un paciente. El paciente le indicó sentirse mal, al cabo de unos segundos perdió la conciencia y no respondía. El estudiante de enfermería que estaba en la habitación tuvo que solicitar ayuda. Al escenario se unieron dos estudiantes de enfermería. Uno de los tres estudiantes adoptó el rol de líder antes de comenzar la actuación. Los observadores estaban en una habitación separada y a través de una pantalla observaban la actuación de los estudiantes, estos observadores eran enfermeras que tenían experiencia en RCP, así como formación en SVB y SVA. Los observadores fueron registrando las intervenciones completadas por los alumnos e identificando elementos de trabajo en equipo. Posteriormente, una vez que se completaron todas las actuaciones de simulación de los estudiantes, el investigador principal llevó a cabo una sesión de debriefing para analizar la experiencia de los estudiantes de enfermería y cómo se sintieron durante la actividad.

Los GFs fueron realizados por el investigador principal. La recogida de datos tuvo lugar en un laboratorio de la Facultad de Ciencias de la Salud de la Universidad de Almería (España) y se llevó a cabo en Marzo de 2020. La duración de cada GF focal varío de 20 minutos a 40 minutos. Las respuestas de los GFs se grabaron en audio y se transcribieron (Green & Thorogood, 2014).

- **Publicación 3:**

El estudio se llevó a cabo en la Universidad de Almería. Los participantes fueron distribuidos en grupos para su actuación. El procedimiento se llevó a cabo en un laboratorio de simulación con el maniquí Resusci Anne® para RCP avanzada.

El escenario de simulación fue descrito de acuerdo a las recomendaciones del INACSL (INACSL Standards Committee, 2016). El escenario contaba con una habitación de hospital que incluía un baño, una cama de hospital, un maniquí sentado en la cama en posición de semifowler, un monitor, un timbre para el paciente, un carro con todo el material necesario para actuar ante una parada cardiaca y dos sillas. El monitor fue configurado para generar aleatoriamente ritmos desfibrilables.

Antes de entrar a la sala de simulación el investigador informó a los estudiantes sobre los objetivos a conseguir. Previamente habían sido instruidos para actuar ante una PCR y realizar el SVA. Además, habían realizado actividades previas durante el año académico en la sala de simulación, por lo que estaban familiarizados con el ambiente y con el maniquí.

La simulación se basó en la siguiente situación: un estudiante se encontraba en la habitación del hospital acompañando al paciente encamado y se dio cuenta de que no respondía, pidiendo ayuda para iniciar la RCP. A continuación, dos estudiantes se incorporaron al escenario con el carro de parada. Una vez determinada la situación de PCR, los estudiantes se distribuyeron las tareas de manejo de la vía aérea, realización de compresiones torácicas, canalización intravenosa y administración de fármacos. El escenario de simulación terminó cuando los participantes detectaron el ritmo desfibrilable e iniciaban la desfibrilación. Una vez finalizada la actuación de cada grupo, se iban a una sala donde esperaban al resto de sus compañeros, con el fin de que los alumnos que ya

habían realizado la simulación no estuviesen en contacto con los que aún no la habían realizado.

Mientras se desarrollaba la simulación, dos observadores se encontraban en la sala de control recogiendo los datos de actuación de los estudiantes de enfermería. Posteriormente, una vez finalizada todas las actuaciones de simulación de los estudiantes, se realizó una sesión de debriefing para comentar la experiencia y como se habían sentido durante la realización del ejercicio. Esta sesión se desarrolló con la siguiente estructura: 1) Una fase de reacción para abordar las reacciones y sentimientos de los estudiantes después de realizar la simulación, 2) Una fase de comprensión para identificar las limitaciones y obstáculos que encontraron durante la intervención, y 3) Una fase de resumen donde se destacaron los objetivos alcanzados para que puedan aplicarlos en la práctica clínica (Palaganas et al., 2016). La sesión de debriefing duró 25 minutos.

3.3. Consideraciones éticas

La presente tesis doctoral se realizó bajo el adecuado cumplimiento de la normativa que regula la legislación del país de estudio en materia de protección de datos; siguió los principios éticos fundamentales recogidos en la declaración de Helsinki; así como los establecidos en el ámbito nacional español y europeo en lo relativo a los derechos humanos y la biomedicina. Se obtuvo la aprobación del Comité de Ética e Investigación del Departamento de Enfermería, Fisioterapia y Medicina de la Universidad de Almería (Ver anexo 4). Los estudiantes fueron informados verbalmente y por escrito sobre los objetivos y características de la investigación, así como del carácter voluntario y la garantía del tratamiento anónimo y confidencial de los datos de acuerdo a la ley vigente en materia de protección de datos. Posteriormente, se trataron todas las cuestiones al respecto y firmaron el consentimiento informado antes de participar (Ver anexo 5). Su participación fue totalmente voluntaria y desinteresada, conservando en todo momento el derecho a abandonar el estudio sin explicaciones.

3.4. Análisis de datos

- **Publicación 1**

Para el análisis de datos se utilizó el programa estadístico SPSS versión 24. En primer lugar, se realizó un análisis descriptivo de las variables sociodemográficas, analizando frecuencia y porcentajes para las variables categóricas (sexo y formación previa), y media y desviación estándar para las variables cuantitativas (edad). Para el contraste de variables categóricas se llevó a cabo la prueba de Chi Cuadrado. En el caso de variables cuantitativas y cualitativas, previa comprobación de la distribución de la muestra mediante la prueba de Kolmogorov-Smirnov, se utilizó la prueba no paramétrica de U de Mann Whitney. Se consideró significativa una $p < 0,05$.

- **Publicación 2**

Para el análisis de los datos, las transcripciones se incluyeron en una unidad hermenéutica y se analizaron utilizando el software Atlas-ti 8.0. Para asegurar la confiabilidad y validez de los resultados, los investigadores realizaron el análisis fenomenológico con el método de Colaizzi (Colaizzi, 1978):

1) Familiarización con los datos para comprender las experiencias vividas de los participantes, leyendo las transcripciones de las entrevistas y GFs (lectura y relectura)
2) Las oraciones significativas se analizaron hasta llegar a una declaración significativa.
3) Las declaraciones significativas se extrajeron de las unidades significativas.
4) Las declaraciones significativas se clasificaron en temas y subtemas.
5) Los temas y subtemas se integraron en una descripción completa de la experiencia vivida por los participantes.

6) Se describió la estructura base de la experiencia vivida por los participantes.
7) Todos los entrevistados analizaron los hallazgos para verificar la exactitud de las transcripciones y el parecido de sus experiencias. Se seleccionaron las citas más relevantes para su inclusión en el estudio.

- **Publicación 3**

Para el análisis de los datos se utilizó el programa estadístico SPSS versión 25. En primer lugar, se realizó un análisis descriptivo de las variables sociodemográficas, calculando frecuencias y porcentajes para las variables cualitativas, mientras que para las variables cuantitativas se obtuvieron medidas de tendencia central y dispersión. Para la evaluación de la consistencia intra-interobservador se calcularon los coeficientes de correlación de Pearson. Para el contraste entre variables cualitativas y cuantitativas se empleó la prueba no paramétrica de U de Mann Whitney. Se utilizó la prueba de correlación de Spearman para comparar variables cuantitativas. Se consideró significativa una $p < 0,05$.

IV. RESULTADOS Y DISCUSIÓN (PUBLICACIONES)

4. RESULTADOS Y DISCUSIÓN (PUBLICACIONES)

La presente tesis doctoral ha sido elaborada según la modalidad de compendio de publicaciones (Tabla 2). A continuación, se presentan los artículos que la componen:

Tabla 2. Publicaciones que avalan la tesis por compendio

Revista	Artículo	Factor de impacto, cuartil y categoría
	Márquez-Hernández, V. V., Gutiérrez-Puertas, L., Garrido-Molina, J. M., García-Viola, A., Granados-Gámez, G., & Aguilera-Manrique, G. (2020). Using a Mobile Phone Application Versus Telephone Assistance During Cardiopulmonary Resuscitation: A Randomized Comparative Study. *Journal of Emergency Nursing*, *46*(4), 460-467. https://doi.org/10.1016/j.jen.2020.03.015	FI: 1.836 (JCR 2020) Q3 Nursing SCIE (65/124) SSCI (63/122)
	Gutiérrez-Puertas, L., Márquez-Hernández, V. V., Gutiérrez-Puertas, V., Rodríguez García, M. C., García-Viola, A., & Aguilera-Manrique, G. (2021). Are you prepared to save a life? Nursing students' experience in advanced life support practice. International Journal of Environmental Research and Public Health, 18(3), 1–13. https://doi.org/10.3390/ijerph18031273	FI: 3.390 (JCR 2020) Q1 Public, environmental & occupational health SCIE (68/203) SSCI (42/176)
	Márquez-Hernández, V. V., Gutiérrez-Puertas, L., García-Viola, A., Garrido-Molina, J. M., Gutiérrez-Puertas, V., Rodríguez-García, M. C., & Aguilera-Manrique, G. (2021). Time out! Pauses during advanced life support in high-fidelity simulation: A cross-sectional study. *Australian Critical Care*. (In press). https://doi.org/10.1016/J.AUCC.2021.07.001	FI: 2.737 (JCR 2020) Q1 Nursing SCIE (20/124) SSCI (20/122)

4.1. Using a Mobile Phone Application Versus Telephone Assistance During Cardiopulmonary Resuscitation: A Randomized Comparative Study

RESEARCH

Using a Mobile Phone Application Versus Telephone Assistance During Cardiopulmonary Resuscitation: A Randomized Comparative Study

Authors: Verónica V. Márquez-Hernández, PhD, RN, Lorena Gutiérrez-Puertas, PhD, RN, José Miguel Garrido-Molina, MSc, RN, Alba García-Viola, MSc, RN, Genoveva Granados-Gámez, PhD, RN, and Gabriel Aguilera-Manrique, PhD, RN, Almería, Spain

CE Earn Up to 7.5 Hours. See page 550.

Contribution to Emergency Nursing Practice

- The current literature on cardiopulmonary resuscitation indicates that the effectiveness of telephone assistance versus mobile phone application in a simulated environment has not been explored.
- This article contributes to knowledge about effective methods of performing cardiopulmonary resuscitation through guided assistance.
- The key implication for emergency nursing practice found in this article can guide the witnesses of a cardiorespiratory arrest to act quickly and effectively.

Abstract

Introduction: In recent years, the way CPR instructions are given has changed because of the development of new technology that allows bystanders who witness a cardiac arrest to be guided in performing CPR. This study aimed to compare the effectiveness of using a mobile phone application (app) versus telephone operator assistance in performing cardiopulmonary resuscitation (CPR) techniques in simulated settings.

Methods: A comparative study was performed with 2 intervention groups: (1) mobile phone app and (2) telephone assistance. A total of 128 students participated and were distributed randomly into each intervention group. A CPR observation checklist and standard CPR quality parameter measurements were used for data collection.

Results: The group that used the app obtained better results than the group that had telephone assistance on 5 items during CPR observation: checking if the area is secure ($X^2(1) = 26.81$; $P < 0.05$), asking for help ($X^2(1) = 66.07$; $P < 0.05$), opening of airways ($X^2(1) = 12.03$; $P < 0.05$), checking for breathing ($X^2(1) = 6.10$; $P < 0.05$), and contacting emergency services ($X^2(1) = 12.41$; $P < 0.05$). Regarding the skill level of CPR, no statistically significant differences were found when comparing the 2 intervention groups ($X^2(1) = 0.91$; $P = 0.33$). As for the parameters measured, there were only statistically significant differences found in the item compression fraction ($U = 1{,}593.00$; $Z = -2.16$; $P < 0.05$), with the group that used the app obtaining better results.

Discussion: Better outcomes were observed in recognizing if the area was safe, asking for help, opening up the airways, checking for breathing, and calling emergency services in the mobile phone app group. However, the results indicated that

Verónica V. Márquez-Hernández is an assistant professor, Department of Nursing, Physiotherapy and Medicine, University of Almería, Almería, Spain; and a researcher in Research Group for Health Sciences, University of Almería, Almería, Spain.

Lorena Gutiérrez-Puertas is an assistant professor, Department of Nursing, Physiotherapy and Medicine, University of Almería, Almería, Spain.

José Miguel Garrido-Molina is a PhD student, Department of Nursing, Physiotherapy and Medicine, University of Almería, Almería, Spain; and a nurse in Public Company of Sanitary Emergencies 061, Almería, Spain.

Alba García-Viola is a PhD student, Department of Nursing, Physiotherapy and Medicine, University of Almería, Almería, Spain.

Genoveva Granados-Gámez is a professor, Department of Nursing, Physiotherapy and Medicine, University of Almería, Almería Spain; and a researcher in Research Group for Health Sciences, University of Almería, Almería, Spain.

Gabriel Aguilera-Manrique is a professor, Department of Nursing, Physiotherapy and Medicine, University of Almería, Spain; and a researcher in Research Group for Health Sciences, University of Almería, Almería, Spain.

For correspondence, write: Lorena Gutiérrez-Puertas, PhD, RN, Department of Nursing, Physiotherapy and Medicine, Universidad of Almería, Ctra Sacramento s/n, 04120, Almería, Andalucía, Spain; E-mail: lgp524@ual.es.

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there were no differences in the CPR parameters, except compression fraction, when the app was used as opposed to being guided by telephone.

Key words: Mobile phone application; Telephone assistance; Cardiac arrest; Cardiopulmonary resuscitation; Basic life support

Introduction

Out-of-hospital cardiac arrest is an important public health issue because there are approximately 420,000 cases in the United States and 275,000 cases in Europe annually, of which 29,000 patients survive if bystanders immediately begin cardiopulmonary resuscitation (CPR).[1,2] In Spain, this figure is situated at approximately 50,000.[3]

Guided assistance for bystanders who perform CPR is usually given via telephone operator support, also known as dispatcher-assisted CPR, and has shown an improvement in survival rates of cardiac arrest.[4-7] Telephone assistance during CPR is defined as a set of instructions offered over the telephone by an operator from emergency medical services coordination centers to offer support and guidance to bystanders about how to perform CPR.[8,9] Nonetheless, other studies have shown that instructions over the telephone can cause delays in performing CPR owing to time lost while a diagnosis is being made, while determining the caller's willingness and capability of performing CPR, and while the bystander receives instructions. These delays[10,11] may negatively affect the outcome.

In the last few years, the way CPR instructions are given has changed, owing to the development of new technology that allows bystanders who witness a cardiac arrest to be guided in performing CPR.[12] More specifically, mobile phone applications (apps) have been developed with the goal of providing feedback and assistance during CPR;[13,14] therefore in addition to having telephone support, the bystanders who witness a cardiac arrest also have mobile phone apps available to guide them through performing CPR.[12] These apps may have different characteristics, such as audiovisual assistance, a chronometer function, and an indicator for the depth of compressions, among other aspects, which may help bystanders perform CPR in a more effective way.[12-14] Furthermore, one of the most fundamental aspects of having a mobile phone app is that it enables bystander intervention, thus achieving an increase in the number of instances CPR is performed.[15] The use of such apps has been recommended in the Guidelines of the European Resuscitation Council (2015).[16]

There are several different CPR apps, though not all of them follow the recommendations of the International Liaison Committee on Resuscitation (ILCOR).[17] ILCOR is a group that provides a liaison among principal resuscitation organizations throughout the world, with the goal of coordinating different aspects of CPR on a global level and encouraging participation in research and dissemination. Because some apps do not follow the recommendations of ILCOR, these apps have not been duly validated.[17] Thus, the quality of the CPR performance may vary according to which feedback device or app is used.[18] Several studies have been carried out to demonstrate the usefulness of smart devices as sources of feedback for CPR, but the results have been contradictory thus far.[19,20] Many of the studies are mainly focused on performing chest compressions and rescue breaths.[13,14] This gap implies that the use of apps for assisting in CPR should be analyzed and investigated compared with other available services such as telephone assistance. In our context, no other studies have been found that analyze the use of a mobile phone app in a simulated CPR setting, compared with using telephone assistance offered by emergency services.

The main objective of this study was to compare the effectiveness of using a mobile phone app versus telephone operator assistance in simulated CPR settings. The specific objectives were (1) to explore the level of performance of CPR techniques, (2) to determine the quality of compressions (compression fraction, number of compressions, depth, etc), and (3) to evaluate the quality of rescue breaths (proper volume, frequency of rescue breaths, etc) in both groups.

Methods

STUDY DESIGN

A randomized comparative study was performed with 2 intervention groups: mobile phone app and telephone assistance.

SAMPLE

The convenience sample for this study included 128 nursing students at a university in Spain. The subjects were randomly assigned to one of the interventions: 66 subjects used the mobile phone app (experimental group), and 62 were assisted over the telephone (control group) (Figure). The assignments were made using a single blind procedure, in which the subjects were previously unaware of their participation group. A software program was used to randomize the participants. Inclusion criteria for

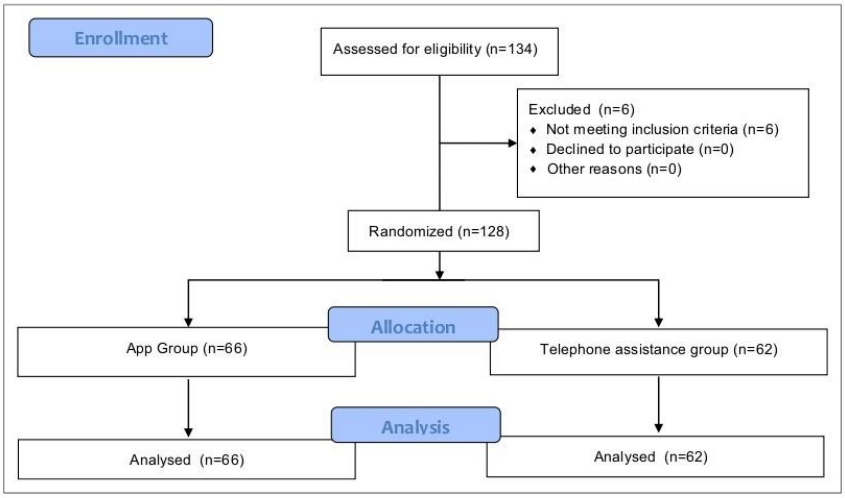


FIGURE
Consolidated Standards of Reporting Trials flow diagram of the study.

participating in the study were being a student in the nursing degree program, being enrolled in the subject of basic and advanced life support, and not having received advanced training in basic life support. It is important to clarify that some students were included who had done a basic course (maximum 2-hour course) on CPR at some point during their schooling. Exclusion criteria included being a foreign exchange student and being enrolled in the subject for at least a second time.

MEASURES

Sociodemographic Data

First, sociodemographic data of the participants, such as sex and age, and information about any previous training in basic life support were gathered.

CPR Observation Checklist

The checklist consisted of 10 questions based on the European Guidelines for Resuscitation[21] for the observation of CPR performance. The 10 items included information from the following stages: recognizing a secure area, checking for level of consciousness, asking for help, opening the airways, checking for breathing, calling emergency services, asking for an automated external defibrillator, starting chest compressions, appropriate rescue breaths, and appropriate chest compressions. Each item was scored in a dichotic way: yes (1) or no (0), and they were totaled to reach a final score of 0-10, to calculate the average final score. Higher scores correlated with a more advanced level of CPR performance. As the intervention took place in a simulated setting, the students were guided by an instructor who was trained in CPR telephone assistance, simulating a real case of assistance after witnessing a cardiac arrest. The steps provided in the telephone instructions followed the guidelines for CPR telephone support for bystanders by the Spanish Cardiopulmonary Resuscitation Council.[4] Regarding the validity of the instrument itself, it was created using the stages for appropriate CPR performance established by the European Guidelines for Resuscitation,[21] which are based on the latest available scientific evidence. Chronbach α was 0.87, which indicates good internal consistency.

CPR Parameters Checklist

This checklist is based on the parameters outlined in SimPad PLUS with SkillReporter by the brand Laerdal. SimPad PLUS with SkillReporter facilitates real-time feedback, records data, and calculates overall performance for thorough training and debrief on CPR performance. The information gathered was classified by CPR level, with the following possible scores: basic level (0-29), intermediate level (30-69), advanced level (70-100). The evaluation included the following elements: a score for compressions (0%-100%), a

score for rescue breaths (0%-100%), compression fraction, compression rate per minute, average depth, compressions with complete expansion, compressions with appropriate depth, compressions with appropriate frequency, average frequency of compressions during the session, rescue breaths, average volume, excessive ventilation volume, appropriate ventilation volume, insufficient ventilation volume, and average frequency of ventilations during the session.

App AsistenteCPR

The mobile app used in this study was AsistenteCPR. The goal of this app is to support users if they encounter a situation of cardiac arrest. It consists of a descriptive guide to the steps recommended to correctly perform CPR through visual, spoken, and written messages. The app was developed on the basis of the current ILCOR guidelines.

PROCEDURE

Once permission was granted to perform the study, we proceeded to carry out the intervention within the basic and advanced life support class. The participants were randomly assigned to 2 intervention groups: mobile phone app and telephone assistance.

App Group

Before the intervention, a mobile phone with the app downloaded was provided to the students. The objective of this group was to perform CPR guided by the AsistenteCPR app. To perform CPR, a Little Anne QCPR manikin was used, and the measurement data detailed in the instruments section was gathered through SimPad PLUS with SkillReporter. First, all of the students were assembled in a room to be explained the objective of the study and sign the informed consent. Then, each student entered a room, separately, where there was a "victim" of cardiac arrest on the floor and a mobile phone next to the victim with the app downloaded on it to guide the participant. The lead researcher was in an adjoining room with visual access to the intervention space and took note of the participant's performance. The intervention time allowed for each participant was 5 minutes. The intervention was carried out by all the participants in the same day to ensure the same conditions for all.

Telephone Assistance Group

First, the participants were assembled in a room to be explained the objectives of the study and to sign the informed consent. Once the participants were randomized and selected, each participant entered a room where there was a victim of cardiac arrest (a Little Anne QCPR manikin) and a telephone next to them to call emergency services. A researcher trained in CPR telephone assistance was located in an adjoining room to answer the telephone call and guide the participant through the intervention, while another researcher took note of the procedure data. The intervention in this group was carried out by all the participants in the same day, and each participant was allotted an intervention time of 5 minutes.

Ethical Aspects

Before beginning the study, permission was obtained from the Ethics and Research Committee of the Department of Nursing, Physical Therapy and Medicine at the University of Almería (EFM-22/19). All participants were informed of the voluntary nature of their participation in the study and the anonymous and confidential treatment of their data. All participants signed an informed consent form before participating, and they were informed about the objective and the characteristics of the study. The study followed the ethical standards established by the Helsinki Declaration in 2015.

Data Analysis

For data analysis, the statistical program SPSS version 24 was used. First, a descriptive analysis was performed on sociodemographic variables, analyzing frequency and percentages for qualitative variables (sex and previous training), and mean and standard deviation for quantitative variables (age). To contrast categorical variables, the chi-square test was used. In the case of quantitative and qualitative variables, before checking the distribution of the sample through the Kolmogorov-Smirnov test, Mann-Whitney nonparametric U test was used. A value of $P < 0.05$ was considered significant.

Results

SOCIODEMOGRAPHIC CHARACTERISTICS

There was a total of 128 participants, of which 75.8% (n = 97) were females and 24.2% (n = 31) males. The average age of the participants was 20.48 years (SD = 5.25). Regarding their previous training in basic life support, 68% (n = 87) had not received training, whereas 32% (n = 41) had received training. Table 1 shows this data, separated by intervention group.

TABLE 1
Sociodemographic characteristics of the sample by intervention group

Variable	App group n = 66	Telephone assistance group n = 62
Sex		
Male	17 (25.8)	14 (22.6)
Female	49 (74.2)	48 (77.4)
Age, y, mean (SD)	19.86 (3.48)	21.15 (6.61)
Previous training		
Yes	22 (33.3)	19 (30.6)
No	44 (66.7)	43 (69.4)

Data are number (%) unless otherwise indicated.
app, application.

OBSERVATION OF CARDIOPULMONARY RESUSCITATION

Taking into account the observation of CPR based on the intervention group, statistically significant differences were found in 5 items: recognizing if the area is secure ($X^2(1) = 26.81$; $P < 0.05$), asking for help ($X^2(1) = 66.07$; $P < 0.05$), opening of airways ($X^2(1)=12.03$; $P < 0.05$), checking for breathing ($X^2(1) = 6.10$; $P < 0.05$), and calling emergency services ($X^2(1) = 12.41$; $P < 0.05$). More specifically, in these 5 items, the app group obtained better results than the telephone assistance group (Table 2).

As for the final score (range of 0-10), the app group had an average score of 5.93 (SD = 1.70) versus the telephone assistance group, which had a score of 3.82 (SD = 2.17), where statistically significant differences were found between the 2 groups ($U = 897.00$; $Z = -5.53$; $P < 0.001$).

PARAMETERS OF CARDIOPULMONARY RESUSCITATION

Regarding the level of CPR performance, considering basic level (0-29), intermediate level (30-69), and advanced level (70-100), no statistically significant differences were found by the intervention group ($X^2(1) = 0.91$; $P = 0.33$). Regarding the parameters measured, there were only statistically significant differences found in the compression fraction item ($U = 1,593.00$; $Z = -2.16$; $P < 0.05$) (Supplementary Figure). The rest of the items are described in Supplementary Table.

Discussion

The purpose of this study was to compare the effectiveness of using a mobile phone app versus telephone operator assistance in performing CPR techniques in simulated settings. The results indicate that there are some actions that are better performed by resuscitators who use the app. Nonetheless, there were no statistically significant differences found in the CPR parameters measured if the app or telephone assistance was used, except in the compression fraction item. In this case, the participants who used the app gained better outcomes than those who had assistance over the telephone, but in neither case did they reach the optimal level of 80%.[16]

First, regarding the students' previous training, none of the students had received advanced training in CPR. Several studies have shown that mobile phone apps, which offer CPR assistance, especially on the topic of chest compressions, improve the quality of the intervention if those participating have training in CPR.[22,23] If they do not have previous training or experience, the app may not achieve its goal.[24] Similarly, the simulation studies carried out with telephone assistance have reported higher quality CPR when performed by trained resuscitators.[25] However, other studies indicate that resuscitators without previous CPR training who are instructed by a telephone assistant show CPR skills comparable with previously trained individuals, even though they take longer to start CPR than the trained group.[8]

Considering telephone assistance, the results indicate a basic level of CPR implementation. The skills of the telephone operator in guiding the bystander through CPR protocol depend on the capacity of the telephone operator, the number of calls about CPR they have taken, and the comments that they have received about the patients' treatment results.[26] One of the most difficult aspects of CPR was giving adequate rescue breaths; they were done correctly in only 25% of the cases in this study. The same results were found in a study by Nord-Ljungquist et al[26] in which the most difficult aspect of CPR was controlling the airways. Previous studies have also shown that control of the airways was the part of the procedure that took the resuscitator the longest to do while they received telephone assistance.[27] As for chest compressions with telephone assistance, the average depth and frequency values established for CPR were not obtained.[18] Similar results were found in the aforementioned study by Nord-Ljungquist et al,[26] which demonstrates how complex it can be to correctly follow the instructions given by the operator.

Regarding app use, better results were obtained in certain aspects of CPR such as recognizing if the area is

TABLE 2
CPR Observation results by group.

Item	App group (n = 66) Yes		No		Telephone assistance group (n = 62) Yes		No		X^2	*P*
	n	%	n	%	n	%	n	%		
Recognize if the area is secure	36	54.5%	30	45.5%	7	11.3%	55	88.7%	26.81	<0.001
Consciousness level	53	80.3%	13	19.7%	45	72.6%	17	27.4%	1.60	0.21
Asking for help	57	86.4%	9	13.6%	9	14.5%	53	85.5%	66.07	<0.001
Opening airways	32	48.5%	34	51.5%	12	19.4%	50	80.6%	12.03	<0.001
Checking for breathing	56	84.8%	10	15.2%	41	66.1%	21	33.9%	6.10	0.01
Calling emergency services	45	68.2%	21	31.8%	23	37.1%	39	62.9%	12.41	<0.001
Asking for a defibrillator	—	--	66	100%	2	3.2%	60	96.8%	2.16	0.23
Starting chest compressions	61	92.4%	5	7.6%	58	93.5%	4	6.5%	0.06	0.54
Proper chest compressions	29	43.9%	37	56.1%	25	40.3%	37	59.7%	0.17	0.41
Proper rescue breaths	23	34.8%	43	65.2%	15	24.2%	47	75.8%	1.74	0.13

app, application; CPR, cardiopulmonary resuscitation.

secure, asking for help, opening the airways, checking for breathing, and calling emergency services than among the group that received telephone assistance. This contrasts with the study by Fernández-Méndez et al,[24] which did not find better results in CPR guided by an app, and in some cases, even showed worse CPR performance.

More specifically, in chest compressions, the rhythm of the compressions was higher among those participants that were assisted over the telephone. In CPR guided by feedback apps, there have been improvements noted in the compression rhythm.[28] In a study performed by Plata et al,[29] using an app improved the quality of the CPR in terms of compression rate, correct hand positioning, opening up the airways, and not delaying the start of CPR compared with telephone assistance. However, the use of an app did not significantly improve the depth of compressions. Similarly, in this study, only 11% of the participants performed deep enough chest compressions. Fernández-Méndez et al[24] found similar results in their study; in all of the analyses performed on depth of compressions, the depths were insufficient. This is a recurring factor in studies carried out with layperson resuscitators,[30] and it may be due to a lack of experience or training, among other factors.

Finally, the results obtained in this study did not show statistically significant differences when comparing the app with telephone assistance regarding the CPR parameters measured, except for compression fraction. In both cases, the CPR level was basic, but there were no additional delays in initiating CPR nor was there a worse result using a mobile device, as the results of other studies suggest.[31]

Limitations

The results of this study must be considered in the context of some limitations. First, the sample was drawn from a convenience sample, which makes it difficult to generalize the results. Second, some participants had already received basic CPR training during their schooling. Third, the lead researcher observed and recorded the accuracy of the CPR observation checklist and was not blinded, which may have introduced bias. The study took place in a simulated setting, therefore the conditions only reflect real-life situations to a certain point. In addition, there were certain data that were not collected, such as intervention time or delay in initiating CPR, which would have enhanced the results of this study.

Implications for Emergency Nurses

This study can contribute to improving the performance of witnesses of a cardiac arrest. The results of this study indicate that both methods can be helpful in providing adequate basic life support. Reducing the reaction time and performing a proper intervention are 2 fundamental elements in increasing the possibilities for survival in cardiac arrest victims. The availability of the app can contribute to

an increase in bystander participation in performing CPR and promote positive survival rates. Because part of the instructions included calling for help, the use of the assistive device would help in decreasing the time from the initial event to definitive care. In addition, the expertise of nursing professionals in emergency rooms could be a potential source of knowledge for improving apps focused on CPR; therefore, these professionals should take on a fundamental role in their design and development. New technologies have now become an important part of clinical interventions, thus, having nursing professionals participate in this subject is a key factor in making these apps effective.

Conclusions

In conclusion, better results were observed among participants who used the mobile phone app in multiple factors including recognizing if the area is secure, asking for help, opening the airways, checking for breathing, and calling emergency services. Nonetheless, the results indicate that there were no differences found in the CPR parameters measured when using the mobile phone app versus telephone operator assistance, which shows that both resources may be useful for bystanders to take action should they witness an out-of-hospital cardiac arrest. However, additional research is needed to determine the most effective feedback measures so that layperson resuscitators can provide greater levels of care during CPR, regardless of which method they use as a guide.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2020.03.015.

Author Disclosures

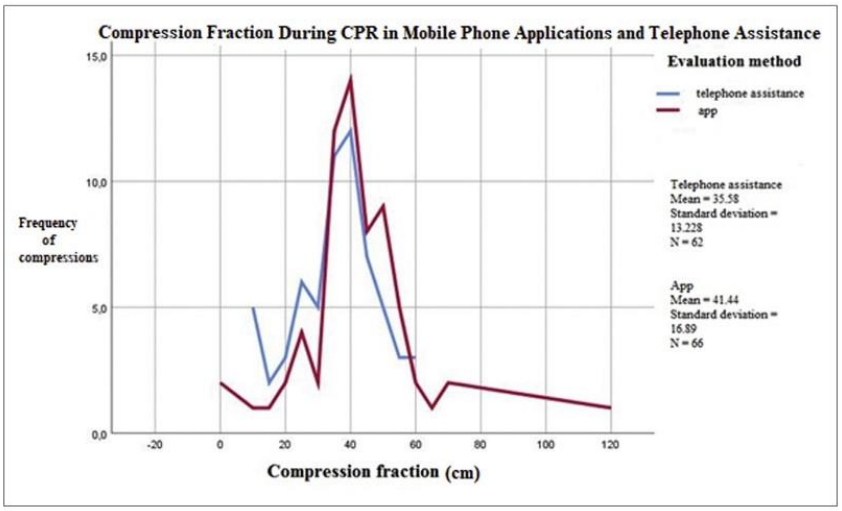
Conflicts of interest: none to report.

REFERENCES

1. Atwood C, Eisenberg MS, Herlitz J, Rea TD. Incidence of EMS-treated out-of-hospital cardiac arrest in Europe. *Resuscitation*. 2005;67(1):75-80. https://doi.org/10.1016/j.resuscitation.2005.03.021
2. Go AS, Mozaffarian D, Roger VL, et al. Heart disease and stroke statistics — 2014 update: a report from the American Heart Association. *Circulation*. 2014;129(3):e28-e292. https://doi.org/10.1161/01.cir.0000441139.02102.80
3. Gazmuri RJ, Álvarez-Fernández JA. [Trends in cardiopulmonary resuscitation] [published correction appears in Med Intensiva. 2009 Mar;33(2):96]. *Med intensiva*. 2009;33(1):31-39. https://doi.org/10.1016/s0210-5691(09)70303-1
4. García del Águila J, López-Messa J, Rossell-Ortiz F, et al. Recomendaciones para el soporte telefónico a la reanimación por testigos desde los centros de coordinación de urgencias y emergencias. *Med Intensiva*. 2015;39(5):298-302.
5. Tanigawa K, Iwami T, Nishiyama C, Nonogi H, Kawamura T. Are trained individuals more likely to perform bystander CPR? An observational study. *Resuscitation*. 2011;82(5):523-528. https://doi.org/10.1016/j.resuscitation.2011.01.027
6. Birkenes TS, Myklebust H, Hardeland C, et al. How to train for telephone-CPR. *Trends Anaesth Crit Care*. 2015;5(5):124-129. https://doi.org/10.1016/j.tacc.2015.07.003
7. Tanaka Y, Taniguchi J, Wato Y, Yoshida Y, Inaba H. The continuous quality improvement project for telephone-assisted instruction of cardiopulmonary resuscitation increased the incidence of bystander CPR and improved the outcomes of out-of-hospital cardiac arrests. *Resuscitation*. 2012;83(10):1234-1241. https://doi.org/10.1016/j.resuscitation.2012.02.013
8. Bohm K, Vaillancourt C, Charette ML, Dunford J, Castrén M. In patients with out-of-hospital- cardiac arrest, does the provision of dispatch cardiopulmonary resuscitation instructions as opposed to no instructions improve outcome: a systematic review of the literature. *Resuscitation*. 2011;82(12):1490-1495. https://doi.org/10.1016/j.resuscitation.2011.09.004
9. Song KJ, Shin SD, Park CB, et al. Dispatcher-assisted bystander cardiopulmonary resuscitation in a metropolitan city: a before–after population-based study. *Resuscitation*. 2014;85(1):34-41. https://doi.org/10.1016/j.resuscitation.2013.06.004
10. O'Neill JF, Deakin CD. Evaluation of telephone CPR advice for adult cardiac arrest patients. *Resuscitation*. 2007;74(1):63-67. https://doi.org/10.1016/j.resuscitation.2006.11.007
11. Spelten O, Warnecke T, Wetsch WA, Schier R, Böttiger BW, Hinkelbein J. Dispatcher-assisted compression-only cardiopulmonary resuscitation provides best quality cardiopulmonary resuscitation by laypersons: a randomised controlled single-blinded manikin trial. *Eur J Anaesthesiol*. 2016;33(8):575-580. https://doi.org/10.1097/EJA.0000000000000432
12. Cheskes S. High School CPR training: it's only an APP away!!. *Resuscitation*. 2017;120:A9-A10. https://doi.org/10.1016/j.resuscitation.2017.08.241
13. Abella BS, Edelson DP, Kim S, et al. CPR quality improvement during in-hospital cardiac arrest using a real-time audiovisual feedback system. *Resuscitation*. 2007;73(1):54-61. https://doi.org/10.1016/j.resuscitation.2006.10.027
14. Yeung J, Meeks R, Edelson D, Gao F, Soar J, Perkins GD. The use of CPR feedback/prompt devices during training and CPR performance: a systematic review. *Resuscitation*. 2009;80(7):743-751. https://doi.org/10.1016/j.resuscitation.2009.04.012
15. Ringh M, Rosenqvist M, Hollenberg J, et al. Mobile-phone dispatch of laypersons for CPR in out-of-hospital cardiac arrest. *N Engl J Med*. 2015;372(24):2316-2325. https://doi.org/10.1056/NEJMoa1406038

16. Perkins GD, Handley AJ, Koster RW, et al. European resuscitation council guidelines for resuscitation 2015: section 2. Adult basic life support and automated external defibrillation. *Resuscitation*. 2015;95:81-99. https://doi.org/10.1016/j.resuscitation.2015.07.015
17. Kalz M, Lenssen N, Felzen M, et al. Smartphone APPs for cardiopulmonary resuscitation training and real incident support: a mixed-methods evaluation study. *J Med Internet Res*. 2014;16(3):e89. https://doi.org/10.2196/jmir.2951
18. Yeung J, Davies R, Gao F, Perkins GD. A randomised control trial of prompt and feedback devices and their impact on quality of chest compressions - a simulation study. *Resuscitation*. 2014;85(4):553-559. https://doi.org/10.1016/j.resuscitation.2014.01.015
19. An M, Kim Y, Cho WK. Effect of smart devices on the quality of CPR training: a systematic review. *Resuscitation*. 2019;144:145-156. https://doi.org/10.1016/j.resuscitation.2019.07.011
20. Eaton G, Renshaw J, Gregory P, Kilner T. Can the British Heart Foundation PocketCPR application improve the performance of chest compressions during bystander resuscitation: a randomised crossover manikin study. *Health Informatics J*. 2018;24(1):14-23. https://doi.org/10.1177/1460458216652645
21. Monsieurs KG, Nolan JP, Bossaert LL, et al. European resuscitation council guidelines for resuscitation 2015: section 1. Executive Summary. *Resuscitation*. 2015;95:1-80. https://doi.org/10.1016/j.resuscitation.2015.07.038
22. Skorning M, Beckers SK, Brokmann JC, et al. New visual feedback device improves performance of chest compressions by professionals in simulated cardiac arrest. *Resuscitation*. 2010;81(1):53-58. https://doi.org/10.1016/j.resuscitation.2009.10.005
23. Pozner CN, Almozlino A, Elmer J, Poole S, McNamara D, Barash D. Cardiopulmonary resuscitation feedback improves the quality of chest compressions provided by hospital health care professionals. *Am J Emerg Med*. 2011;29(6):618-625. https://doi.org/10.1016/j.ajem.2010.01.008
24. Fernández-Méndez F, Barcala-Furelos R, Otero-Agra M, Fernández-Méndez M, Santos-Folgar M, Rodríguez-Núñez A. Evaluación sobre la técnica de compresiones torácicas usando APP. ¿Ayudan o entorpecen la reanimación cardiopulmonar? *Med Intensiva*. 2018;44(2):72-79.
25. Birkenes TS, Myklebust H, Neset A, Olasveengen TM, Kramer-Johansen J, Kramer-Johansen J. Video analysis of dispatcher-rescuer teamwork-effects on CPR technique and performance. *Resuscitation*. 2012;83(4):494-499. https://doi.org/10.1016/j.resuscitation.2011.09.021
26. Nord-Ljungquist H, Brännström M, Bohm K. Communication and protocol compliance and their relation to the quality of cardiopulmonary resuscitation (CPR): a mixed-methods study of simulated telephone-assisted CPR. *Int Emerg Nurs*. 2015;23(3):254-259. https://doi.org/10.1016/j.ienj.2014.12.001
27. Clegg GR, Lyon RM, James S, Branigan HP, Bard EG, Egan GJ. Dispatcher-assisted CPR: where are the hold-ups during calls to emergency dispatchers? A preliminary analysis of caller-dispatcher interactions during out-of-hospital cardiac arrest using a novel call transcription technique. *Resuscitation*. 2014;85(1):49-52. https://doi.org/10.1016/j.resuscitation.2013.08.018
28. Abelairas-Gómez C, Gili-Roig C, López-García S, Palacios-Aguilar J, Romo-Pérez V, Barcala-Furelos R. Benefits of visual feedback on cardiopulmonary resuscitation training: A non-randomised manikin study with bystanders. *HK J Emerg Med*. 2017;24(3):115-122. https://doi.org/10.1177/102490791702400301
29. Plata C, Stolz M, Warnecke T, et al. Using a smartphone application (PocketCPR) to determine CPR quality in a bystander CPR scenario — A manikin trial. *Resuscitation*. 2019;137:87-93. https://doi.org/10.1016/j.resuscitation.2019.01.039
30. González-Salvado V, Fernández-Méndez F, Barcala-Furelos R, Peña-Gil C, González-Juanatey JR, Rodríguez-Núñez A. Very brief training for lay people in hands-only cardiopulmonary resuscitation. Effect of real-time feedback. *Am J Emerg Med*. 2016;34(6):993-998. https://doi.org/10.1016/j.ajem.2016.02.047
31. Zapletal B, Greif R, Stumpf D, et al. Comparing three CPR feedback devices and standard BLS in a single rescuer scenario: A randomized simulation study. *Resuscitation*. 2014;85(4):560-566. https://doi.org/10.1016/j.resuscitation.2013.10.028

Supplemental Material



SUPPLEMENTARY FIGURE

Compression fraction during Cty PR in mobile phone apps and telephone assistance. app, application; CPR, cardiopulmonary resuscitation.

SUPPLEMENTARY TABLE
CPR parameter results

Parameter	App group (n = 66)		Telephone assistance group (n = 62)		Z	*P*
	M	SD	M	SD		
CPR level					-0.95	0.33
Basic level (n, %)	63	95.9	61	98.4		
Intermediate level (n, %)	3	4.5	1	1.6		
Compression score, %	14.53	25.15	19.42	25.80	-1.52	0.13
Rescue breaths score, %	26.58	33.66	24.39	30.05	-0.22	0.82
Compression fraction, %	41.44	16.89	35.58	13.22	-2.16	0.03
Number of compressions/min	120.50	53.88	109	48.67	-1.09	0.27
Average depth, mm	37.33	20.78	36.87	11.56	-1.20	0.23
Compressions with full expansion, %	70.95	33.51	73.34	32.05	-0.59	0.55
Compressions with enough depth, %	10.47	24.75	16.79	29.67	-1.46	0.14
Compressions with proper frequency, %	28.36	33.20	30.56	34.19	-0.32	0.75
Average frequency of compressions during the session, min	100.90	20.15	95.76	31.35	-0.64	0.52
Rescue breaths	5.35	16.40	2.10	2.85	-0.70	0.48
Average volume, mL	218.08	271.82	245.76	312.64	-0.40	0.72
Rescue breaths with excessive volume, %	8.09	19.43	11.27	26.70	-0.17	0.86
Rescue breaths with proper volume, %	15.23	27.91	12.92	21.37	-0.39	0.70
Rescue breaths with insufficient volume, %	23.65	38.38	23.40	34.59	-0.15	0.88
Average frequency of rescue breaths during the session, min	0.74	1.10	0.73	1.02	-0.12	0.91

app, application; CPR, cardiopulmonary resuscitation; M, mean.

4.2. Are you prepared to save a life? Nursing students' experience in advanced life support practice.

International Journal of *Environmental Research and Public Health*

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Article

Are You Prepared to Save a Life? Nursing Students' Experience in Advanced Life Support Practice

Lorena Gutiérrez-Puertas [1], Verónica V. Márquez-Hernández [1,2,*], Vanesa Gutiérrez-Puertas [1], Mª Carmen Rodríguez-García [1,2], Alba García-Viola [1] and Gabriel Aguilera-Manrique [1,2]

[1] Department of Nursing, Physiotherapy and Medicine, Faculty of Health Sciences, University of Almeria Sacramento S/N, en La Cañada de San Urbano, 04120 Almería, Spain; lgp524@ual.es (L.G.-P.); vgp919@ual.es (V.G.-P.); mrg451@ual.es (M.C.R.-G.); albagarciaviola@hotmail.com (A.G.-V.); gaguiler@ual.es (G.A.-M.)
[2] Research Group of Health Sciences, CTS-451, 04120 Almería, Spain
* Correspondence: vmh380@ual.es; Tel.: +34-950-214-590

Abstract: The objective of this study was to explore the experiences and perceptions of nursing students after applying advanced life support techniques on a hospitalised patient in cardiac arrest in a simulated setting. A qualitative descriptive phenomenological study was conducted. Fifty-four nursing students from the University of Almería (Spain) participated. Three main themes and six subthemes were identified, which illustrate the experiences and perceptions of nursing students about performing advanced life support. The main themes were: (1) Analysing practice as part of the learning process, with the subthemes "working in an unknown environment" and "acquiring knowledge as the key to success"; (2) Facing reality: nursing students' perceptions of an emergency situation, with the subthemes "facing stressful elements" and "emotional impact in emergency situations"; (3) Experience as a key element to integrating advanced life support into the healthcare setting, with the subthemes "discovering and facing the experience as a team" and "linking and transferring the situation to a real clinical setting". The nursing students reported that the process of practising for an emergency situation through simulation was a fundamental part of their training, as it allowed them to acquire skills necessary for emergency situations and improve their clinical performance in advanced life support. In addition, they considered the experience a key element in integrating advanced life support into the healthcare setting. The results of this study highlight the need to develop and implement training programs focused on clinical and teamwork skills in nursing programs.

Keywords: advanced life support; cardiac arrest; hospital; nursing students; qualitative research

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1. Introduction

Students in nursing programs face a great challenge, as they must master both didactic content and clinical skills [1]. The clinical setting allows the students to practise on patients what they have learned in the nursing-practice laboratory [2]. However, nursing students have difficulties developing skills in clinical procedures during their clinical practice [3], such as performing cardiac arrest techniques. Therefore, it is necessary for university professors to provide sound training in clinical skills, based on innovative teaching methodologies, in order to guarantee patient safety and foster self-confidence in the students when carrying out clinical procedures on patients [4].

Cardiac arrest is a time-dependent, high-acuity event, which requires the coordination of various healthcare professionals at once to optimise the success of cardiopulmonary resuscitation (CPR) [5]. The organisation of the team in the hospital environment becomes a challenge due to the stress that comes from performing advanced life support

(ALS) [6]. Similarly, compliance with ALS guidelines is related to a higher rate of return of spontaneous circulation, which is key to preventing patient deterioration and minimising complications [7]. Furthermore, adjusting to the recommended times, as well as determining the optimal time to monitor the rhythm, epinephrine and defibrillation are important aspects that could improve the team's performance [5]. High-quality CPR could positively affect patient outcomes and survival rates [8,9]. Other aspects that could optimise ALS performance are team communication [10] and leadership skills [11].

Advanced life support skills, as well as teamwork, are essential to healthcare professionals, which is why ALS training and practice are needed [7]. The American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) recommend that students in health professions be trained in advance in ALS techniques [12]. Specifically, ALS training continues to be a vital part of nursing education and requires an adequate intervention to guarantee that nurses feel competent and are capable of acting when faced with individuals in cardiac arrest [13]. Moreover, nursing curricula must incorporate elements such as CPR techniques into the early stages of the students' education, with the aim of generating self-confidence and preparing the students for this important procedure in clinical practice [14], although several studies show the majority of nursing students have suitable ALS skills [15,16].

Furthermore, a high-fidelity simulation could be an efficient way to learn actively and practice the ALS guidelines in a safe and reproducible environment [17]. This type of simulation may improve knowledge, acquisition of technical and non-technical skills, and teamwork and self-confidence in performing ALS techniques [15]. Similarly, ALS may have to be performed in a variety of clinical situations. Thus, simulation would enable students to develop situational awareness, which is an important aspect of carrying out ALS guidelines in the clinical environment [18]. Previous studies have shown that simulation positively affects nursing students' learning and competency acquisition for managing emergency situations, like ALS [19]. Furthermore, simulation based on ALS improves knowledge retention and skills in nursing students [20] and minimizes the time it takes to act during these situations [15]. However, there are no studies that explore the experience of nursing students in the application of ALS techniques, considering the stressful situation they must face while working as a team, in order to identify the factors involved in performing ALS techniques, which is the novel nature of this study.

The educational framework for this simulation workshop was based on Kolb's Experiential Learning Theory. Following the basic concepts of this theory, the students who participated in the simulation experienced a real-life situation. Afterwards, the students reflected on their actions during the debriefing session to analyse the experience and get feedback on how they felt during the activity. Moreover, the students were encouraged to reflect on what they could have done differently and generalize those topics to other situations, which allowed an abstract conceptualization that could be extrapolated to similar situations [21].

As previously mentioned, the application of ALS techniques in the clinical setting are essential for nursing students, given that nursing professionals are the first to act in these types of situations [22]. In addition, previous experience has been shown to be crucial to the success of carrying out ALS techniques [23]. However, there are no studies that explore the experience of nursing students in the application of ALS techniques, taking into account the stressful situation they must face, while working as a team. Therefore, the objective of this study was to explore the experiences and perceptions of nursing students after applying advanced life support techniques on a hospitalised patient in cardiac arrest in a simulated setting.

2. Materials and Methods

2.1. Study Design

A descriptive phenomenological approach was used as a guide to enable a rich understanding of the participants' life experiences. Phenomenology was created to explore the meanings of live experiences, to be directly open to phenomena and to be able to perceive "the things" themselves [24]. In Husserl's descriptive phenomenology, in order to clarify the life-world, researchers must put aside prior knowledge and preconceptions as much as possible so that descriptions can reveal unexpected connections and meanings [25]. The study was presented in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist [26].

2.2. Participants

The nursing students were from the University of Almería (Spain). The nursing students were selected through an intentional convenience sample and were not given economic compensation for their participation. The inclusion criteria established were: (a) being enrolled in the subject Basic Life Support (BLS) and ALS, and (b) having attended all the previous training sessions on BLS and ALS. The exclusion criteria included: (a) being a foreign exchange student, in order to ensure complete understanding of the experience, and (b) being a healthcare professional with experience in CPR.

2.3. Data Collection

Data collection took place in a laboratory in the Health Sciences Faculty. Data collection included 6 focus groups (FGs) and took place in March 2020. The focus groups were moderated by the lead researcher. The FGs allowed participants to express their perceptions and experiences in a spontaneous way and to reflect on them, generating an exchange of ideas [27]. Previously, a script with open questions was developed, based on a review of the literature (Table 1). Each FG included nine nursing students who agreed to discuss and share their simulation experiences in applying ALS to a hospitalised patient who went into cardiac arrest.

Table 1. Guide questions used for the focus groups.

Guide Questions
Could you tell us about your first experience of advanced life support in the hospital environment?
How do you think this experience has influenced in your clinical training?
Could you tell me if you have detected elements that interfere with the development of advanced life support procedures? Which have they been? Why?
How have you felt acting in this emergency situation? Why?
Tell me about your experience working as a team
What teamwork factors have you detected that influences the adequate development of advanced life support?
How do you think this experience could help you develop advanced life support in the clinical practices?
What are your general impressions of the experience?
Is there anything else you would like to add about this theme?

The simulated scenario (Figure 1) was developed according to the recommendations of the International Nursing Association for Clinical Simulation and Learning (INACSL) standards of best practice in simulation [28]. Before participating in the simulation, the participants attended six informative sessions about ALS procedures and received training on the guidelines to follow when assisting a patient who goes into cardiac arrest in a hospital setting. The pre-briefing included an orientation on the expectations of the students, and they were informed that the aim of the simulation was for training purposes, although they would be evaluated as well, as the evaluation formed part of the training process. Before the students began the simulation, a group discussion was held on ALS intervention protocols. The lead researcher briefed the students on the patient's current

hospital situation. The scenario focused on ALS skill development. Actors assumed the role of the patient's voice, having been instructed in a standardised orientation session on how to perform their roles. The assignment of teams, as well as the roles of nursing students within the teams, was done by the professors of the subject. The scenario began with a nursing student, who was in a hospital room with a patient. The patient reported feeling poorly, and after a few seconds, the patient lost consciousness and became unresponsive. The nursing student that was in the room had to call for help, and then two other nursing students would join the first student. One of the three students took on the role of leader before beginning their simulation. The observers watched the scene from a separate room through a video screen. The observers were registered nurses who had experience in CPR as well as basic life support- advanced life support (BLS-ACLS) training. The role of the observers was to document the interventions completed by the nurses and identify elements of teamwork. Subsequently, once all of the simulations were carried out, the lead researcher held a debriefing session to analyse the experience and get feedback on how the nursing students felt throughout the activity.

The FGs were monitored by the lead researcher. The duration of the FGs varied from 20 to 40 min. Sociodemographic data was collected from all participants before beginning the FGs. The responses of participants in FGs were audio-recorded and transcribed [27]. Data collection through the FGs ceased when data saturation was reached.

Figure 1. The simulated scenario.

2.4. Data Analysis

For data analysis, the transcriptions were included in a hermeneutic unit and analysed using the Atlas-ti 8.0. software. To ensure the reliability and validity of the results, the researchers followed the Colaizzi [29] methods of descriptive phenomenological data analysis: (1) Completed transcript of the interview and understood the participants´ lived experiences; (2) Significant sentences were scrutinized to meaningful statements; (3) Meaningful statements were extracted to meaningful units; (4) Meaningful units were classified into subthemes and themes; (5) Themes and subthemes were integrated into a comprehensive description of the participants´ lived experiences; (6) The basic structure of the participants´ lived experiences was described; (7) Two interviewees analysed the findings for verification of the accuracy of the transcripts and resemblance of their experiences.

2.5. Ethical Considerations

The study was approved by the Ethics and Research Committee at the university where it was carried out (EFM-62/20). All participants were previously informed about the objective of the research as well as the voluntary nature of their participation. The

participants signed an informed consent form prior to starting their interviews. In addition, participants were asked for permission to record their conversations and given access to the results of the study. To ensure anonymity and confidentiality of the data, all interviews received codes. The guidelines of the Declaration of Helsinki were followed at all times.

2.6. Rigour

Finally, reliability and rigour were established for the qualitative data. With the aim of increasing reliability, data triangulation was performed by three of the researchers (L.G.P., V.G.P., and V.M.H.), which included analysing the data separately and discussing the differences until a consensus was reached, in order to select themes and subthemes. A separate researcher (G.A.M.) read the transcriptions of the FGs to confirm their concurrence with the findings obtained (themes and subthemes), verifying that all of the participants' perspectives were considered. The recordings, data analysis and interviews were saved to ensure reliability. The participants verified the transcriptions and data analysis, ensuring their confirmability.

3. Results

The total study sample consisted of 54 nursing students, distributed into 6 FGs. Of the participants, 75.9% (n = 41) were female and 24.1% (n = 13) were male. The average age was 20.63 years old (SD = 4.42; range = 18-46). The sociodemographic characteristics of participants can be seen in Table 2.

Table 2. Socio-demographic data of the participants (n = 54).

Variable	Total (n = 54)	
	n	**%**
Sex		
Male	13	24.1
Female	41	75.9
Age	20.63 *	4.42 **
Previous Training Basic PCR		
Yes	8	14.8
No	46	85.2

* Mean ** Standard Deviation.

The three main themes, subthemes and units of meaning that emerged in the analysis are presented in Table 3.

Table 3. Units of meaning, subthemes and main themes of the analysis.

Units of Meaning	Subthemes	Main Themes
Out of place, contextualization of the realistic environment, abstraction of the evaluation, feeling observed.	Working in an unknown environment.	Theme 1. Analysing practice as a part of the training process.
Theory-practice gap, integration of procedures, meaningful learning, satisfactory experience.	Acquiring knowledge as the key to success.	
Preconceived ideas, task simultaneity, psychological pressure, time.	Facing stressful elements.	Theme 2. Facing reality: nursing students' perceptions in an emergency situation.
Fear, nervousness, overwhelmed, frustration.	Emotional impact in emergency situations.	
Communication, leadership, work a team.	Discovering and facing the experience as a team.	

Clinical training, clinical performance, self-confidence, improved healthcare.	Linking and transferring the situation to a real clinical setting.	Theme 3. Experience as a key element to integrating ALS in care settings.

3.1. Analysing Practice as a Part of the Training Process

One of the main themes that emerged from the interviews was the importance of simulation in nursing training. This meaning is based on the evaluation that nursing students make of their performance, in a setting which is full of uncertainty for them, as part of the learning process. The participants reported that the simulation allowed them to acquire key skills for successful ALS. This theme contains two subthemes, discussed below.

3.1.1. Working in an Unknown Environment

The nursing students identified their work environment as one of the most essential elements to the successful performance of ALS guidelines. At the beginning of the simulation, participants reported feeling out of place when facing an unknown environment, which caused difficulties in initiating ALS manoeuvres. Similarly, participants highlighted the realism of the environment in which the simulation occurred. This realism helped the students to fully immerse themselves in the situation, and to feel like independent nursing professionals with self-reliance and responsibility over the procedures that they carried out, regardless of being evaluated.

> "I felt a bit lost at the beginning and it was like...oh dear, what do I do now? I didn't know where to start, I felt out of place and in a crisis situation, where you have to act quickly…" (G3-P2, female, 19 years old)

> "It was all really realistic, and that helps, because you take on the role more, you really get into it, you feel as if you were actually the patient's nurse, and it shows you how you would react… I forgot that there were people evaluating us, I just thought about doing my best, because the patient's life depended on us." (G1-P5, female, 20 years old)

Some participants commented that feeling observed did not negatively interfere with them carrying out ALS, but rather, it increased their expectations for themselves, as they felt that their ability to save someone's life was being evaluated.

> "You know they're watching you, but it's not distracting, although I did feel questioned. That [feeling observed] makes you take it more seriously." (G3-P6, female, 19 years old)

3.1.2. Acquiring Knowledge as the Key to Success

One of the aspects which the participants indicated could be improved in the training process was the integration of theoretical concepts into practice. The participants noted that, despite having received theoretical training in ALS, when it came to the real situation, they had trouble applying that knowledge.

> "Theory is one thing, and how you apply it is another. When it comes time to really do it, you say, what do I have to do? And that...how do I do it again? ...With everything they've taught us about the rhythm, we still got it wrong when identifying it..." (G2-P8, female, 25 years old)

Some participants reported that the simulation allowed them to incorporate various techniques into one situation. This led students to comprehend the complexity of the clinical work that nursing professionals have to deal with when addressing emergency situations.

> "In our practical classes, you focus on a certain intervention, for example, practice about the Ambu® is only about the Ambu®. Here [in the simulation] you

focus on several different things… you see the complexity of the work [of nursing professionals] and you realise all that it entails." (G4-P7, male, 23 years old)

The debriefing allowed the students to reflect on their performance and detect any aspects they needed to improve for similar future situations. This led students to recognise simulation as the learning methodology that could be most beneficial to completing their training in ALS.

> "The fact that they [the professors] tell you the mistakes you have made so you know if you've performed well on the things you studied… that way you can learn from your mistakes... This [the debriefing] helps you see what you've done wrong so you can correct those mistakes and learn more than you would otherwise." (G2-P9, female, 20 years old)

3.2. Facing Reality: Nursing Students' Perceptions in an Emergency Situation

This category explored the stressful factors perceived by the students, as well as the emotional impact that they experienced when facing an emergency situation. The students identified several stressful elements that interfered with performing ALS, which made it more difficult to achieve the desired outcome of saving the patient's life.

3.2.1. Facing Stressful Elements

The participants noted that they had to face several stressful elements during the simulation. The students had preconceived ideas about the complexity of the situation, as well as about the work that nursing professionals do. When faced with the complexity of the situation, the students reported having difficulty concentrating and an inability to carry out interventions in a simultaneous way.

> "You imagine that it's going to be easier, you don't think that one nurse is capable of doing everything that has to be done. You have to be aware of so many things, you have a lot weighing on you… you feel a bit lost, overwhelmed, incapable, and that leads to mistakes...nothing turned out as I hoped it would, I couldn't concentrate...my heart was pounding." (G3-P7, female, 21 years old)

In addition, the fact that students had to perform the steps of ALS rapidly, due to the importance of time in the success rate of CPR, made them work quickly, yet not as efficiently.

> "The person is dying, so ti5,35 cmme is crucial in saving them...you feel like you can't go any faster...so you start rushing, miss steps, you get more and more nervous...you see that time is running out...that they're going to die." (G6-P9, male, 20 years old)

3.2.2. Emotional Impact in Emergency Situations

When faced with the emergency situation, participants experienced an emotional impact that manifested itself through various feelings that arose throughout the practice. These feelings stemmed from the fact that they wanted to save the patient's life, but their inexperience in making decisions autonomously hindered their performance in the interventions. Some participants noted feeling a fear of failure, which led them to want to release their feelings of guilt. Others spoke about the nervousness that they felt, which gave them insecurity upon taking action, which increased their stress levels, as they felt they were not helping the patient.

> "Fear just took over… we were just looking around guiltily [at each other] … we were failing." (G3-P2, female, 19 years old)

Another feeling expressed by the students was distress, caused by the uncertainty of the situation and by perceiving that the results were beyond their control, increasing their anxiety. Similarly, their inability to save the patient's life was taken as a personal matter,

causing them to feel disappointed with themselves, which manifested as a sense of frustration.

> "We felt like crying… I feel frustrated and disappointed in myself… I just kept making mistakes… I couldn't save his life… I just wasn't able to." (G6-P2, female, 19 years old)

3.3. Experience as a Key Element to Integrating ALS in Care Settings

This theme analysed the students' perception of the teamwork needed to perform the ALS steps, as well as the transfer of the simulation experience to a clinical setting. It includes the subthemes "discovering and facing the experience as a team" and "linking and transferring the situation to a real clinical setting".

3.3.1. Discovering and Facing the Experience as a Team

The experience of working as a team was regarded as revealing for the participants. This experience allowed a greater understanding of the importance of teamwork in providing adequate care and achieving desired patient outcomes. Students recognised that effective communication was key to having positive interactions and improving decision-making during the process of ALS. A lack of communication led students to make decisions independently, generating conflicts between them, which decreased their efficiency.

> "[The members of the team] we communicated well, we told each other what we were doing as we did it and any changes that occurred in the patient... agreeing on the different actions to take...we were coordinated...it went well for us." (G6-P3, male, 22 years old)

> "If you don't communicate, it's chaos, everyone does their own thing, which is what happened to us... we were both preparing the same material... we were wasting our time... And she [my classmate] got mad at me." (G1-P8, female, 32 years old)

The participants considered the leader to be the person responsible for directing, organising, prioritising and assigning actions to every member of the team, facilitating the cohesion of the team, in order to guarantee the success of their performance and to save the patient's life. Some participants recognised their inability to be a leader.

> "I believe it is important that one person lead because that way we followed a specific order, we prioritised…we worked in a coordinated way and…everything was focused on saving the patient." (G6-P2, female, 19 years old)

> "I'm not used to giving my classmates orders… I'm not good at it…Not everybody can be a leader, you have to have certain qualities…know how to communicate…have experience, I mean, you have to have done it more." (G5-P8, female, 20 years old)

Rapport was another central aspect to the success of working as a team. Some participants commented that working as a team minimised the pressure of the situation, as they perceived support from their peers and felt that responsibility was shared. Other participants stressed the importance of knowing your team members in assigning each person the most appropriate role.

> "It doesn't just depend on you, the responsibility is everyone's [the team], so you feel supported...if you miss something, there are other people who can do it… you feel less pressure." (G6-P6, female, 46 years old)

> "You know them [your colleagues], you know what each person does best." (G2-P7, female, 21 years old)

3.3.2. Linking and Transferring the Situation to a Real Clinical Setting

The simulation formed part of their prior experience and allowed students to become more aware of emergency situations, which made them feel more prepared to attend to a patient who goes into cardiorespiratory arrest. This preparation was based on improving clinical skills and learning how to work as a team. The participants felt that the experience positively influenced their clinical performance, as it allowed them to recall their previous actions and be more efficient in following ALS guidelines in the hospital environment, improving the clinical safety of the patient. In addition, the participants also pointed out that they would benefit from additional simulation experiences in facing complicated clinical scenarios, which they sometimes are not exposed to during their training, in order to improve their professional work in clinical settings.

> "This [the simulation] has helped us greatly improve our skills, the teamwork makes you feel more…prepared for your practice or…for your future job…I think that if we did it all again right now, we would do it…a lot better, faster…we've gained experience." (G5-P7, female, 19 years old)

Some participants pointed out that the simulation increased their self-confidence in coping with emergency situations in a hospital setting. However, another participant said that the experience actually decreased their self-confidence due to their inability to act in a stressful situation. The psychological impact of the experience led the student to question if nursing was the right profession for her.

> "… because, until you find yourself in the situation, you don't trust yourself, you're not aware of how much you can really do." (G3-P5, male, 20 years old)

> "I realised that the situation was just too much for me… I find it very difficult to adapt to stressful situations… I didn't feel comfortable…I don't know if this is my thing [referring to the nursing profession]." (G6-P7, female, 19 years old)

4. Discussion

The objective of this study was to explore the experiences and perceptions of nursing students after applying advanced life support techniques on a hospitalised patient in cardiac arrest in a simulated setting. Firstly, the nursing students highlighted the realism of the situation, which led them to become disorientated and stood in the way of starting ALS steps. Likewise, some nurses reported having difficulty starting CPR in an unknown setting, which could influence patient outcomes [30]. Conversely, the students commented that the fact that they were being observed did not negatively interfere with their ALS performance; rather, that it increased their personal motivation when they saw that their skills were being questioned. However, no studies were found that address how feeling observed might influence nursing students' performance. Students also indicated that they forgot that they were being evaluated during the simulation exercise, and they became fully immersed in the role of the nurse in an emergency situation. In addition, simulation allows students to put themselves into the position of a nursing professional, minimising the anxiety they feel towards being evaluated, by focusing solely on their professional performance [31].

Regarding the training process, the students indicated that simulation allowed them to link theory with practice and assimilate various clinical procedures. Simulation translates nursing students' knowledge into better performance of clinical skills [15]. Additionally, the nursing students considered the debriefing essential to encouraging significant learning, as it helped them identify aspects that they need to improve in their performance of ALS techniques. The implementation of the debriefing after performing CPR gives students the opportunity to exchange ideas to improve their technique or teamwork skills, with the aim of optimising their performance and improving patient outcomes [32].

Nevertheless, participants identified multiple stressors that influenced their ability to perform according to ALS guidelines. This stress could be due to a lack of awareness of

the emergency situation, as well as having to respond immediately [33]. Stress can affect the clinical performance of nursing students, so students' exposure to similar stressful experiences during the training process is essential in order to achieve optimal performance [34]. In addition, the experience had a negative emotional impact on students. This aspect has been fairly unexplored, as only one study has analysed the emotional impact of simulating an emergency situation on medical students [35], and its results coincide with the data reported by the participants in this study. Similarly, simulation programs often do not address potential emotional issues that participants face when dealing with stressful situations [36]. Nursing students should therefore be trained in emotional management to address stressors during high-acuity events.

Nursing students stressed the importance of teamwork in providing adequate care and achieving desired patient outcomes. Students also noticed shortcomings in interprofessional communication skills that negatively interfered with the team's performance. Verbal and nonverbal communication has been shown to be vital to team coordination when performing ALS manoeuvres, reducing action time by improving teamwork skills [37]. This improvement in action time minimises the risk of neurological damage [9] and increases the patient's chances of survival [8]. Furthermore, many students reported not feeling capable of being a leader. Previous studies showed that simulation enables leadership training by improving cooperative skills during CPR [38,39]. It is therefore imperative that nursing students apply effective communication techniques, such as the implementation of closed-loop communication. This technique has been shown to improve communication between team members in emergency situations [33].

The students reported that the experience could be applied to a hospital setting, as they felt more capable of following the ALS guidelines due to an increase in their confidence and clinical skills. Additionally, the closer the situation and the simulation setting are to reality, the more likely the learned behaviour is to be transferred to the clinical environment [18]. In addition, students indicated that the experience would allow them to perform better and improve the health care they provide. In fact, when simulation experiences are comparable to real-life clinical practice situations, students can accurately recall the actions they have taken, which has a positive influence on patient safety [40]. Increased exposure to simulated scenarios could improve CPR performance [17]. In addition, students do not have the opportunity to address numerous clinical situations during their clinical practice, facing them for the first time as nursing professionals. Because of this, simulation allows nursing students to safely cope with clinical situations in which they may find themselves immersed, which provides them with prior training for later use in the clinical environment [15].

However, some students went so far as to question if they could handle being nursing professionals after facing an emergency situation. This perception could be due to the stress caused by the situation and a lack of the skills required to successfully carry out the procedure [34]. Thus, it would be necessary to address the psychological impact that facing stressful clinical situations can have and how this can interfere with the performance of their clinical work as a future nursing professional, which has not been addressed in previous studies. Furthermore, there are no studies that explore the experience of nursing students in the application of ALS techniques, considering the stressful situation they must face while working as a team, in order to identify the factors involved in performing ALS techniques and develop strategies that promote student success when performing ALS techniques in the clinical setting. The results of this study highlight the need to develop and implement training programs focused on clinical and teamwork skills in nursing programs, in order to train future nursing professionals in addressing emergencies, as well as the need to develop measures to evaluate and minimize the psychological impact that facing stressful situations can have on the students in their future work as a nursing professional.

Limitations

The results of this study should be considered in the light of some limitations, such as sample size and participant selection, as the sample was drawn from a single institution. On the other hand, the design of the study does not aim to generalise the results, but to explore the experiences and perceptions of nursing students in the development of ALS in the hospital environment, which are relatively unknown. Future research could involve a broader representation of participants from different nursing faculties in order to gain greater diversity of experience and greater confidence in the transferability of the findings.

5. Conclusions

Nursing students identify the simulation of an emergency situation as a critical part of their learning process. In addition, they consider experience a key element in integrating ALS into the care environment. Training future nursing professionals and providing them with the skills they need to face emergency situations would aid in their familiarisation with the hospital setting and improve their clinical performance of advanced life support manoeuvres.

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References

1. Van Horn, E.; Christman, J. Assessment of nursing student confidence using the clinical skills self-efficacy scale. *Nurs. Educ. Perspect.* **2017**, *38*, 344–346, doi:10.1097/01.nep.0000000000000169.
2. Ewertsson, M.; Allvin, R.; Holmström, I.K.; Blomberg, K. Walking the bridge: Nursing students' learning in clinical skill laboratories. *Nurs. Educ. Pract.* **2015**, *15*, 277–283.
3. Hayden, J.K.; Smiley, R.A.; Alexander, M.; Kardong-Edgren, S.; Jeffries, P.R. The NCSBN national simulation study: A longitudinal, randomized, controlled study replacing clinical hours with simulation in prelicensure nursing education. *J. Nurs. Regul.* **2014**, *5*, S3–S40, doi:10.1016/s2155-8256(15)30062-4.
4. Wright, C.; Hogard, E.; Ellis, R.; Smith, D.; Kelly, C. Effect of PETTLEP imagery training on performance of nursing skills: Pilot study. *J. Adv. Nurs.* **2008**, *63*, 259–265, doi:10.1111/j.1365-2648.2008.04706.x.
5. Crabb, D.B.; Hurwitz, J.E.; Reed, A.C.; Smith, Z.J.; Martin, E.T.; Tyndall, J.A.; Taasan, M.V.; Plourde, M.A.; Beattie, L.K. Innovation in resuscitation: A novel clinical decision display system for advanced cardiac life support. *Am. J. Emerg. Med.* **2020**, in press.
6. Neumar, R.W.; Shuster, M.; Callaway, C.W.; Gent, L.M.; Atkins, D.L.; Bhanji, F.; Brooks, D.C.; de Caen, A.R.; Donnino, M.W.; Ferrer, J.M.E.; et al. Part 1: Executive summary: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* **2015**, *132*, S315–S367.
7. Link, M.S.; Berkow, L.C.; Kudenchuk, P.J.; Halperin, H.R.; Hess, E.P.; Moitra, V.K.; Neumar, R.W.; O'Neil, B.J.; Paxton, J.H.; Silvers, S.M.; et al. Part 7: Adult advanced cardiovascular life support: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* **2015**, *132*, S444–S464.
8. Girotra, S.; Nallamothu, B.K.; Spertus, J.A.; Li, Y.; American Heart Association Get with the Guidelines–Resuscitation Investigators; Krumholz, H.M.; Chan, P.S. Trends in survival after in-hospital cardiac arrest. *N. Engl. J. Med.* **2012**, *367*, 1912–1920, doi:10.1056/nejmoa1109148.

9. Michelland, L.; Adnet, F.; Escutnaire, J.; Baker, C.; Hubert, H.; Chevret, S. Association between early advanced life support and good neurological outcome in out of hospital cardiac arrest: A propensity score analysis. *J. Eval. Clin. Pract.* **2019**, *26*, 1013–1021, doi:10.1111/jep.13268.
10. Lauridsen, K.G.; Watanabe, I.; Løfgren, B.; Cheng, A.; Duval-Arnould, J.; Hunt, E.A.; Good, G.L.; Niles, D.; Berg, R.A.; Nishisaki, A.; et al. Standardising communication to improve in-hospital cardiopulmonary resuscitation. *Resuscitation* **2020**, *147*, 73–80, doi:10.1016/j.resuscitation.2019.12.013.
11. Yeung, J.H.Y.; Ong, G.J.; Davies, R.P.; Gao, F.; Perkins, G.D. Factors affecting team leadership skills and their relationship with quality of cardiopulmonary resuscitation. *Crit. Care Med.* **2012**, *40*, 2617–2621, doi:10.1097/ccm.0b013e3182591fda.
12. Bhanji, F.; Donoghue, A.J.; Wolff, M.S.; Flores, G.E.; Halamek, L.P.; Berman, J.M.; Sinz, E.H.; Cheng, A. Part 14: Education: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* **2015**, *132*, S561–S573.
13. Bukiran, A.; Erdur, B.; Ozen, M.; Bozkurt, A.I. Retention of nurses' knowledge after basic life support and advanced cardiac life support training at immediate, 6-month, and 12-month post-training intervals: A longitudinal study of nurses in Turkey. *J. Emerg. Nurs.* **2014**, *40*, 146–152, doi:10.1016/j.jen.2012.08.011.
14. Powers, S.; Claus, N.; Jones, A.R.; Lovelace, M.R.; Weaver, K.; Watts, P. Improving transition to practice: Integration of Advanced cardiac life support into a baccalaureate nursing program. *J. Nurs. Educ.* **2019**, *58*, 182–184, doi:10.3928/01484834-20190221-11.
15. Chen, J.; Yang, J.; Hu, F.; Yu, S.-H.; Yang, B.X.; Liu, Q.; Zhu, X.-P. Standardised simulation-based emergency and intensive care nursing curriculum to improve nursing students' performance during simulated resuscitation: A quasi-experimental study. *Intensive Crit. Care Nurs.* **2018**, *46*, 51–56, doi:10.1016/j.iccn.2018.02.003.
16. Roh, Y.S.; Issenberg, S.B. Association of cardiopulmonary resuscitation psychomotor skills with knowledge and self-efficacy in nursing students. *Int. J. Nurs. Pract.* **2014**, *20*, 674–679, doi:10.1111/ijn.12212.
17. Cheng, A.; Lockey, A.; Bhanji, F.; Lin, Y.; Hunt, E.A.; Lang, E. The use of high-fidelity manikins for advanced life support training—A systematic review and meta-analysis. *Resuscitation* **2015**, *93*, 142–149, doi:10.1016/j.resuscitation.2015.04.004.
18. Merchant, D.C. Does high-fidelity simulation improve clinical outcomes? *J. Nurses Staff Dev.* **2012**, *28*, E1–E8, doi:10.1097/nnd.0b013e318240a728.
19. Arrogante, O.; González-Romero, G.M.; Carrión-García, L.; Polo, A. Reversible causes of cardiac arrest: Nursing competency acquisition and clinical simulation satisfaction in undergraduate nursing students. *Int. Emerg. Nurs.* **2021**, *54*, 100938, doi:10.1016/j.ienj.2020.100938.
20. Gabbard, K.L.; Smith-Steinert, R.M. Advanced cardiac life support simulation for nurse anesthetists and student nurse anesthetists. *Clin. Simul. Nurs.* **2021**, *50*, 65–73, doi:10.1016/j.ecns.2020.06.006.
21. Kolb, D.A. *Experiential Learning: Experience as the Source of Learning and Development*; Prentice Hall, Inc.: New Jersey, NJ, USA, 1984.
22. Kim, E.J.; Lee, K.R.; Lee, M.H.; Kim, J. Nurses' cardiopulmonary resuscitation performance during the first 5 minutes in in-situ simulated cardiac arrest. *J. Korean Acad. Nurs.* **2012**, *42*, 361–368, doi:10.4040/jkan.2012.42.3.361.
23. Ireland, S.; Marquez, M.; Hatherley, C.; Farmer, N.; Luu, B.; Stevens, C.; Paul, E.; Mitra, B. Emergency nurses' experience of adult basic and advanced life support workstations as a support strategy for clinical practice in the emergency department. *Australas. Emerg. Care* **2020**, *23*, 77–83, doi:10.1016/j.auec.2019.11.001.
24. Creswell, J.W.; Poth, C.N. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*; Sage Publications: Thousand Oaks, CA, USA, 2016.
25. Todres, L.; Wheeler, S. The complementarity of phenomenology, hermeneutics and existentialism as a philosophical perspective for nursing research. *Int. J. Nurs. Stud.* **2001**, *38*, 1–8, doi:10.1016/s0020-7489(00)00047-x.
26. Tong, A.; Sainsbury, P.; Craig, J. Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *Int. J. Qual. Health Care* **2007**, *19*, 349–357, doi:10.1093/intqhc/mzm042.
27. Green, J.; Thorogood, N. *Qualitative Methods for Health Research*, 3rd ed.; Sage: London, UK, 2014.
28. INACSL Standards Committee. Standards of best practice: Simulation. *Clin. Simul. Nurs.* **2016**, *12*, S16-S20.
29. Vincelette, C.; Quiroz-Martinez, H.; Fortin, O.; Lavoie, S. Timely recognition of ventricular fibrillation and initiation of cardiopulmonary resuscitation by intensive care unit nurses: A high-fidelity simulation observational study. *Clin. Simul. Nurs.* **2018**, *23*, 1–9.
30. Dwyer, T.; Reid-Searl, K.; McAllister, M.; Guerin, M.; Friel, D. Advanced life simulation: High-fidelity simulation without the high technology. *Nurse Educ. Pract.* **2015**, *15*, 430–436, doi:10.1016/j.nepr.2015.05.007.
31. Wolfe, H.; Zebuhr, C.; Topjian, A.A.; Nishisaki, A.; Niles, D.E.; Meaney, P.A.; Boyle, L.; Giordano, R.T.; Davis, D.; Priestley, M.; et al. Interdisciplinary ICU cardiac arrest debriefing improves survival outcomes. *Crit. Care Med.* **2014**, *42*, 1688–1695, doi:10.1097/ccm.0000000000000327.
32. Carolan-Olah, M.; Kruger, G.; Brown, V.; Lawton, F.; Mazzarino, M.; Vasilevski, V. Communicating out loud: Midwifery students' experiences of a simulation exercise for neonatal resuscitation. *Nurse Educ. Pract.* **2018**, *29*, 8–14, doi:10.1016/j.nepr.2017.10.027.
33. Judd, B.K.; Currie, J.; Dodds, K.L.; Fethney, J.; Gordon, C.J. Registered nurses psychophysiological stress and confidence during high-fidelity emergency simulation: Effects on performance. *Nurse Educ. Today* **2019**, *78*, 44–49, doi:10.1016/j.nedt.2019.04.005.

34. Liaw, S.Y.; Chan, S.W.C.; Scherpbier, A.; Rethans, J.J., Pua, G.G. Recognizing, responding to and reporting patient deterioration: Transferring simulation learning to patient care settings. *Resuscitation* **2012**, *83*, 395–398.
35. Schlairet, M.C.; Schlairet, T.J.; Sauls, D.H.; Bellflowers, L. Cognitive load, emotion, and performance in high-fidelity simulation among beginning nursing students: A pilot study. *J. Nurs. Educ.* **2015**, *54*, S5–S11, doi:10.3928/01484834-20150218-10.
36. Husebø, S.E.; Rystedt, H.; Friberg, F. Educating for teamwork—Nursing students' coordination in simulated cardiac arrest situations. *J. Adv. Nurs.* **2011**, *67*, 2239–2255, doi:10.1111/j.1365-2648.2011.05629.x.
37. Castelao, E.F.; Russo, S.G.; Cremer, S.; Strack, M.; Kaminski, L.; Eich, C.; Timmermann, A.; Boos, M. Positive impact of crisis resource management training on no-flow time and team member verbalisations during simulated cardiopulmonary resuscitation: A randomised controlled trial. *Resuscitation* **2011**, *82*, 1338–1343, doi:10.1016/j.resuscitation.2011.05.009.
38. Hunziker, S.; Bühlmann, C.; Tschan, F.; Balestra, G.; Legeret, C.; Schumacher, C.; Semmer, N.K.; Hunziker, P.; Marsch, S. Brief leadership instructions improve cardiopulmonary resuscitation in a high-fidelity simulation: A randomized controlled trial. *Crit. Care Med.* **2010**, *38*, 1086–1091, doi:10.1097/ccm.0b013e3181cf7383.
39. Reader, T.W.; Cuthbertson, B.H. Challenges in using high-fidelity simulation to improve learning and patient safety. *Resuscitation* **2012**, *83*, 1317–1318, doi:10.1016/j.resuscitation.2012.08.004.

4.3. Time out! Pauses during advanced life support in high-fidelity simulation: A cross-sectional study

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Time out! Pauses during advanced life support in high-fidelity simulation: A cross-sectional study

Verónica V. Márquez-Hernández, RN, PhD [a, b]
Lorena Gutiérrez-Puertas, RN, PhD [a, *]
Alba García-Viola, RN, MN [a]
José Miguel Garrido-Molina, RN, MN [a]
Vanesa Gutiérrez-Puertas, RN, MN [a]
Mª Carmen Rodríguez-García, RN, MN [a, b]
Gabriel Aguilera-Manrique, RN, PhD [a, b]

[a] Department of Nursing, Physiotherapy and Medicine, Universidad de Almería, Spain
[b] Research Group for Health Center CTS-451, Health Research Center, Universidad de Almería, Spain

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ABSTRACT

Background: Prolonged preshock pauses are associated with negative effects on patient outcomes and survival. A greater understanding of these pauses may help to improve the quality of advanced life support (ALS) and clinical outcomes.
Objective: The objective of this study was to identify the pauses that occur during ALS situations in high-fidelity simulation scenarios and the frequency and duration of these pauses.
Methods: One hundred forty-two nursing students participated in this cross-sectional study, involving high-fidelity simulation scenario of cardiorespiratory arrest in a simulated hospital room. Pauses were assessed using an observation checklist.
Results: Students performed the scenario in an average time of 8.32 (standard deviation = 1.13) minutes. Pauses between chest compressions were longer than recommended (mean = 0.36, standard deviation = 1.14). A strong positive correlation was found between the identification of the arrhythmia and the initiation of countershock ($rs = 0.613$, $p < 0.001$).
Conclusions: Nursing students generally performed ALS within the time limits recommended by resuscitation guidelines. Early identification of shockable rhythms may lead to early nurse-initiated defibrillation. Strategies to speed up the identification of arrhythmias should be put in place to minimise preshock pauses and improve ALS outcomes.

1. Introduction

In recent years, the importance of performing high-quality advanced life support (ALS) in hospital settings has been analysed to improve mortality and morbidity rates.[1,2] Early initiation of cardiopulmonary resuscitation (CPR) manoeuvres and the minimisation of pauses between chest compressions have been identified as two of the most important components of high-quality CPR.[3]

Prolonged preshock pauses—pauses between chest compressions before defibrillatory shock—have been associated with decreased survival rates and reduced reperfusion success after defibrillation.[4,5] Increasing attention has been given to the proportion of time spent performing or interrupting chest compressions.[6] The American Heart Association (AHA) recommends that the first chest compressions be initiated in less than 1 min during in-hospital cardiorespiratory arrest (CA).[7] In addition, the same association recommends limiting the duration of pauses to no more than 10 s and to coordinate tasks during said pauses.

* Corresponding author at: Department of Nursing, Physiotherapy and Medicine, Faculty of Health Sciences, University of Almeria, Spain Sacramento S/N, en La Cañada de San Urbano, 04120, Spain. Tel.: +34 950214585.
E-mail address: lgp524@ual.es (L. Gutiérrez-Puertas).

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Early identification and defibrillation of shockable rhythms have been shown to increase survival rates in cases of pulseless ventricular tachycardia (VT) or ventricular fibrillation (VF).[3,8] In regards to defibrillation during situations of ALS with nursing professionals, the use of a manual defibrillator is recommended[9] over an automated external defibrillator (AED) as the use of an AED may be associated with less success owing to a greater loss of time.[10] This greater loss of time may result from users who do not interrupt the "chain of advice" from the AED, which is associated with a prolonged time interval from AED activation to the first shock.[10] To properly use a manual defibrillator and avoid preshock pauses, nurses must possess the ability to recognise ventricular arrhythmias, assess the pulse rate, and initiate CPR as soon as possible.[11]

It has been observed that training nurses to recognise shockable rhythms and initiate defibrillation manoeuvres in simulated environments reduces the time to the first countershock.[12] The use of high-fidelity simulation has been recommended to improve competency acquisition[13] and attitudes towards ALS training, permit self-guided or self-directed learning, minimise obstacles for practicing CPR,[14,15] and improve teamwork, therefore facilitating more positive patient outcomes during an ALS situation.[16] Furthermore, this methodology enables the analysis of factors that may delay the start of chest compressions in a CA scenario as well as the time in delivering the first countershock. Understanding the reasons behind preshock pauses can help to improve team organisation as well as reduce the time of pauses.[17] Having a greater understanding of the preshock pauses may help to improve the quality of CPR and propose new educational interventions. Therefore, the objective of this study was to identify the pauses that occur during ALS situations in high-fidelity simulation scenarios and the frequency and duration of pauses among student nurses.

2. Methods

2.1. Study design

An exploratory descriptive cross-sectional study, involving high-fidelity simulation, was conducted.

2.2. Setting

The research was conducted in a university simulation laboratory using the Resusci Anne® mannequin for advanced CPR. The Resusci Anne® mannequin reinforces skills such as (i) high-quality management of the airway with endotracheal tubes and supraglottic airway devices, (ii) real defibrillation and synchronised ECG, (iii) pulse monitoring, (iv) insertion for intravenous treatment, and (v) information on the quality of CPR in SimPad PLUS. All simulations took place in January 2020. The simulated scenario was based on an ALS situation and a prebriefing–simulation–debriefing sequence.[18]

2.3. Participants

The initial sample consisted of 165 students, of which 142 nursing students were ultimately selected through convenience sampling. Nursing students were in the second of the four years that made up the nursing degree. The inclusion criteria were (i) to be enrolled in the course of basic life support (BLS) and ALS and (ii) having attended all three training sessions of BLS and ALS before the simulated experience. Therefore, students had received CPR training, but they had no previous experience in a team-based ALS simulation situation (with three participants). International students whose primary language was not Spanish were excluded from the study to prevent potential bias and ensure an adequate understanding of the activity.

2.4. Data collection and instruments

A checklist of 10 items was developed to measure pauses between the ALS performances (Table 1). The checklist was developed by the research team together with a panel of 12 experts. These experts were university nursing professors, university professors with expertise in simulation, or nursing professionals with expertise in emergencies. The criteria established by the European Resuscitation Council Guidelines[19] and the AHA[7] was used to prepare the checklist. The time for each task and in between each task was measured using a digital chronometer.

Sociodemographic variables of the participants such as sex and age were also collected.

2.5. Procedure

The study was conducted in an urban university that has three simulation rooms. For this study, a single simulation room was used with a hospital bed prepared for up to three students to perform at a time. At the start of the study, the participants proceeded to the waiting room to be randomly distributed into groups of three nursing students. Subsequently, each group was called into the simulation room.

The simulated scenario was written by the lead researcher, who had expertise in simulation in accordance with International Nursing Association for Clinical Simulation and Learning (INACSL) recommendations.[18] The description of the scenario was as follows: a simulation laboratory of a hospital room which included a bathroom for the patient, a hospital bed, a mannequin on the bed sitting in a semifowler position, a monitor, a buzzer for the patient, a CA cart with all the necessary equipment (located in the hallway outside the room), and two chairs. The cardiac monitor was configured to randomly generate shockable VF/VT rhythms.

Before entering the simulation room, the researcher briefed the students on the objectives of the scenario. Specifically, students were instructed to act in a CA situation and carry out an ALS performance. The students had carried out previous activities during the academic year in the simulation room, so they were familiar with the environment and the mannequin and had no problems detecting the scenario.

The simulation proceeded as follows: A nursing student was in a simulated hospital room with a bedridden patient and realised that the patient was not responding and therefore called for help to initiate CPR. Then, two students joined the scenario arriving with the CA cart. Once the CA situation was determined, the students assigned themselves roles as they had been instructed in previous sessions. The students were expected to identify the VF/VT rhythm displayed on the cardiac monitor and perform ALS. The three participants were to distribute the tasks of airway management, intravenous monitoring, and cannulation, as well as drug administration and chest compressions. The simulation scenario ended when the students initiated defibrillation. While the simulation was taking place, two observers were in the control room collecting real-time data. These observers were registered nurses who had CPR experience as well as BLS–ALS training. Each group that finished the simulation then went to a second waiting room where they waited for the rest of their classmates. Therefore, the students who had carried out the simulation and those who had not yet carried it out were not in contact at any time until the end of the simulation.

Once all simulations of the students were finished, a debriefing session was held to comment on the experience and how they had felt during the simulation. The debriefing session consisted of small

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Table 1
Observation checklist and pauses measured during advanced life support performance.

Item	Time (min)	
	M	SD
1. Pause between determining the CA situation and identifying the arrhythmia (VF/VT)	1.43	0.64
2. Pause between identifying VF/VT and asking for help	0.17	0.17
3. Pause between identifying VF/VT and distribute tasks to start CPR	0.42	0.28
4. Pause between identifying VF/VT and starting compressions	0.78	0.43
5. Pause between identifying VF/VT and opening the airway	1.18	0.44
6. Pause between identifying VF/VT and initiating ventilation	1.36	0.44
7. Pause between identifying VF/VT and venous cannulation	2.87	0.84
8. Pause between identifying VF/VT and administration of drugs	4.49	1.75
9. Pause between identifying VF/VT and initiation of countershock	1.70	0.76
10. Pause in chest compressions during ALS performance	0.36	1.14

ALS: advanced life support; CA: cardiorespiratory arrest; CPR: cardiopulmonary resuscitation; M: mean; SD: standard deviation; VF/VT: ventricular fibrillation/ventricular tachycardia.

groups of students led by a nursing professor who was a member of the research team. The session was developed with the following structure: (i) a reaction phase to address the reactions and feelings of students after working on the case, (ii) a comprehension phase to identify the limitations and obstacles during the performance of the intervention, and (iii) a summary phase in which the knowledge acquired from the simulation experience and its applicability in the real clinical context were noted.[20] The debriefing session lasted 25 min.

2.6. Data analysis

The SPSS Statistics for Windows, version 25 (IMB Corp; Armonk:NY), was used for data analysis for Windows. A descriptive analysis of the sociodemographic variables was performed. Pearson's correlation coefficients were calculated to evaluate the intraobserver and interobserver consistency. A Spearman correlation coefficient was calculated for the relationship between participants' pauses in the ALS performance, considering them to be negligible (0.00−0.20), weak (0.21−0.40), moderate (0.41−0.60), strong (0.61−0.80), and very strong (0.81−1.00) according to Prion and Haerling.[21] Nonparametric Mann−Whitney U test and Spearman's correlation test were used. Specifically, the Mann−Whitney U test was used to compare the scores of the pauses with the sociodemographic variable of sex. Additionally, Spearman's correlation coefficient was used to measure the correlation between the pauses taken by students in the simulation scenario. The strength of correlation for the rs value was classified as very weak (0.00-0.19), weak (0.20-0.39), moderate (0.40-0.59), strong (0.60-0.79), and very strong (0.80−1.0). A p-value < 0.05 was considered significant.

2.7. Ethical considerations

The study was approved by the Ethics and Research Commission of the university where it was carried out (EFM 62/20). All participants were previously informed about the objective of the study, anonymous and confidential treatment of the data, and the voluntary nature of their participation. They also signed an informed consent form. The guidelines established in the Declaration of Helsinki were followed at all times.

3. Results

3.1. Sociodemographic characteristics of the sample

A total of 142 students participated in the study, of which 80% (n = 111) were women and 20% (n = 31) were men. The average age of the students was 21.08 years (standard deviation [SD] = 5.22). The students were in their second year of a nursing degree.

3.2. ALS simulation and pauses during the intervention

The students performed the ALS scenario in an average time of 8.32 (SD = 1.13) minutes. Specifically, it was observed that the average duration of pause between identifying VF/VT and distributing tasks to start CPR was 42 s (SD = 0.28). On the other hand, the average duration of pause between identifying VF/VT and starting compressions was 0.78 s (SD = 0.43). Intravenous cannulation (mean [M] = 2.87, SD = 0.84) and drug administration (M = 4.49, SD = 1.75) resulted the most time-consuming tasks for nursing students. The mean scores for pauses during ALS are shown in Table 1. No statistically significant differences were found when comparing the pauses with sex or age.

A Spearman correlation coefficient was calculated to analyse the relationship between the different types of pauses taken by the nursing students in an ALS situation (Table 2). A strong positive correlation was found ($rs = 0.613$, $p < 0.001$), indicating a significant relationship between nursing students' identification of VF/VT in the monitor and the initiation of countershock. Pauses between identifying VF/VT and starting compressions showed a strong positive relationship with the distribution of task to start CPR ($rs = 0.629$, $p < 0.001$) and the start of ventilation ($rs = 0.640$, $p < 0.001$). Pauses in identification of the arrhythmia and opening the airway showed a strong positive relationship with the start of ventilation ($rs = 0.678$, $p < 0.001$). Indeed, a strong positive correlation was observed ($rs = 0.653$, $p < 0.001$), indicating a significant relationship between pauses in identification of the VF/VT and venous cannulation and drug administration.

4. Discussion

The objective of this study was to identify the pauses that occur during ALS situations in high-fidelity simulation scenarios. Numerous studies have shown that the quality of CPR is an important determinant of the results of CA and that minimising interruptions is essential for obtaining better survival rates.[22–24]

In this study, participants took an average of 42 s to identify the arrhythmia and distribute tasks to start CPR. These results are consistent with the recommendations of the AHA, which indicate that it is important to initiate CPR before the first minute.[7] Other studies have found similar results where the start time ranged from 47 to 50 s.[25,26]

In addition, with respect to the pauses without chest compressions, the AHA recommends minimising the duration to improve the quality of CPR. The chest compression fraction should

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Table 2
Spearman correlation coefficient between pauses during ALS performance.

Item	Correlation	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10
Item 1[a]	rs	–	0.192	**0.372**	**0.352**	0.257	**0.418**	0.157	0.178	**0.613**	0.152
	p		0.182	**0.008**	**0.012**	0.071	**0.003**	0.277	0.216	**0.000**	0.213
Item 2	rs	0.192	-	**0.566**	**0.598**	0.161	**0.289**	0.064	0.167	0.253	0.313
	p	0.182		**0.000**	**0.000**	0.265	**0.042**	0.660	0.245	0.077	0.135
Item 3	rs	**0.372**	**0.566**	-	**0.629**	0.213	**0.512**	0.102	0.070	0.219	**0.212**
	p	**0.008**	**0.000**		**0.000**	0.138	**0.000**	0.480	0.627	0.127	**0.005**
Item 4	rs	**0.352**	**0.598**	**0.629**	–	**0.427**	**0.640**	0.245	**0.294**	**0.358**	**0.121**
	p	**0.012**	**0.000**	**0.000**		**0.002**	**0.000**	0.086	**0.038**	**0.011**	**0.035**
Item 5	rs	0.257	0.161	0.213	**0.427**	–	**0.678**	**0.399**	0.265	0.124	0.115
	p	0.071	0.265	0.138	**0.002**		**0.000**	**0.004**	0.063	0.390	0.370
Item 6	rs	**0.418**	**0.289**	**0.512**	**0.640**	**0.678**	–	**0.391**	0.218	**0.324**	**0.225**
	p	**0.003**	**0.042**	**0.000**	**0.000**	**0.000**		**0.005**	0.128	**0.022**	**0.045**
Item 7	rs	0.157	0.064	0.102	0.245	**0.399**	**0.391**	–	**0.653**	0.122	0.275
	p	0.277	0.660	0.480	0.086	**0.004**	**0.005**		**0.000**	0.398	0.130
Item 8	rs	0.178	0.167	0.070	**0.294**	0.265	0.218	**0.653**	–	0.174	0.325
	p	0.216	0.245	0.627	**0.038**	0.063	0.128	**0.000**		0.227	0.161
Item 9	rs	**0.613**	0.253	0.219	**0.358**	0.124	**0.324**	0.122	0.174	–	0.320
	p	**0.000**	0.077	0.127	**0.011**	0.390	**0.022**	0.398	0.227		0.112
Item 10	rs	0.152	0.313	**0.212**	**0.121**	0.115	**0.225**	0.275	0.325	0.320	–
	p	0.213	0.135	**0.005**	**0.035**	0.370	**0.045**	0.130	0.161	0.112	

Bold values indicate significant correlations at the level of 0.05.
[a] Refer to Table 1.

be above 80%, and the duration of the pause should be no more than 10 s.[7] However, the results of the present study show pauses lasting longer than recommended. Specifically, the average time without chest compressions was 36 s. This indicates that there were excessively long pauses between compressions, which affect the quality of CPR in situations of CA. In the study by Kessler et al.,[27] although it was based on the paediatric population and had a multidisciplinary team (nurses, medical students, residents, and attending physicians), it was found that a large percentage of the pauses lasted longer than 10 s. These pauses may be related to the execution of other tasks, such as controlling vital signs during CPR.[17] Specifically, these authors observed that the number of tasks performed by physicians during a pause was associated with a significant increase in the duration of the pause.

Regarding the onset of chest compressions, the participants in this study took an average time of 78 s to begin from the moment they identified the VF/VT arrhythmia. These results are slightly better than those found by Painter et al.,[28] in which the lay participants took an average time of 99 s to initiate the first chest compression in a study where scenarios took place at local community and retirement centres in Washington with lay participants. These findings could lead greater survival rates because survival rates significantly improve when CPR is initiated within the first minute of CA.[29]

On the other hand, it has also been shown that the initiation of defibrillation within 2 min is associated with better survival rates at discharge.[30] In this case, the participants took an average time of 2 min and 10 s.

Additionally, it was found that the various measured pauses can be correlated with each other. The results of this study showed the delay in identifying the arrhythmia can lead to a delay in the onset of compressions or the onset of countershock, which is essential for a shockable rhythm. These findings contribute to the literature suggesting that an early identification of the rhythms could lead to early nurse-initiated defibrillation and early compression. Both early identification and rapid defibrillation have been shown to increase survival rates in situations of shockable rhythms.[3]

The results of the present study might be useful for developing future strategies to improve survival rates as well as to minimise preshock pauses, aiding students and nurses to recognise the most time-consuming factors that trigger the errors and interruptions in ALS. The findings of this research can help to better organise and prepare BLS and ALS instructional courses for future professionals.

4.1. Study limitations and future research

This investigation should be considered with various limitations in mind. First, the scenario was simulated, and therefore, the findings of this study should be interpreted with caution and should not be extrapolated to a real-life situation. Also, the simulation experience was only run once with the same participants, although it would be interesting to see if the results change with a second or third experience in further research. In addition, another series of factors that could have interfered with the groups' performances, such as leadership, were not considered. Establishing a leader can help the group to better organise ALS tasks, as well as minimise interruptions during CPR. Future studies should consider this element as an important factor within the group. Also, investigations analysing the relationship between pauses or interruptions during the simulation and training variables involved (i.e., the type of simulation scenario and the methodology used for theoretical training) are necessary. The students' prior level of education should also be considered. Further research reporting the cause of delays in ALS performance might aid reinforcement sessions that can be planned, or the content of courses aimed at teaching students about ALS can be restructured.

5. Conclusion

Knowing exactly when pauses occur and their frequency and duration is essential for improving the results of ALS in the hospital setting. Nursing students should be trained using ALS simulation scenarios to help them improve their ALS performance in vital emergency situations. The students generally performed within the time limits recommended by resuscitation guidelines and expressed being satisfied with the simulation experience. This study indicates that high-fidelity simulation can be a useful tool for investigating the pauses that occur during ALS and to better understand what causes them. The results of this study should be considered to improve student training and propose new teaching methods that focus on the areas for improved performance made during their BLS and ALS learning.

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CRediT authorship contribution statement

Verónica V. Márquez-Hernández: Conceptualisation, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Lorena Gutiérrez-Puertas**: Conceptualisation, Methodology, Writing – original draft, Writing – review & editing. **Alba García-Viola**: Investigation, Resources, Writing – original draft, Writing – review & editing. **José Miguel Garrido-Molina**: Investigation, Resources, Writing – original draft, Writing – review & editing. **Vanesa Gutiérrez-Puertas**: Methodology, Investigation, Resources. **Mª Carmen Rodríguez-García**: Investigation, Resources, Writing – original draft, Writing – review & editing. **Gabriel Aguilera-Manrique**: Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that there is no conflict of interest.

References

[1] Cheng A, Overly F, Kessler D, Nadkarni VM, Lin Y, Doan Q, et al. Perception of CPR quality: influence of CPR feedback, just-in-time CPR training and provider role. Resuscitation 2015;87:44–50.
[2] Sullivan NJ, Duval-Arnould J, Twilley M, Smith SP, Aksamit D, Boone-Guercio P, et al. Simulation exercise to improve retention of cardiopulmonary resuscitation priorities for in-hospital cardiac arrests: a randomized controlled trial. Resuscitation 2015;86:6–13.
[3] Kleinman ME, Brennan EE, Goldberger ZD, Swor RA, Terry M, Bobrow BJ, et al. Part 5: adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation 2015;132:S414–35.
[4] Brouwer TF, Walker RG, Chapman FW, Koster RW. Association between chest compression interruptions and clinical outcomes of ventricular fibrillation out-of-hospital cardiac arrest. Circulation 2015;132(11):1030–7.
[5] Cheskes S, Schmicker RH, Christenson J, Salcido DD, Rea T, Powell J, et al. Perishock pause: an independent predictor of survival from out-of-hospital shockable cardiac arrest. Circulation 2011;124(1):58–66.
[6] Inaba H, Maeda T. Continuous or interrupted chest compressions for EMS-performed cardiopulmonary resuscitation. J Thorac Dis 2016;8(1):E118–20.
[7] de Caen AR, Berg MD, Chameides L, Gooden CK, Hickey RW, Scott HF, et al. Part 12: pediatric advanced life support: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation 2015;132:S526–42.
[8] Link MS, Berkow LC, Kudenchuk PJ, Halperin HR, Hess EP, Moitra VK, et al. Part 7: adult advanced cardiovascular life support: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation 2015;132:S444–64.
[9] Chan PS, Krumholz HM, Spertus JA, Jones PG, Cram P, Berg RA, et al. Automated external defibrillators and survival after in-hospital cardiac arrest. J Am Med Assoc 2010;304(19):2129–36.
[10] Wurmb T, Vollmer T, Sefrin P, Kraus M, Happel O, Wunder C, et al. Monitoring of in-hospital cardiac arrest events with the focus on Automated External Defibrillators–a retrospective observational study. Scand J Trauma Resuscitation Emerg Med 2015;23(87):1–7.
[11] Vincelette C, Quiroz-Martinez H, Fortin O, Lavoie S. Timely recognition of ventricular fibrillation and initiation of cardiopulmonary resuscitation by intensive care unit nurses: a high-fidelity simulation observational study. Clin Simul Nurs 2018;23:1–9.
[12] Delac K, Blazier D, Daniel L, Donamarie N. Five alive: using mock code simulation to improve responder performance during the first 5 minutes of a code. Crit Care Nurs Q 2013;36(2):244–50.
[13] Arrogante O, González-Romero GM, Carrión-García L, Polo A. Reversible causes of cardiac arrest: nursing competency acquisition and clinical simulation satisfaction in undergraduate nursing students. Int Emerg Nurs 2021:100938.
[14] Chang TP, Raymond T, Dewan M, MacKinnon R, Whitfill T, Harwayne-Gidansky I, et al. The effect of an International competitive leaderboard on self-motivated simulation-based CPR practice among healthcare professionals: a randomized control trial. Resuscitation 2019;138:273–81.
[15] Issenberg BS, Mcgaghie WC, Petrusa ER, Lee Gordon D, Scalese RJ. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. Med Teach 2005;27(1):10–28.
[16] Shepherd I, Chatwin C. Preparing ward nursing staff for more effective team involvement in a code blue (BLS/ALS) utilizing high fidelity patient simulation (HFPS). Resuscitation 2006;70(2):330.
[17] O'Connell KJ, Keane RR, Cochrane NH, Sandler AB, Donoghue AJ, Kerrey BT, et al. Pauses in compressions during pediatric CPR: opportunities for improving CPR quality. Resuscitation 2019;145:158–65.
[18] INACSL Standards Committee. INACSL standards of best practice: Simulation℠ Simulation design. Clin Simul Nurs 2016;12:S5–12.
[19] Monsieurs KG, Nolan JP, Bossaert LL, Greif R, Maconochie IK, Nikolaou NI, et al. European resuscitation council guidelines for resuscitation 2015 section 1. Executive summary. Resuscitation 2015;95:1–80.
[20] Palaganas JC, Fey M, Simon R. Structured debriefing in simulation-based education. AACN Adv Crit Care 2016;27(1):78–85.
[21] Prion S, Haerling KA. Making sense of methods and measurement: Spearman-rho ranked-order correlation coefficient. Clin Simul Nurs 2014;10(10):535–6.
[22] Abella BS, Edelson DP, Kim S, Retzer E, Myklebust H, Barry AM, et al. CPR quality improvement during in-hospital cardiac arrest using a real-time audiovisual feedback system. Resuscitation 2007;73(1):54–61.
[23] Edelson DP, Litzinger B, Arora V, Walsh D, Kim S, Lauderdale DS, et al. Improving in-hospital cardiac arrest process and outcomes with performance debriefing. Arch Intern Med 2008;168(10):1063–9.
[24] Wik L, Kramer-Johansen J, Myklebust H, Sørebø H, Svensson L, Fellows B, et al. Quality of cardiopulmonary resuscitation during out-of-hospital cardiac arrest. J Am Med Assoc 2005;293(3):299–304.
[25] Olson M, Helfenbein E, Su L, Berg M, Knight L, Troy L, et al. Variability in the time to initiation of CPR in continuously monitored pediatric ICUs. Resuscitation 2018;127:95–9.
[26] Siems A, Tomaino E, Watson A, Spaeder MC, Su L. Improving quality in measuring time to initiation of CPR during in-hospital resuscitation. Resuscitation 2017;118:15–20.
[27] Kessler DO, Peterson DT, Bragg A, Lin Y, Zhong J, Duff J, et al. Causes for pauses during simulated pediatric cardiac arrest. Pediatr Crit Care Med 2017;18(8):e311–7.
[28] Painter I, Chavez DE, Ike BR, Yip MP, Tu SP, Bradley SM, et al. Changes to DA-CPR instructions: can we reduce time to first compression and improve quality of bystander CPR? Resuscitation 2014;85(9):1169–73.
[29] Herlitz J, Bang A, Alsen B, Aune S. Characteristic outcomes among patients suffering from in-hospital cardiac arrest in relation to whether the arrest took place during office hours. Resuscitation 2002;53:127–33.
[30] Chan PS, Krumholz HM, Nichol G, Nallamothu BK. American Heart association national registry of cardiopulmonary resuscitation investigators. Delayed time to defibrillation after in-hospital cardiac arrest. N Engl J Med 2008;358(1):9–17.

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V. IMPLICACIONES PARA LA PRÁCTICA Y FUTURAS LÍNEAS DE INVESTIGACIÓN

5. IMPLICACIONES PARA LA PRÁCTICA Y FUTURAS LÍNEAS DE INVESTIGACIÓN

Las investigaciones derivadas de la presente tesis pueden contribuir a mejorar la actuación de los estudiantes de enfermería ante la presencia de una PCR. Reducir el tiempo de reacción ante la misma y realizar una intervención adecuada ante esta situación tiempo-dependiente, son dos elementos fundamentales para aumentar las posibilidades de supervivencia en los pacientes que sufren una PCR.

Destaca la necesidad de desarrollar e implementar metodologías docentes para la formación en SVB y SVA, centradas en el desarrollo de las habilidades clínicas y de trabajo en equipo, con el fin de capacitar a estos futuros profesionales en el abordaje de situaciones de emergencia.

Así pues, la simulación clínica juega un papel imprescindible en los planes de estudios del Grado de Enfermería, siendo identificada por los estudiantes como una parte fundamental dentro de su formación, ya que le permite un mayor acercamiento al entorno real sin exponer a los pacientes a los riesgos asociados.

En relación al proceso de formación, la simulación permite asociar la teoría con la práctica e integrar diversos procedimientos clínicos. Los estudiantes identificaron sentirse más preparados debido al incremento de su confianza y de las competencias clínicas. Además, esta metodología resalta la importancia del trabajo en equipo, necesario para minimizar con éxito las interrupciones y mejorar los resultados en la actuación ante una PCR.

Cabe destacar el avance de nuevas tecnologías que permiten guiar la actuación de los testigos presenciales en una PCR. Entre ellas, destaca el desarrollo de apps que pretenden dirigir la actuación ante la PCR, logrando un incremento en la realización de las

maniobras de RCP y, por tanto, aumentando las posibilidades de supervivencia y calidad de vida de la víctima.

Futuras investigaciones podrían incorporar una representación más amplia de participantes de diferentes facultades de enfermería, así como, desarrollarse en profesionales de enfermería con el fin de obtener una mayor diversidad de resultados y una mayor confianza en la transferibilidad de los hallazgos. Además, sería interesante observar si los resultados cambian con una segunda o tercera experiencia de simulación de los mismos participantes. Así como, profundizar en la relación entre las pausas o interrupciones acontecidas durante la simulación, y las variables formativas implicadas (por ej. el tipo de escenario en la simulación, la metodología empleada en la formación teórica).

VI. CONCLUSIONES

6. CONCLUSIONES

A continuación, se muestran las principales conclusiones extraídas de las publicaciones derivadas de la presente tesis doctoral, las cuales dan respuesta a los objetivos de investigación previamente planteados.

- **Artículo 1 - Objetivo 1**

Los estudiantes que utilizaron la app realizaron mejor las acciones de reconocimiento de la seguridad de la zona, pedir ayuda, apertura de la vía área, comprobar la respiración y llamar a emergencias. No obstante, los resultados indican que no hay diferencias en los parámetros de RCP cuando se utiliza una app o es guiado por asistencia telefónica, por lo que ambos recursos pueden resultar útiles para la actuación de testigos ante una PCR. Sin embargo, se necesitan nuevas investigaciones que profundicen en las medidas de feedback necesarias para que los reanimadores legos puedan alcanzar mejores niveles de atención en la RCP indistintamente del modo en que sean guiados.

- **Artículo 2 - Objetivo 2**

Los estudiantes de enfermería identifican el proceso de entrenamiento en una situación de emergencia a través de la simulación como una parte fundamental de su formación. Además, consideran la experiencia un elemento clave para integrar el SVA en el entorno asistencial. La formación y adquisición de competencias y de las habilidades necesarias para enfrentarse a situaciones de emergencia, les ayuda a familiarizarse con el entorno hospitalario y mejora el desempeño en la práctica clínica de los estudiantes de enfermería.

- **Artículo 3 - Objetivo 3**

Los estudiantes de enfermería deben ser entrenados en escenarios de simulación que les ayuden a optimizar la ejecución del SVA en una situación de emergencia vital. Los

estudiantes demostraron una actuación a nivel general, que se adhiere a las pautas recomendadas por las guías de resucitación y expresaron estar satisfechos con la experiencia de simulación. Este estudio indica que la simulación de alta fidelidad puede ser una herramienta útil para explorar las pausas acontecidas durante la RCP, y de este modo profundizar en las causas que las producen.

No obstante, resultados como las pausas prolongadas durante las compresiones torácicas, deben ser tenidos en cuenta para mejorar la formación de los estudiantes, y proponer nuevos procedimientos de enseñanza enfocados en los errores más comunes durante su aprendizaje en SVB y SVA.

VII. REFERENCIAS

7. REFERENCIAS

Abe, Y., Kawahara, C., Yamashina, A., & Tsuboi, R. (2013). Repeated scenario simulation to improve competency in critical care: a new approach for nursing education. *American Journal of Critical Care, 22*(1), 33-40. https://doi.org/10.4037/AJCC2013229

Abella, B. S., Alvarado, J. P., Myklebust, H., Edelson, D. P., Barry, A., O'Hearn, N., Vanden Hoek, T. L., & Becker, L. B. (2005). Quality of cardiopulmonary resuscitation during in-hospital cardiac arrest. *Journal of the American Medical Association, 293*(3), 305-310. https://doi.org/10.1001/jama.293.3.305

Acosta, P., Varon, J., Sternbach, G. L., & Baskett, P. (2005). Kouwenhoven, Jude and Knickerbocker: The introduction of defibrillation and external chest compressions into modern resuscitation. *Resuscitation, 64*(2), 139-143. https://doi.org/10.1016/j.resuscitation.2004.12.004

Adekola, O., Menkiti, D., & Desalu, I. (2013). How much do we Remember after CPR Training? Experience from a Sub-Saharan Teaching Hospital. *Analgesia & Resuscitation : Current Research, 1(*S1). https://doi.org/10.4172/2324-903x.s1-009

Aebersold, M. (2018). Simulation-based learning: No longer a novelty in undergraduate education. *Online Journal of Issues in Nursing, 23*(2). https://doi.org/10.3912/OJIN.VOL23NO02PPT39

Agencia Nacional de Evaluación de la Calidad y Acreditación. (2003). *Programa de Convergencia Europea. El crédito europeo.*

Aggarwal, R., Mytton, O. T., Derbrew, M., Hananel, D., Heydenburg, M., Issenberg, B., MacAulay, C., Mancini, M. E., Morimoto, T., Soper, N., Ziv, A., & Reznick, R.

(2010). Training and simulation for patient safety. *Quality & Safety in Health Care*, *19*(2). https://doi.org/10.1136/QSHC.2009.038562

Ahnefeld, F., Frey, R., Fritsche, P., & Nolte, H. (1967). Die Glieder der Rettungskette. *Munch Med Wochenschr*, *109*, 2157-2161.

Akhu-Zaheya, L. M., Gharaibeh, M. K., & Alostaz, Z. M. (2013). Effectiveness of Simulation on Knowledge Acquisition, Knowledge Retention, and Self-Efficacy of Nursing Students in Jordan. *Clinical Simulation In Nursing*, *9*(9), 335-342. https://doi.org/10.1016/J.ECNS.2012.05.001

Akselbo, I., Olufsen, V., Ingebrigtsen, O., & Aune, I. (2019). Simulation as a learning method in public health nurse education. *Public Health Nursing*, *36*(2), 226-232. https://doi.org/10.1111/PHN.12560

Alconero-Camarero, A. R., Sarabia-Cobo, C. M., Catalán-Piris, M. J., González-Gómez, S., & González-López, J. R. (2021). Nursing Students' Satisfaction: A Comparison between Medium- and High-Fidelity Simulation Training. *International Journal of Environmental Research and Public Health*, *18*(2), 1–11. https://doi.org/10.3390/IJERPH18020804

Aldridge, M. (2012). Defining and exploring clinical skills and simulation-based education. *Developing Healthcare Skills Through Simulation*, 3-17. https://doi.org/10.4135/9781446269954.N2

Alhaj Ali, A., Miller, E., Ballman, K., Bakas, T., Geis, G., & Ying, J. (2020). The impact of debriefing modalities on nurse practitioner students' knowledge and leadership skills in managing fatal dysrhythmias: A pilot study. *Nurse Education in Practice*, *42*. https://doi.org/10.1016/J.NEPR.2019.102687

Almeida, R. G., Mazzo, A., Martins, J. C. A., Baptista, R. C. N., Girão, F. B., & Mendes, I. A. C. (2015). Validation to Portuguese of the Scale of Student Satisfaction and Self-Confidence in Learning. *Revista Latino-Americana de Enfermagem*, *23*(6), 1007-1013. https://doi.org/10.1590/0104-1169.0472.2643

American Heart Association. (2020). *American Heart Association Guidelines for CPR and ECC*. https://cpr.heart.org/en/resuscitation-science/cpr-and-ecc-guidelines

Andersen, L. W., Holmberg, M. J., Berg, K. M., Donnino, M. W., & Granfeldt, A. (2019). In-Hospital Cardiac Arrest: A Review. *JAMA*, *321*(12), 1200-1210. https://doi.org/10.1001/JAMA.2019.1696

Andersen, P. O., Jensen, M. K., Lippert, A., & Østergaard, D. (2010). Identifying non-technical skills and barriers for improvement of teamwork in cardiac arrest teams. *Resuscitation*, *81*(6), 695-702. https://doi.org/10.1016/j.resuscitation.2010.01.024

Anderson, G. S., Gaetz, M., & Statz, C. (2012). CPR skill retention of first aid attendants within the workplace. *Prehospital and Disaster Medicine*, *27*(4), 312-318. https://doi.org/10.1017/S1049023X1200088X

Argullós, J. L. P., & Sancho, C. G. (2010). El uso de las simulaciones en educación médica. *Education in the Knowledge Society*, *11*(2), 147-170. https://doi.org/10.14201/EKS.7075

Basak, T., Unver, V., Moss, J., Watts, P., & Gaioso, V. (2016). Beginning and advanced students' perceptions of the use of low- and high-fidelity mannequins in nursing simulation. *Nurse Education Today*, *36*, 37-43. https://doi.org/10.1016/J.NEDT.2015.07.020

Baskett, P., Bossaert, L., Carli, P., Chamberlain, D., Dick, W., Nolan, J. P., Parr, M. J.

A., Scheidegger, D., Zideman, D., Blancke, W., Delooz, H., Handley, A., Kettler, D., Kloeck, W., Kramer, E., Quan, L., Studer, W., & Van Drenth, A. (1996). Guidelines for the basic management of the airway and ventilation during resuscitation: A statement by the airway and ventilation management working group of the European Resuscitation Council. *Resuscitation*, *31*(3), 187-200. https://doi.org/10.1016/0300-9572(96)00975-6

Bevan, A. L., Joy, R., Keeley, S., & Brown, P. (2015). Learning to nurse: Combining simulation with key theory. *British Journal of Nursing*, *24*(15), 781-785. https://doi.org/10.12968/BJON.2015.24.15.781

Bhanji, F., Donoghue, A. J., Wolff, M. S., Flores, G. E., Halamek, L. P., Berman, J. M., Sinz, E. H., & Cheng, A. (2015). Part 14: Education: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, *132*(18), S561–S573. https://doi.org/10.1161/CIR.0000000000000268

Bossaert, L., & Chamberlain, D. (2013). The European Resuscitation Council: Its history and development. *Resuscitation*, *84*(10), 1291-1294. https://doi.org/10.1016/j.resuscitation.2013.07.025

Bradley, P. (2006). The history of simulation in medical education and possible future directions. *Medical Education*, *40*(3), 254-262. https://doi.org/10.1111/J.1365-2929.2006.02394.X

Brennan, E. E., McGraw, R. C., & Brooks, S. C. (2016). Accuracy of instructor assessment of chest compression quality during simulated resuscitation. *Canadian Journal of Emergency Medicine*, *18*(4), 276-282. https://doi.org/10.1017/cem.2015.104

Brewer, E. P. (2011). Successful techniques for using human patient simulation in nursing education. *Journal of Nursing Scholarship*, *43*(3), 311-317. https://doi.org/10.1111/J.1547-5069.2011.01405.X

Carvalho, E. C., Oliveira-Kumakura, A. R. S., & Morais, S. C. R. V. (2017). Clinical reasoning in nursing: teaching strategies and assessment tools. *Revista Brasileira de Enfermagem*, *70*(3), 662-668. https://doi.org/10.1590/0034-7167-2016-0509

Chamberlain, D., Bossaert, L., Carli, P., Edgren, E., Ekstrom, L., Hapnes, S., Holmberg, S., Koster, R., Lindner, K., Pasqualucci, V., Perales, N., Von Planta, M., Robertson, C., & Steen, P. (1992). Guidelines for advanced life support. A statement by the Advanced Life Support Working Party of the European Resuscitation Council, 1992. *Resuscitation*, *24*(2), 111-121. https://doi.org/10.1016/0300-9572(92)90016-6

Chamberlain, D., Vincent, R., Baskett, P., Bossaert, L., Robertson, C., Juchems, R., & Lindner, K. (1994). Management of peri-arrest arrhythmias. A statement for the advanced cardiac life support committee of the European resuscitation council, 1994. *Resuscitation*, *28*(2), 151-159. https://doi.org/10.1016/0300-9572(94)90088-4

Chamberlain, Gattiker, R., Hart, H. N., Holmberg, S., Kulbertus, H. E., Marsden, A., Meursing, B. T. J., & Mogensen, L. (1987). Report from a symposium: Recent achievements and present controversies in cardiopulmonary resuscitation. *European Heart Journal*, *8*(5), 438-443. https://doi.org/10.1093/oxfordjournals.eurheartj.a062302

Colaizzi, P. F. (1978). Psychological research as the phenomenologist views it. *Existential-Phenomenological Alternatives for Psychology*, 48-71. Oxford University Press.

Consejo Español de Resucitación Cardiopulmonar. (2021). *Día Mundial de la Parada Cardíaca, 16 de octubre*. https://www.cercp.org/wp-content/uploads/2021/10/NP-Dia-mundial-parada-cardiaca.pdf

Cordero Torres, J. A., & Caballero Oliver, A. (2015). The Moodle platform: A useful tool for training in life support. Analysis of satisfaction questionnaires from students and instructors of the semFYC advanced life support courses. *Atencion Primaria*, *47*(6), 376-384. https://doi.org/10.1016/J.APRIM.2015.02.006

Corvetto, M., Bravo, M. P., Montaña, R., Utili, F., Escudero, E., Boza, C., Varas, J., & Dagnino, J. (2013). Simulación en educación médica: Una sinopsis. *Revista Medica de Chile*, *141*(1), 70-79. https://doi.org/10.4067/S0034-98872013000100010

Creutzfel, J., Hedman, L., Heinrichs, L., Youngblood, P., & Felländer-Tsai, L. (2013). Cardiopulmonary resuscitation training in high school using avatars in virtual worlds: an international feasibility study. *Journal of Medical Internet Research*, *15*(1). https://doi.org/10.2196/JMIR.1715

Daniel Guerrero, A. B., Domínguez Quintero, G. F., Andrade Osorio, A., & Morales López, S. (2021). Simulación de alta fidelidad y método pausa reflexión en estudiantes de medicina de la UNAM. *Educación Médica*, *22*, 248-255. https://doi.org/10.1016/J.EDUMED.2019.02.011

Dávila-Cervantes, A. (2014). Simulación en Educación Médica. *Investigación en Educación Médica*, *3*(10), 100-105. https://doi.org/10.1016/S2007-5057(14)72733-4

Dieckmann, P. (2009). Simulation settings for learning in acute medical care. *Using Simulations for Education, Training and Research*, 40-138.

Dieckmann, P., Friis, S. M., Lippert, A., & Østergaard, D. (2009). The art and science of debriefing in simulation: Ideal and practice. *Medical Teacher*, *31*(7), 287-294. https://doi.org/10.1080/01421590902866218

Durá Ros, M. J. (2013). *La simulación clínica como metodología de aprendizaje y adquisición de competencias en enfermería*. Universidad Complutense de Madrid.

Espacio Europeo de Educación Superior. (1999). *Declaración de Bolonia*. http://eees.umh.es/contenidos/Documentos/DeclaracionBolonia.pdf

Ettl, F., Testori, C., Weiser, C., Fleischhackl, S., Mayer-Stickler, M., Herkner, H., Schreiber, W., & Fleischhackl, R. (2011). Updated teaching techniques improve CPR performance measures: A cluster randomized, controlled trial. *Resuscitation*, *82*(6), 730-735. https://doi.org/10.1016/j.resuscitation.2011.02.005

European Resuscitation Council. (2021). *ERC Guidelines*. https://cprguidelines.eu/

Falcó Pegueroles, A. (2004). La nueva formación de profesionales: sobre la competencia profesional y la competencia del estudiante de enfermería. *Educación Médica*, *7*(1), 42–45.

Fernández-Ayuso, D., Fernández-Ayuso, R., Del-Campo-Cazallas, C., Pérez-Olmo, J. L., Matías-Pompa, B., Fernández-Carnero, J., & Calvo-Lobo, C. (2018). The Modification of Vital Signs According to Nursing Students' Experiences Undergoing Cardiopulmonary Resuscitation Training via High-Fidelity Simulation: Quasi-Experimental Study. *JMIR Serious Games*, *6*(3). https://doi.org/10.2196/11061

Fernández Ayuso, D., Campo Cazallas, C., & Fernández Ayuso, R. (2016). Aprendizaje en entornos de simulación de alta fidelidad: evaluación del estrés en estudiantes de

enfermería. *Educación Médica, 17*(1), *25-28*. https://doi.org/10.1016/j.edumed.2016.02.003

Flin, R., & Maran, N. (2015). Basic concepts for crew resource management and non-technical skills. *Best Practice & Research Clinical Anaesthesiology*, *29*(1), 27-39. https://doi.org/10.1016/J.BPA.2015.02.002

Gaba, D. M. (2004). The future vision of simulation in health care. *Quality & Safety in Health Care*, *13*(1), 2-10. https://doi.org/10.1136/QHC.13.SUPPL_1.I2

García-Carpintero Blas, E., Siles González, J., Martínez Roche, M. E., Martínez Miguel, E., Manso Perea, C., & Álvarez Embarba, B. (2017). Metodologías de enseñanza-aprendizaje en enfermería: ¿Es el portafolio una metodología acorde con el Espacio Europeo de Educación Superior?. *Revista Enfermería Docente*, *108*, 24-28. http://hdl.handle.net/10045/68356

Gillan, P. C., Parmenter, G., Van der Riet, P. J., & Jeong, S. (2013). The experience of end of life care simulation at a rural Australian University. *Nurse Education Today*, *33*(11), 1435-1439. https://doi.org/10.1016/J.NEDT.2012.11.015

Gómez Antúnez, M., López Gonzalez-Cobos, C., Villalba García, M. V., & Muiño Miguez, A. (2011). Resucitación cardiopulmonar. Soporte vital Básico y avanzado. *Medicine*, *10*(87), 5877-5889.

González Melero, M. S., & García Ramiro, P. A. (2016). Evaluación de la calidad de dos modelos de simulación clínica. *Revista de Ciencias Humanas y Sociales*, 677-690.

Gräsner, J. T., Herlitz, J., Tjelmeland, I. B. M., Wnent, J., Masterson, S., Lilja, G., Bein, B., Böttiger, B. W., Rosell-Ortiz, F., Nolan, J. P., Bossaert, L., & Perkins, G. D. (2021). European Resuscitation Council Guidelines 2021: Epidemiology of cardiac

arrest in Europe. *Resuscitation*, *161*, 61-79. https://doi.org/10.1016/J.RESUSCITATION.2021.02.007

Gräsner, J. T., Lefering, R., Koster, R. W., Masterson, S., Böttiger, B. W., Herlitz, J., Wnent, J., Tjelmeland, I. B. M., Ortiz, F. R., Maurer, H., Baubin, M., Mols, P., Hadžibegović, I., Ioannides, M., Škulec, R., Wissenberg, M., Salo, A., Hubert, H., Nikolaou, N. I., … Bossaert, L. L. (2016). EuReCa ONE—27 Nations, ONE Europe, ONE Registry: A prospective one month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe. *Resuscitation*, *105*, 188-195. https://doi.org/10.1016/j.resuscitation.2016.06.004

Green, J., & Thorogood, N. (2014). *Qualitative methods for health research (3rd ed.)*. SAGE Publications UK: London, England.

Greif, R. (2015). "The ERC considers these new resuscitation guidelines to be the most effective and easily learned interventions that can be supported by current knowledge, research and experience." Koen Monsieurs, Secretary of ILCOR and ERC Board Director guidelines. *Trends in Anaesthesia and Critical Care*, *5*(6), 161-162. https://doi.org/10.1016/j.tacc.2015.10.008

Greif, R., Lockey, A., Breckwoldt, J., Carmona, F., Conaghan, P., Kuzovlev, A., Pflanzl-Knizacek, L., Sari, F., Shammet, S., Scapigliati, A., Turner, N., Yeung, J., & Monsieurs, K. G. (2021). European Resuscitation Council Guidelines 2021: Education for resuscitation. *Resuscitation*, *161*, 388-407. https://doi.org/10.1016/J.RESUSCITATION.2021.02.016

Greif, R., Lockey, A. S., Conaghan, P., Lippert, A., De Vries, W., Monsieurs, K. G., Ballance, J. H. W., Barelli, A., Biarent, D., Bossaert, L., Castren, M., Handley, A. J., Lott, C., Maconochie, I., Nolan, J. P., Perkins, G., Raffay, V., Ringsted, C., Soar,

J., … Zideman, D. (2015). European Resuscitation Council Guidelines for Resuscitation 2015. Section 10. Education and implementation of resuscitation. *Resuscitation*, *95*, 288-301. https://doi.org/10.1016/j.resuscitation.2015.07.032

Hagen, I. H., & Molnes, S. I. (2013). Simulering kan gi bedre praksis. *Sykepleien*, *101*(11), 48-50. https://doi.org/10.4220/SYKEPLEIENS.2013.0103

Harris, A. W., & Kudenchuk, P. J. (2018). Cardiopulmonary resuscitation: the science behind the hands. *Heart*, *104*(13), 1056-1061. https://doi.org/10.1136/HEARTJNL-2017-312696

Heng, K. W. J., Fong, M. K., Wee, F. C., & Anantharaman, V. (2011). The role of nurses in the resuscitation of in-hospital ardiac arrests. *Singapore Medical Journal*, *52*(8), 611-615.

Hernández-Padilla, J., Suthers, F., Fernández-Sola, C., & Granero-Molina, J. (2014). Development and psychometric assessment of the Basic Resuscitation Skills Self-Efficacy Scale. *European Journal of Cardiovascular Nursing*, *15*(3), e10-e18. https://doi.org/10.1177/1474515114562130

Hicks, F. D., Coke, L., & Li, S. (2009). The Effect of High-Fidelity Simulation on Nursing Students' Knowledge and Performance: A Pilot Study. *National Council of State Boards of Nursing*, *40*.

Holmberg, S., Handley, A., Bahr, J., Baskett, P., Bossaert, L., Chamberlain, D., Dick, W., Van Drenth, A., Ekstrom, L., Juchem, R., Kettler, D., Marsden, A., Moeschler, O., Monsieurs, K., Petit, P., Primoz, H., & Schuttler, J. (1992). Guidelines for basic life support: A statement by the Basic Life Support Working Party of the European Resuscitation Council, 1992. *Resuscitation*, *24*(2), 103-110. https://doi.org/10.1016/0300-9572(92)90015-5

Hunziker, S., Tschan, F., Semmer, N. K., & Marsch, S. (2013). Importance of leadership in cardiac arrest situations: from simulation to real life and back. *Swiss Medical Weekly, 143*. https://doi.org/10.4414/SMW.2013.13774

INACSL Standards Committee. (2016). INACSL Standards of Best Practice: SimulationSM Facilitation. *Clinical Simulation In Nursing, 12*, S16-S20. https://doi.org/10.1016/J.ECNS.2016.09.007

Issenberg, S. B., McGaghie, W. C., Hart, I. R., Mayer, J. W., Felner, J. M., Petrusa, E. R., Waugh, R. A., Brown, D. D., Safford, R. R., Gessner, I. H., Gordon, D. L., & Ewy, G. A. (1999). Simulation technology for health care professional skills training and assessment. *JAMA*, *282*(9), 861-866. https://doi.org/10.1001/JAMA.282.9.861

Jack, K., Hamshire, C., & Chambers, A. (2017). The influence of role models in undergraduate nurse education. *Journal of Clinical Nursing*, *26*(23–24), 4707-4715. https://doi.org/10.1111/JOCN.13822

Jansen, D. A., Johnson, N., Larson, G., Berry, C., & Brenner, G. H. (2009). Nursing Faculty Perceptions of Obstacles to Utilizing Manikin-based Simulations and Proposed Solutions. *Clinical Simulation In Nursing*, *5*(1), e9-e16. https://doi.org/10.1016/J.ECNS.2008.09.004

Jeffries, P. R. (2005). A framework for designing, implementing, and evaluating simulations used as teaching strategies in nursing. *Nursing Education Perspective*, *26*(2), 96-103. https://pubmed.ncbi.nlm.nih.gov/15921126/

Jeffries, P. R. (2008). Getting in S.T.E.P. with simulations: simulations take educator preparation. *Nursing Education Perspectives*, *29*(2), 70-71. https://doi.org/10.1097/00024776-200803000-00006

Kashef, M. A., & Lotfi, A. S. (2021). Evidence-Based Approach to Out-of-Hospital Cardiac Arrest. *Current Treatment Options in Cardiovascular Medicine*, *23*(6). https://doi.org/10.1007/S11936-021-00924-3

Ker, J., Mole, L., & Bradley, P. (2003). Early introduction to interprofessional learning: a simulated ward environment. *Medical Education*, *37*(3), 248-255. https://doi.org/10.1046/J.1365-2923.2003.01439.X

Kiguchi, T., Okubo, M., Nishiyama, C., Maconochie, I., Ong, M. E. H., Kern, K. B., Wyckoff, M. H., McNally, B., Christensen, E., Tjelmeland, I., Herlitz, J., Perkins, G. D., Booth, S., Finn, J., Shahidah, N., Shin, S. Do, Bobrow, B. J., Morrison, L. J., Salo, A., … Iwami, T. (2020). Out-of-hospital cardiac arrest across the World: First report from the International Liaison Committee on Resuscitation (ILCOR). *Resuscitation*, *152*, 39-49. https://doi.org/10.1016/J.RESUSCITATION.2020.02.044

Kim, E. J., Lee, K. R., Lee, M. H., & Kim, J. (2012). Nurses' cardiopulmonary resuscitation performance during the first 5 minutes in in-situ simulated cardiac arrest. *Journal of Korean Academy of Nursing*, *42*(3), 368. https://doi.org/10.4040/JKAN.2012.42.3.361

Kim, Issenberg, B., & Roh, Y. S. (2019). The Effects of Simulation-Based Advanced Life Support Education for Nursing Students. *Computers, Informatics, Nursing*, *38*(5), 240-245. https://doi.org/10.1097/cin.0000000000000560

Kim, J., Park, J.-H., & Shin, S. (2016). Effectiveness of simulation-based nursing education depending on fidelity: a meta-analysis. *BMC Medical Education*, *16*(1) https://doi.org/10.1186/s12909-016-0672-7

Kim, S., Ahn, K. O., & Jeong, S. (2018). The effect of team-based CPR on outcomes in out of hospital cardiac arrest patients: A meta-analysis. *American Journal of Emergency Medicine*, *36*(2), 248-252. https://doi.org/10.1016/j.ajem.2017.07.089

Kleinman, M. E., Perkins, G. D., Bhanji, F., Billi, J. E., Bray, J. E., Callaway, C. W., de Caen, A., Finn, J. C., Hazinski, M. F., Lim, S. H., Maconochie, I., Morley, P., Nadkarni, V., Neumar, R. W., Nikolaou, N., Nolan, J. P., Reis, A., Sierra, A. F., Singletary, E. M., … Zideman, D. (2018). ILCOR Scientific Knowledge Gaps and Clinical Research Priorities for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care: A Consensus Statement. *Resuscitation*, *127*, 132-146. https://doi.org/10.1016/j.resuscitation.2018.03.021

Kuznar, K. A. (2007). Associate degree nursing students' perceptions of learning using a high-fidelity human patient simulator. *Teaching and Learning in Nursing*, *2*(2), 46-52. https://doi.org/10.1016/J.TELN.2007.01.009

Leblanc, V. R., Regehr, C., Tavares, W., Scott, A. K., MacDonald, R., & King, K. (2012). The Impact of Stress on Paramedic Performance During Simulated Critical Events. *Prehospital and Disaster Medicine*, *27*(4), 369-374. https://doi.org/10.1017/S1049023X12001021

Lewis, R., Strachan, A., & Smith, M. M. (2012). Is high fidelity simulation the most effective method for the development of non-technical skills in nursing? A review of the current evidence. *The Open Nursing Journal*, *6*, 82-89. https://doi.org/10.2174/1874434601206010082

Liaw, S. Y., Rethans, J. J., Scherpbier, A., & Piyanee, K. Y. (2011). Rescuing A Patient In Deteriorating Situations (RAPIDS): A simulation-based educational program on recognizing, responding and reporting of physiological signs of deterioration.

Resuscitation, *82*(9), 1224-1230. https://doi.org/10.1016/J.RESUSCITATION.2011.04.014

Link, M. S., Donnino, M. W., White, R. D., Paxton, J. H., Kudenchuk, P. J., Halperin, H. R., Yannopoulos, D., Neumar, R. W., Silvers, S. M., Berkow, L. C., Moitra, V. K., Hess, E. P., & O'Neil, B. J. (2015). Part 7: Adult Advanced Cardiovascular Life Support. *Circulation*, *132*(18), S444-S464. https://doi.org/10.1161/cir.0000000000000261

Lockey, A., Lin, Y., & Cheng, A. (2018). Impact of adult advanced cardiac life support course participation on patient outcomes—A systematic review and meta-analysis. *Resuscitation, 129*, 48-54. https://doi.org/10.1016/j.resuscitation.2018.05.034

Madden, C. (2006). Undergraduate nursing students' acquisition and retention of CPR knowledge and skills. *Nurse Education Today*, *26*(3), 218–227. https://doi.org/10.1016/j.nedt.2005.10.003

Mäkinen, M., Axelsson, Å., Castrén, M., Nurmi, J., Lankinen, I., & Niemi-Murola, L. (2010). Assessment of CPR-D skills of nursing students in two institutions: Reality versus recommendations in the guidelines. *European Journal of Emergency Medicine*, *17*(4), 237-239. https://doi.org/10.1097/MEJ.0b013e328331471b

Maran, N. J., & Glavin, R. J. (2003). Low- to high-fidelity simulation - a continuum of medical education? *Medical Education*, *37*(1), 22-28. https://doi.org/10.1046/J.1365-2923.37.S1.9.X

Martínez-Castillo, F., & Matus-Miranda, R. (2015). Desarrollo de habilidades con simulación clínica de alta fidelidad. Perspectiva de los estudiantes de enfermería. *Enfermería Universitaria*, *12*(2), 93-98. https://doi.org/10.1016/J.REU.2015.04.003

Martínez-Clares, P., Martínez-Juárez, M., & Muñoz-Cantero, J. M. (2008). Formación basada en competencias en educación sanitaria: aproximaciones a enfoques y modelos de competencia. *Revista Electrónica de Investigación y Evaluación Educativa*, *14*(2). https://doi.org/10.7203/RELIEVE.14.2.4190

Martins, J. C. A., Mazzo, A., Baptista, R. C. N., Coutinho, V. R. D., De Godoy, S., Mendes, I. A. C., & Trevizan, M. A. (2012). The simulated clinical experience in nursing education: a historical review. *ACTA Paulista de Enfermagem*, *25*(4), 619-625. https://doi.org/10.1590/S0103-21002012000400022

Meaney, P. A., Sutton, R. M., Tsima, B., Steenhoff, A. P., Shilkofski, N., Boulet, J. R., Davis, A., Kestler, A. M., Church, K. K., Niles, D. E., Irving, S. Y., Mazhani, L., & Nadkarni, V. M. (2012). Training hospital providers in basic CPR skills in Botswana: Acquisition, retention and impact of novel training techniques. *Resuscitation*, *83*(12), 1484-1490. https://doi.org/10.1016/j.resuscitation.2012.04.014

Mokhtari Nori, J., Saghafinia, M., Kalantar Motamedi, M. H., & Khademolv Hosseini, S. M. (2012). CPR training for nurses: How often is it necessary? *Iranian Red Crescent Medical Journal*, *14*(2), 104-107.

Monsieurs, K. G., Nolan, J., Bossaert, L., Greif, R., Maconochie, I., Nikolaou, N., Perkins, G., Soar, J., Truhlar, A., Wyllie, J., & Zideman, D. (2015). Recomendaciones para la Resucitación 2015 del Consejo Europeo de Resucitación (ERC) Sección 1: Resumen Ejecutivo. *Consejo Español de Resucitación Cardiopulmonar*. https://doi.org/10.1016/j.resuscitation.2015.07.038

Moon, H., & Hyun, H. S. (2019). Nursing students' knowledge, attitude, self-efficacy in blended learning of cardiopulmonary resuscitation: a randomized controlled trial.

BMC Medical Education, *19*(1). https://doi.org/10.1186/S12909-019-1848-8

Morley, P. T., Lang, E., Aickin, R., Billi, J. E., Eigel, B., Ferrer, J. M. E., Finn, J. C., Gent, L. M., Griffin, R. E., Hazinski, M. F., Maconochie, I. K., Montgomery, W. H., Morrison, L. J., Nadkarni, V. M., Nikolaou, N. I., Nolan, J. P., Perkins, G. D., Sayre, M. R., Travers, A. H., … Zideman, D. A. (2015). Part 2: Evidence Evaluation and Management of Conflicts of Interest: 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. *Circulation*, *132*(16). https://doi.org/10.1161/CIR.0000000000000271

Motola, I., Devine, L. A., Chung, H. S., Sullivan, J. E., & Issenberg, S. B. (2013). Simulation in healthcare education: a best evidence practical guide. AMEE Guide No. 82. *Medical Teacher*, *35*(10), 1511-1530. https://doi.org/10.3109/0142159X.2013.818632

Nasr-Esfahani, M., Yazdannik, A., & Mohamadiriz, S. (2019). Development of nursing students' performance in advanced cardiopulmonary resuscitation through role-playing learning model. *Journal of Education and Health Promotion*, *8*(1). https://doi.org/10.4103/jehp.jehp_125_18

Navarrete Espinosa, C. (2016). Resucitación cardiopulmonar Recomendaciones 2015. Principales modificacione. *Revista Médica de Jaén*, 11-26.

Navarro-Vargas, J. R., Matiz-Camacho, H., & Osorio-Esquivel, J. (2015). Manual de práctica clínica basado en la evidencia: Reanimación cardiocerebropulmonar. *Revista Colombiana de Anestesiología*, *43*(1), 9-19. https://doi.org/10.1016/j.rca.2014.10.004

Nielsen, A. M., Henriksen, M. J. V., Isbye, D. Lou, Lippert, F. K., & Rasmussen, L. S. (2010). Acquisition and retention of basic life support skills in an untrained population using a personal resuscitation manikin and video self-instruction (VSI). *Resuscitation*, *81*(9), 1156-1160. https://doi.org/10.1016/j.resuscitation.2010.06.003

Nielsen, B., & Harder, N. (2013). Causes of Student Anxiety during Simulation: What the Literature Says. *Clinical Simulation in Nursing*, *9*(11), e507-e512. https://doi.org/10.1016/J.ECNS.2013.03.003

Nodal Leyva, P. E., López Héctor, J. G., & De la Llera Domínguez, G. (2006). Paro cardiorrespiratorio (PCR). Etiología. Diagnóstico. Tratamiento. *Revista Cubana de Cirugía*, *45*(3-4).

Nolan, J. P., Soar, J., Zideman, D. A., Biarent, D., Bossaert, L. L., Deakin, C., Koster, R. W., Wyllie, J., & Böttiger, B. (2010). European Resuscitation Council Guidelines for Resuscitation 2010 Section 1. Executive summary. *Resuscitation*, *81*(10), 1219-1276. https://doi.org/10.1016/J.RESUSCITATION.2010.08.021

Oermann, M. H., Kardong-Edgren, S. E., & Odom-Maryon, T. (2011). Effects of monthly practice on nursing students' CPR psychomotor skill performance. *Resuscitation*, *82*(4), 447-453. https://doi.org/10.1016/j.resuscitation.2010.11.022

Olasveengen, T. M., Semeraro, F., Ristagno, G., Castren, M., Handley, A., Kuzovlev, A., Monsieurs, K. G., Raffay, V., Smyth, M., Soar, J., Svavarsdottir, H., & Perkins, G. D. (2021). European Resuscitation Council Guidelines 2021: Basic Life Support. *Resuscitation, 161*, 98-114 https://doi.org/10.1016/j.resuscitation.2021.02.009

Paige, J. T., Garbee, D. D., Brown, K. M., & Rojas, J. D. (2015). Using Simulation in Interprofessional Education. *The Surgical Clinics of North America*, *95*(4), 751-766.

https://doi.org/10.1016/J.SUC.2015.04.004

Palaganas, J. C., Fey, M., & Simon, R. (2016). Structured Debriefing in Simulation-Based Education. *AACN Advanced Critical Care*, *27*(1), 78-85. https://doi.org/10.4037/AACNACC2016328

Pallás Beneyto, L. A., Rodríguez Luis, O., & Miguel Bayarri, V. (2012). Reanimación cardiocerebral intrahospitalaria. *Medicina Clínica*, *138*(3), 120-126. https://doi.org/10.1016/j.medcli.2011.05.012

Partin, J. L., Payne, T. A., & Slemmons, M. F. (2011). Students' perceptions of their learning experiences using high-fidelity simulation to teach concepts relative to obstetrics. *Nursing Education Perspectives*, *32*(3), 186-188. https://doi.org/10.5480/1536-5026-32.3.186

Peláez Sánchez, M. E. (2016). Conocimientos de los enfermeros del hospital del oriente de asturias (HOA) en reanimación cardiopulmonar. *Enfermería Comunitaria*, *4*(3), 18-30.

Perales Rodríguez de Viguri, N., López Messa, J., & Ruano Marco, M. (2007). *Manual de soporte vital avanzado*.

Perkins, G. D., Graesner, J.-T., Semeraro, F., Olasveengen, T., Soar, J., Lott, C., Van de Voorde, P., Madar, J., Zideman, D., Mentzelopoulos, S., Bossaert, L., Greif, R., Monsieurs, K., Svavarsdóttir, H., Nolan, J. P., Boccuzzi, A., Böttiger Roman Burkart, B., Carli, P., Cassan, P., … Lopez Mesa, F. (2021). European Resuscitation Council Guidelines 2021. Resumen ejecutivo. *Consejo Español de Resucitación Cardiopulmonar*. https://erc.edu/about

Perkins, G. D., Neumar, R., Monsieurs, K. G., Han Lim, S., Castren, M., Nolan, J. P., Nadkarni, V., Montgomery, B., Steen, P., Cummins, R., Chamberlain, D., Aickin, R., de Caen, A., Wang, T.-L., Stanton, D., Escalante, R., Callaway, C. W., Soar, J., Olasveengen, T., … behalf of the International Liaison Committee on Resuscitation. (2017). The International Liaison Committee on Resuscitation—Review of the last 25 years and vision for the future. *Resuscitation*, *121*, 104-116. https://doi.org/10.1016/j.resuscitation.2017.09.029

Perkins, Handley, A. J., Koster, R. W., Castrén, M., Smyth, M. A., Olasveengen, T., Monsieurs, K. G., Raffay, V., Gräsner, J. T., Wenzel, V., Ristagno, G., Soar, J., Bossaert, L. L., Caballero, A., Cassan, P., Granja, C., Sandroni, C., Zideman, D. A., Nolan, J. P., … Greif, R. (2015). European Resuscitation Council Guidelines for Resuscitation 2015. Section 2. Adult basic life support and automated external defibrillation. *Resuscitation*, *95*, 81-99. https://doi.org/10.1016/j.resuscitation.2015.07.015

Porter, J. E., Cooper, S. J., & Taylor, B. (2014). Emergency Resuscitation team roles: What constitutes a team and who's looking after the family?. *Journal of Nursing Education and Practice*, *4*(3), 124. https://doi.org/10.5430/jnep.v4n3p124

Provencal Levesque, O., Vandyk, A., Vanderspank-Wright, B., Kaluzienski, M., & Jacob, J. D. (2021). Engaging in resuscitation status conversations in psychiatry: A qualitative study of nurses' perspectives. *Journal of Psychiatric and Mental Health Nursing*, *28*(6), 995–1004. https://doi.org/10.1111/JPM.12791

Raffay, V. (2013). European Resuscitation Council (ERC) - The Network to fight against cardiac arrest in Europe. *Best Practice and Research: Clinical Anaesthesiology*, *27*(3), 383-386. https://doi.org/10.1016/j.bpa.2013.07.007

Reed-Schrader, E., Rivers, W. T., White, L. J., & Clemency, B. M. (2018). Cardiopulmonary Resuscitation Quality Issues. *Cardiology Clinics*, *36*(3), 351-356. https://doi.org/10.1016/j.ccl.2018.03.002

Roh, Y. S., & Issenberg, S. B. (2014). Association of cardiopulmonary resuscitation psychomotor skills with knowledge and self-efficacy in nursing students. *International Journal of Nursing Practice*, *20*(6), 674-679. https://doi.org/10.1111/ijn.12212

Rosell Ortiz, F., Mellado Vergel, F. J., Fernández Valle, P., González Lobato, I., Martínez Lara, M., Ruiz Montero, M. M., Fregenal López, A., Romero Morales, F., Paz Rodríguez, M. Á., Vivar Díaz, I., García del Águila, J. J., & Olavarría Govantes, L. (2013). Descripción y resultados iniciales del registro andaluz de parada cardiaca extrahospitalaria . *Emergencias: Revista de La Sociedad Española de Medicina de Urgencias y Emergencias*, *25*(5), 345-352. https://dialnet.unirioja.es/servlet/articulo?codigo=5442980

Rossler, K. L., Sankaranarayanan, G., & Duvall, A. (2019). Acquisition of Fire Safety Knowledge and Skills With Virtual Reality Simulation. *Nurse Educator*, *44*(2), 88–92. https://doi.org/10.1097/NNE.0000000000000551

Rushton, M. A., Drumm, I. A., Campion, S. P., & O'Hare, J. J. (2020). The Use of Immersive and Virtual Reality Technologies to Enable Nursing Students to Experience Scenario-Based, Basic Life Support Training-Exploring the Impact on Confidence and Skills. *Computers, Informatics, Nursing*, *38*(6), 281-293. https://doi.org/10.1097/CIN.0000000000000608

Sancho, R., Rábago, J. L., Maestre, J. M., Del Moral, I., & Carceller, J. M. (2010). Integración de la simulación clínica en el programa formativo de la especialidad de Anestesiología y Reanimación. *Revista Española de Anestesiología y Reanimación*, *57*(10), 656-663. https://doi.org/10.1016/S0034-9356(10)70302-9

Saraç, L., & Ok, A. (2010). The effects of different instructional methods on students' acquisition and retention of cardiopulmonary resuscitation skills. *Resuscitation*, *81*(5), 555-561. https://doi.org/10.1016/j.resuscitation.2009.08.030

Saramma, P. P., Raj, L., Dash, P. K., & Sarma, P. S. (2016). Assessment of long-term impact of formal certified cardiopulmonary resuscitation training program among nurses. *Indian Journal of Critical Care Medicine*, *20*(4), 226-232. https://doi.org/10.4103/0972-5229.180043

Schiavenato, M. (2009). Reevaluating simulation in nursing education: beyond the human patient simulator. *The Journal of Nursing Education*, *48*(7), 388-394. https://doi.org/10.3928/01484834-20090615-06

Shinnick, M. A., Woo, M., Horwich, T. B., & Steadman, R. (2011). Debriefing: The Most Important Component in Simulation?. *Clinical Simulation in Nursing*, *7*(3), e105-e111. https://doi.org/10.1016/J.ECNS.2010.11.005

Sittner, B. J., Aebersold, M. L., Paige, J. B., Graham, L. L. M., Schram, A. P., Decker, S. I., & Lioce, L. (2015). INACSL Standards of Best Practice for simulation: Past, present, and future. *Nursing Education Perspectives*, *36*(5), 294-298. https://doi.org/10.5480/15-1670

Smith-Blair, N., & Neighbors, M. (2000). Use of the Critical Thinking Disposition Inventory in critical care orientation. *Journal of Continuing Education in Nursing*, *31*(6), 251-256. https://doi.org/10.3928/0022-0124-20001101-05

Soar, J., Böttiger, B. W., Carli, P., Couper, K., Deakin, C. D., Djärv, T., Lott, C., Olasveengen, T., Paal, P., Pellis, T., Perkins, G. D., Sandroni, C., & Nolan, J. P. (2021). European Resuscitation Council Guidelines 2021: Adult advanced life support. *Resuscitation*, *161*, 115-151. https://doi.org/10.1016/J.RESUSCITATION.2021.02.010

Soar, J., Nolan, J. P., Böttiger, B. W., Perkins, G. D., Lott, C., Carli, P., Pellis, T., Sandroni, C., Skrifvars, M. B., Smith, G. B., Sunde, K., & Deakin, C. D. (2015). European Resuscitation Council Guidelines for Resuscitation 2015: Section 3. Adult advanced life support. *Resuscitation*, *95*, 100-147. https://doi.org/10.1016/j.resuscitation.2015.07.016

Society for Simulation in Healthcare. (2021). *Healthcare simulation dictionary (Second ed. 2.1)*. https://www.ssih.org/Dictionary

Søreide, E., Morrison, L., Hillman, K., Monsieurs, K., Sunde, K., Zideman, D., Eisenberg, M., Sterz, F., Nadkarni, V. M., Soar, J., & Nolan, J. P. (2013). The formula for survival in resuscitation. *Resuscitation*, *84*(11), 1487-1493. https://doi.org/10.1016/J.RESUSCITATION.2013.07.020

Stroup, C. (2014). Simulation Usage in Nursing Fundamentals: Integrative Literature Review. *Clinical Simulation in Nursing*, *10*(3), e155-e164. https://doi.org/10.1016/J.ECNS.2013.10.004

Sullivan, N. J., Duval-Arnould, J., Twilley, M., Smith, S. P., Aksamit, D., Boone-Guercio, P., Jeffries, P. R., & Hunt, E. A. (2015). Simulation exercise to improve retention of cardiopulmonary resuscitation priorities for in-hospital cardiac arrests: A randomized controlled trial. *Resuscitation*, *86*, 6–13. https://doi.org/10.1016/J.RESUSCITATION.2014.10.021

Sutton, R. M., Niles, D., Meaney, P. A., Aplenc, R., French, B., Abella, B. S., Lengetti, E. L., Berg, R. A., Helfaer, M. A., & Nadkarni, V. (2011). "Booster" training: Evaluation of instructor-led bedside cardiopulmonary resuscitation skill training and automated corrective feedback to improve cardiopulmonary resuscitation compliance of Pediatric Basic Life Support providers during simulated cardiac arrest. *Pediatric Critical Care Medicine*, *12*(3), e116-21. https://doi.org/10.1097/PCC.0b013e3181e91271

Takei, Y., Nishi, T., Kamikura, T., Tanaka, Y., Wato, Y., Kubo, M., Hashimoto, M., & Inaba, H. (2015). Do early emergency calls before patient collapse improve survival after out-of-hospital cardiac arrests? *Resuscitation*, *88*, 20-27. https://doi.org/10.1016/j.resuscitation.2014.11.028

Thidemann, I. J., & Söderhamn, O. (2013). High-fidelity simulation among bachelor students in simulation groups and use of different roles. *Nurse Education Today*, *33*(12), 1599-1604. https://doi.org/10.1016/J.NEDT.2012.12.004

Vacek, J. E. (2009). Using a conceptual approach with concept mapping to promote critical thinking. *The Journal of Nursing Education*, *48*(1), 45-48. https://doi.org/10.3928/01484834-20090101-11

Vural, M., Koşar, M. F., Kerimoğlu, O., Kızkapan, F., Kahyaoğlu, S., Tuğrul, S., & İşleyen, H. B. (2017). Cardiopulmonary resuscitation knowledge among nursing students: A questionnaire study. *Anatolian Journal of Cardiology*, *17*(2), 140-145. https://doi.org/10.14744/AnatolJCardiol.2016.7156

Weidman, E. K., Bell, G., Walsh, D., Small, S., & Edelson, D. P. (2010). Assessing the impact of immersive simulation on clinical performance during actual in-hospital cardiac arrest with CPR-sensing technology: A randomized feasibility study.

Resuscitation, *81*(11), 1556-1561. https://doi.org/10.1016/J.RESUSCITATION.2010.05.021

Williams, S., & Bacon, R. (2017). Current recommendations on adult resuscitation. *BJA Education*, *3*, 99-104. https://doi.org/10.1093/bjaed/mkw051

Yeung, J., Okamoto, D., Soar, J., & Perkins, G. D. (2011). AED training and its impact on skill acquisition, retention and performance – A systematic review of alternative training methods. *Resuscitation*, *82*(6), 657-664. https://doi.org/10.1016/j.resuscitation.2011.02.035

Zideman, D. A., Bingham, R., Beattie, T., Bland, J., Blom, C., Bruins-Stassen, M., Frei, F., Gamsu, H., Lemburg, P., Mercier, J., Milner, A., Pepper, J., Philips, B., Riesgo, L., & Van Reempts, P. (1994). Guidelines for paediatric life support, a statement by the Paediatric Life Support Working Party of the European Resuscitation Council, 1993. *British Medical Journal*, 27, 91-105. https://doi.org/10.1016/0300-9572(94)90001-9

Zoltán, B. P., Luca, T., Szilárd, R., László, M., Norbert, N., Mihály, B., Bálint, N., Miklós, N., & Péter, M. (2020). The present and the future of medical simulation education in Hungary. *Orvosi Hetilap*, *161*(26), 1078-1087. https://doi.org/10.1556/650.2020.31761

VIII. OTRAS APORTACIONES CIENTÍFICAS DERIVADAS DE LA TESIS DOCTORAL

8. OTRAS APORTACIONES CIENTÍFICAS DERIVADAS DE LA TESIS DOCTORAL

8.1. Capítulo de libro

García-Viola, A., Muñoz-Montoya, M., & Garrido-Molina, J. M. (2020). Metodologías empleadas durante el entrenamiento en soporte vital para enfermería. ASUNIVEP (Ed.), *Revisión e innovación en la actitud de los profesionales de la salud* (Vol. IV, pp. 63–72).

CERTIFICADO DE CARÁCTER CIENTÍFICO Y AUTORÍA DE CAPÍTULO DE LIBRO

Dra. MARÍA DEL MAR MOLERO JURADO, Profesora de la Universidad de Almería, responsable del Grupo de Investigación SEJ-473 "Intervención Psicológica y Médica a lo largo del Ciclo Vital" de la Universidad de Almería y perteneciente al Plan Andaluz de Investigación de la Consejería de Conocimiento, Investigación y Universidad de la Junta de Andalucía, Editora del Libro "*Revisión e innovación en la actuación de los profesionales de la salud. Volumen IV*"

CERTIFICA, que:

ALBA GARCÍA VIOLA
MARIA MUÑOZ MONTOYA
JOSÉ MIGUEL GARRIDO MOLINA

son autores/as del capítulo número **8** (pp. 63-72), denominado **METODOLOGÍAS EMPLEADAS DURANTE EL ENTRENAMIENTO EN SOPORTE VITAL PARA ENFERMERÍA** publicado en el libro titulado REVISIÓN E INNOVACIÓN EN LA ACTUACIÓN DE LOS PROFESIONALES DE LA SALUD. VOLUMEN IV, editado por ASUNIVEP con número de ISBN: 978-84-09-18754-6, Depósito Legal: AL 386-2020, y fecha de edición 02/04/2020.

El carácter Científico de este Capítulo de Libro redactado por los autores mencionados anteriormente, viene avalado por los siguientes indicadores académicos, y técnicos:

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5. El Libro ha sido revisado por un comité editorial, formado por especialistas Doctores en distintas áreas (Enfermería, Fisioterapia, Medicina, Psicología, etc.) que han constatado el valor científico y profesional de cada publicación realizada.
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7. La difusión de la publicación ha sido de carácter nacional e Internacional, y se puede acceder al índice de contenidos en: https://ciccs.es/6/contenido/textos/descargar_libro/176

Y para que conste, firma el presente en Almería a 22 de mayo de 2020

Fdo: Dra. María del Mar Molero Jurado
Grupo de Investigación SEJ-473
Universidad de Almería

8.2. Comunicaciones a Congresos y Jornadas de Investigación Internacionales

- García-Viola, A., Muñoz-Montoya, M., & Garrido-Molina, J. M. (2021, 14-15 julio). *Simulación clínica en el desarrollo de las competencias en reanimación cardiopulmonar del personal de enfermería* [Comunicación tipo póster en Congreso]. VII Congreso Internacional en Contextos Clínicos y de la Salud.

VII CONGRESO INTERNACIONAL EN CONTEXTOS CLÍNICOS Y DE LA SALUD

CERTIFICADO

Por su contribución en la modalidad de PÓSTER en el "VII CONGRESO INTERNACIONAL EN CONTEXTOS CLÍNICOS Y DE LA SALUD", con el título:

SIMULACIÓN CLÍNICA EN EL DESARROLLO DE LAS COMPETENCIAS EN REANIMACIÓN CARDIOPULMONAR DEL PERSONAL DE ENFERMERÍA

Cuyos autores son:
ALBA GARCÍA VIOLA ; MARIA MUÑOZ MONTOYA ; JOSE MIGUEL GARRIDO MOLINA

Dicha aportación está PUBLICADA en el libro de Actas del VII Congreso Internacional en Contextos Clínicos y de la Salud. Volumen II con ISBN: 978-84-09-32279-4 y Depósito Legal: 2215-2021

El Congreso se ha celebrado durante los días 14 y 15 de julio de 2021, con una duración de 20 horas, organizado por la Sociedad Científica Española para la Investigación y la Formación en Ciencias de la Salud [Sociedad Miembro Adherida a COSCE-Confederación de Sociedades Científicas de España] (entidad sin fin de lucro al amparo de la Ley 1/2002 donde en sus estatutos constan de forma expresa la formación y la investigación e inscritas en el Registro de Asociaciones de la Junta de Andalucía con el número: 1-4922, Sección 1), con la colaboración del Grupo de Investigación SEJ-473 de la UNIVERSIDAD DE ALMERÍA, perteneciente al Plan Andaluz de Investigación PAIDI, de la Consejería de Economía, Conocimiento, Empresas y Universidad de la Junta de Andalucía. Dicha actividad cuenta con la Resolución Favorable de Reconocimiento de Interés Sanitario concedida por la Comunidad de Murcia (Orden de fecha 20 de abril de 2021 al número de registro 202190000114027), igualmente dicha actividad ha sido avalada por la Sociedad Española de Educación Médica (SEDEM).

Murcia, a 15 de julio de 2021

Fdo.: Dr. José Jesús Gázquez Linares
Presidente del Congreso

SOCIEDAD CIENTÍFICA ESPAÑOLA PARA LA INVESTIGACIÓN Y FORMACIÓN EN CIENCIAS DE LA SALUD

UNIVERSIDAD DE ALMERÍA Grupo de Investigación SEJ-473 Intervención Psicológica y Médica a lo largo del Ciclo Vital

SEDEM

COSCE CONFEDERACIÓN DE SOCIEDADES CIENTÍFICAS DE ESPAÑA

- Garrido-Molina, J. M., García-Viola, A., & Muñoz-Montoya, M. (2020, 21-22 mayo). *Aprendizaje basado en el juego durante el proceso de formación de los profesionales de enfermería en técnicas de reanimación cardiopulmonar* [Comunicación tipo póster en Congreso]. VI Congreso Internacional en Contextos Clínicos y de la Salud.

VI CONGRESO INTERNACIONAL EN CONTEXTOS CLÍNICOS Y DE LA SALUD

CERTIFICADO

Por su contribución en la modalidad de PÓSTER en el "VI CONGRESO INTERNACIONAL EN CONTEXTOS CLÍNICOS Y DE LA SALUD", con el título:

APRENDIZAJE BASADO EN EL JUEGO DURANTE EL PROCESO DE FORMACIÓN DE LOS PROFESIONALES DE ENFERMERÍA EN TÉCNICAS DE REANIMACIÓN CARDIOPULMONAR

Cuyos autores son:
JOSÉ MIGUEL GARRIDO MOLINA ; ALBA GARCÍA VIOLA ; MARIA MUÑOZ MONTOYA

Dicha aportación está PUBLICADA en el libro de Actas del VI Congreso Internacional en Contextos Clínicos y de la Salud. Volumen I con ISBN: 978-84-09-20781-7 y Depósito Legal: AL 982-2020

El Congreso se ha celebrado durante los días 21 y 22 de mayo de 2020, con una duración de 20 horas, organizado por el Grupo de Investigación SEJ-473 de la UNIVERSIDAD DE ALMERÍA, perteneciente al Plan Andaluz de Investigación PAIDI, de la Consejería de Economía, Conocimiento, Empresas y Universidad de la Junta de Andalucía, por la Asoc. University of Scientific Formation Psychology and Education Research, la Sociedad Científica Española para la Investigación y la Formación en Ciencias de la Salud [**Sociedad Miembro Adherida a COSCE-Confederación de Sociedades Científicas de España**] (entidades sin fin de lucro al amparo de la Ley 1/2002 donde en sus estatutos constan de forma expresa la formación y la investigación e inscritas en el Registro de Asociaciones de la Junta de Andalucía con los números: 1-6372, Sección 1; y 1-4922, Sección 1, respectivamente), e Investigación y Formación en Psicología, Educación y Salud. Dicha actividad cuenta con la Resolución Favorable de Reconocimiento de Interés Sanitario concedida por la Comunidad de Murcia (Orden de fecha 03 de febrero de 2020 al número de registro 202090000014018), igualmente dicha actividad ha sido avalada por la Sociedad Española de Educación Médica (SEDEM).

Murcia, a 22 de mayo de 2020

Fdo.: Dr. José Jesús Gázquez Linares

Presidente del Congreso

IX. ANEXOS

9. ANEXOS

Anexo 1. *Checklist* de observación de RCP y parámetros recogidos en el SimPad PLUS

CHECK LIST DE EVALUACIÓN	GUÍA TELEFÓNICA☐	APP☐	
Sexo: Hombre ☐ Mujer☐	Edad:	Peso:	
¿Has recibido formación previa en SVB?: Sí: ☐	No: ☐	Sí	No
Tiempo de inicio:			
1. Reconoce si la zona es segura			
2. Reconocimiento adecuado de la situación de inconsciencia			
3. Pide Ayuda			
4. Maniobra de apertura de la vía aérea			
5. Comprueba respiración			
6. Llama al servicio de emergencias			
7. Pide un DEA			
8. Inicia masaje cardiaco			
9. Masaje cardiaco adecuado			
10. Ventilaciones adecuadas			
Tiempo Final:			

Puntuación de RCP: _____% Nivel Básico ☐ Intermedio ☐ Avanzado ☐

Puntuación compresiones: _____ %
Puntuación Ventilaciones: _____%

Fracción de compresiones: _____%

Nº de compresiones:_____

Profundidad media:_____

Compresiones con reexpansión completa:_____

Compresiones con profundidad suficiente:_____

Compresiones con frecuencia adecuada:_____

Frecuencia media de compresiones durante la sesión:_____

Ventilaciones:_____

Volumen medio:_____

Ventilaciones con volumen excesivo:_____

Ventilaciones con volumen adecuado:_____

Ventilaciones con volumen insuficiente:_____

Frecuencia media de ventilaciones en la sesión:_____

Anexo 2. Guion de preguntas abiertas

Guion de preguntas

- ¿Podría hablarnos de su primera experiencia de Soporte Vital Avanzado en el ámbito hospitalario?
- ¿Cómo cree que ha influido esta experiencia en su formación?
- ¿Podría indicarnos si ha detectado elementos que interfieran en el desarrollo del procedimiento de Soporte Vital Avanzado? ¿Cuáles han sido? ¿Por qué?
- ¿Cómo te has sentido actuando ante esta situación? ¿Por qué?
- Cuéntame sobre tu experiencia de trabajo en equipo
- ¿Qué factores del trabajo en equipo ha detectado que influyen en el adecuado desarrollo del procedimiento de Soporte Vital Avanzado?
- ¿Cómo cree que esta experiencia podría ayudarle a realizar Soporte Vital Avanzado en sus prácticas clínicas?
- ¿Cuáles son sus impresiones generales de la experiencia?
- ¿Hay algo más que le gustaría añadir sobre el tema?

Anexo 3. *Checklist* para medir las pausas en una situación de SVA

Ítem	Tiempo (minutos)
1. Pausa entre determinar la situación de PCR e identificar la arritmia (FV/TV). 2. Pausa entre identificar la FV/TV y pedir ayuda. 3. Pausa entre identificar la FV/TV y distribuir las tareas para iniciar la RCP 4. Pausa entre identificar la FV/TV e iniciar las compresiones torácicas 5. Pausa entre identificar la FV/TV y abrir la vía aérea 6. Pausa entre identificar la FV/TV e iniciar las ventilaciones 7. Pausa entre identificar la FV/TV y canalizar un acceso venoso 8. Pausa entre identificar la FV/TV y administrar medicación 9. Pausa entre identificar la FV/TV e iniciar la desfibrilación 10. Pausas en las compresiones torácicas durante la realización del SVA	

FV/TV: Fibrilación ventricular/Taquicardia ventricular; PCR: Parada Cardiorrespiratoria; RCP: Reanimación Cardiopulmonar; SVA: Soporte Vital Avanzado

Anexo 4. Permiso del Comité de Ética e Investigación

UNIVERSIDAD DE ALMERÍA
Departamento de Enfermería, Fisioterapia y Medicina

D. JOSÉ MANUEL HERNÁNDEZ PADILLA, Secretario del Departamento de Enfermería, Fisioterapia y Medicina

INFORMA

Que la Comisión de Ética e Investigación del Departamento de Enfermería, Fisioterapia y Medicina de la Universidad de Almería, ha aprobado por asentimiento, el desarrollo del Proyecto de Investigación:

Título: Gamificación en estudiantes de Enfermería

Investigador principal: Dra. Verónica Victoria Márquez Hernández

Alumno: Alba García Viola

Nº Protocolo: EFM-22/19

Y para que conste a los efectos oportunos donde proceda, firmo el presente en Almería, a once de marzo de 2019.

Fdo: D. José Manuel Hernández Padilla,
Secretario del Departamento.
Departamento de Enfermería, Fisioterapia y Medicina.
Universidad de Almería.

Ctra. Sacramento La Cañada de San Urbano 04120 Almería (España) Telf.: 950 015750 FAX: 950 015750 www.ual.es

Anexo 5. Consentimiento informado

DECLARACIÓN DE CONSENTIMIENTO INFORMADO

Yo,

D. /Dña. .....

Este consentimiento informado va dirigido a los alumnos del Grado en Enfermería de la Universidad de Almería (España), matriculados en la asignatura de Soporte Vital Básico y Avanzado. Siendo invitados a participar en el proyecto de tesis: "Aprendizaje y adquisición de competencias en Soporte Vital Básico y Avanzado en estudiantes de enfermería a través de la simulación clínica".

Este proyecto tiene como objetivo analizar como influye la simulación clínica en el proceso de formación en Soporte Vital Básico y Avanzado de los estudiantes de enfermería. Todo ello, con idea de identificar posibles mejoras futuras en su formación.

Manifiesto que he leído y entendido la hoja de información que se me ha entregado, que he hecho las preguntas que me surgieron sobre el proyecto y que he recibido información suficiente sobre el mismo.

Comprendo que mi participación es totalmente voluntaria, que puedo retirarme del estudio cuando quiera sin tener que dar explicaciones y sin que esto tenga repercusión alguna.

Presto libremente mi conformidad para participar en el Proyecto de Investigación titulado "Aprendizaje y adquisición de competencias en Soporte Vital Básico y Avanzado en estudiantes de enfermería a través de la simulación clínica".

He sido también informado/a de que mis datos personales serán protegidos y tratados de forma totalmente anónima. Solo podrán acceder a estos datos el personal investigador y en ningún caso conocerán la identidad del participante. Los resultados del estudio podrán ser publicados manteniendo la confidencialidad de todos los participantes según la normativa de Ley Orgánica 15/1999, de 13 de diciembre referidos a la protección de las personas físicas en lo que respecta al tratamiento de datos personales.

Tomando ello en consideración, OTORGO mi CONSENTIMIENTO para cubrir los objetivos especificados en el proyecto.

En Almería, a …./…./….

Firma del participante:	Firma del investigador:
Nombre y apellidos:	Nombre y apellidos:
DNI:	DNI: