Revista Española de Educación Médica

Análisis comparativo del nivel de adquisición de habilidades en Soporte Vital Avanzado y Soporte Vital Inmediato.

Comparative analysis of Advanced and Immediate Life Support acquisition degree.

Cárdenas-Cruz, A[1]. Peregrina-Caño, E[2]. Cárdenas-Cruz DP[3]. Santiago-Suárez, IM[3*]. Martín-Piedra, MA[2]. Parrilla-Ruiz, F[2].

[1]Hospital de Poniente, Almería, España. [2]Facultad de Medicina, Universidad de Granada. [3]Hospital Clínico San Cecilio, Granada. [1] Antonio Cárdenas Cruz: antoniocardenascruz@yahoo.es; [2] Eva Peregrina Caño evaperegrina95@gmail.com ; [3] Dolores Cárdenas Cruz lolayparri@gmail.com; [3] Isabel Santiago Suárez isa.santiago.suarez@gmail.com ; [2] Miguel Ángel Martín Piedra mmartin@ugr.es ; [2] Francisco Manuel Parrilla Ruiz parrilola@gmail.com; [*] Correspondencia: isa.santiago.suarez@gmail.com

Recibido: 5-3-2021; Aceptado: 12-3-2021; Publicado: 17-3-2021

Resumen: La Parada Cardiorrespiratoria (PCR) es un problema de salud pública en los países desarrollados. De acuerdo con La Sociedad Española de Resucitación, en España hay alrededor de treinta mil muertes al año y unos veinte mil intentos de resucitación, y aun así hasta hace muy poco los alumnos de Medicina no recibían formación reglada en Soporte Vital Avanzado (SVA). Con la introducción en 2018 de una nueva asignatura afrontamos este problema, y sin embargo nos encontramos con que no está establecido qué tipo de Soporte Vital es el adecuado para nuestros estudiantes. Por ello, el objetivo de este estudio es analizar de manera comparativa el nivel de adquisición de competencias en SVA y Soporte Vital Inmediato (SVI) y su evolución temporal en estudiantes de quinto y sexto de Medicina de la Universidad de Granada (UGR). Para alcanzar este objetivo, obtuvimos datos en una primera evaluación de los alumnos de medicina que participaron en la asignatura optativa de SVA en la Universidad de Granada durante los meses de Octubre y Noviembre (2019). Esta evaluación se llevó a cabo a través de evaluadores externos y en base a las variables que recoge la ERC de 2015. Meses después, se llevó a cabo una nueva re evaluación durante los meses de Febrero y Marzo de 2020 a la misma muestra de estudiantes, gracias a la cual obtuvimos los datos para la comparación. Dichos datos mostraron que el nivel de adquisición de competencias en SVI supera al de las competencias que componen el SVA y, además, el efecto de la Curva del Olvido para las competencias incluidas en el SVI es menor. De esta manera, se puede concluir que las competencias que componen el SVI presentan un mayor nivel de adquisición, y un menor efecto de la Curva del Olvido y por tanto deberían ser las que pasaran a formar parte de la formación para los estudiantes de Medicina de la Universidad de Granada.

Palabras clave: Parada cardiorrespiratoria, resucitación cardiopulmonar avanzada, soporte vital avanzado, formación en soporte vital para estudiantes de medicina.

Abstract: Cardiac arrest (CA) is a major public health problem in developed countries. According to the Spanish Cardiopulmonary Resuscitation Council, in Spain there are around thirty thousand deaths a year and about twenty thousand resuscitation attempts, and yet until very recently medical students did not receive formal training in Advanced Life Support (ALS). With the introduction in 2018 of a new subject, we faced the problem of not having established what type of Life Support was appropriate for our students. As a result, the aim of this study is to analyze in a comparative way the degree of acquisition of competences in ALS and Immediate Life Support (ILS) and their temporal evolution by the

students of fifth and sixth year (Medicine Degree) of the University of Granada (UGR). To achieve that aim, we obtained the data in an initial evaluation to the medical students who enrolled in the optional subject of Advanced Life Support in the Faculty of Medicine (UGR), during the months of October and November (2019). This evaluation was carried out by external evaluators and was based on the ERC 2015 guidelines. Months later, a reassessment that was carried out during the months of February and March 2020 to the same sample of students gave us the data for the comparison. Data showed that the degree of acquisition of competencies related to the ILS exceeds the level of acquisition of the competences included within the ALS, and that the effect of the Oblivion Curve for the competences included in the ILS is lower than those included in the ALS. We could conclude that the competences that are integrated within the ILS present a higher level of acquisition and a lesser effect on the forgetting curve, so they should become part of the curricular content of the UGR Medical Degree.

Keywords: Cardiorespiratory arrest; advanced cardiopulmonary resuscitation; advanced life support; immediate life support; life support training for medical students.

---

1. Introduction.

Cardiac arrest is a major public health problem in developed countries, sometimes under-estimated. According to the Spanish Cardiopulmonary Resuscitation Council, in Spain there are around thirty thousand deaths a year and about twenty thousand resuscitation attempts. Furthermore, sudden cardiac arrest (SCA) is one of the leading causes of death in Europe (1). In the initial analysis of heart rhythm, approximately 25-50% of victims of sudden cardiac arrest have Ventricular Fibrillation (VF), but when the rhythm is recorded shortly after collapse, particularly by an Automatic External Defibrillator (AED) *in situ*, the VF casualty ratio can be as high as 76% (1). The recommended treatment for VF cardiac arrest is immediate witness cardiopulmonary resuscitation (CPR) and early electrical defibrillation (2), from which it follows that Life Support training is essential, and yet, until very recently, Spanish medical students did not receive formal training in ALS.

In 2018, with the introduction at the School of Medicine (Granada) of a new subject titled "ALF: urgencies and out of hospital emergencies" (approved by the Spanish National Agency of Quality and Accreditation with code 22211AG), the situation at the University of Granada was solved, and yet another problem appeared; it is not established what type of Life Support is appropriate for medical students. It remains unclear what complexity of knowledge and skills they are capable of assuming, retaining over time, and carrying out when the time comes for them. Therefore, the main aim of this study is to analyze the impact caused by the implementation of an ALS training program for 5th and 6th year students (Medicine Degree) at the UGR. We will analyze the degree of acquisition of competencies in ALS and ILF. We will also attempt to study and compare the degree of acquisition of each competence that is part of the ALS algorithm and study comparatively the degree of acquisition of competencies in ALS and ILS. Finally, we shall analyze the maintenance of competences over time. Our main hypothesis was that training in ILS would be the most appropriate program for fifth- and sixth-year students of the Medicine Degree, UGR.

2. Methods.

This is a descriptive longitudinal study (with follow-up). The training was based on the ERC recommendations according to the 2015 guidelines, current at the time. It was carried out in the context of the optional subject of Advanced Life Support. The students received free online training following these guides. After that, during the months of

October and November (2019), 9 workshops of approximately 1 hour each were held. The first week, ILS training took place, consisting on 3 different workshops: Basic Life Support (BLS), Basic Airway and Basic Arrhythmia. In each one of them, the variables showed in Table 1 were taught by the professor, who made sure that all of the students were able to carry them out in the best way possible by the end of the hour. The following week, an evaluation of these workshops took place with external evaluators, resident doctors from the Clinical Hospital who observed and took notes without interfering. This was an individual evaluation. One by one, the students were asked to repeat the skills taught the week before. This was not a clinical case type evaluation. The week after, the three ALS workshops were held; CPR with quality control, Advanced Airway with Orotracheal Intubation (OTI) and Advanced Arrhythmia, and the variables included in Table 2 were the ones that were instructed. A week later, a competency evaluation of the ALS variables took place as described for ILS. The two last weeks consisted on the Integrated Workshops, in which the students were put into different groups and had to face a CA situation and solve it as a team in real time. In each workshop (2 workshops for shockable rhythms and 1 for non-shockable rhythms) each team faced 2 or 3 different clinical cases, depending on the time. Finally, during the months of February and March, a reevaluation of all the competencies took place. The Integrated Workshops were not re-evaluated at this time, as it was not possible to ask the students to spend so much time with us.

These evaluations and re-evaluations were carried out with the exact same procedure as the initial ones and their purpose was only to obtained the data for this study. The students knew about the study being carried out, gave consent and came to the re-evaluation to participate voluntarily. The grades of this subject had already come out in February.

Table 1. Dates and activities carried out for the study

Date	Activity
October 7th, 2019	ILS 1st workshop
October 14th, 2019	ILS 1st evaluation
October 21st, 2019	ALS 1st whorshop
October 28th, 2019	ALS 1 st evaluation
November 4th, 2019	Integrated workshops
November 11th, 2019	Integrated workshops evaluation
March 3rd, 2020	ILS and ALS re-evaluation

2.1 Study Population:

Medicine students enrolled in the optional fifth grade subject: "Advanced Life Support: Urgencies and out-of-hospital emergencies" during the academic year 2019-2020. The total number of students was 23 and all of them were present during all of the phases of this study. No random sampling was performed since all enrolled students were included in the study.

2.2 Material:

During the ILS skills program, cardiac arrest simulators and barrier systems disposable masks were used for the BLS workshop. Magill forceps, oropharyngeal and nasopharyngeal cannulas, a manual fan, supraglottic devices and connection for the oxygen were essential for the Basic Airway workshop. The Basic Arrhythmia workshop consisted on a defibrillation simulation system and medication: adrenaline and amiodarone. Meanwhile, the ALS skills program consisted firstly on CPR with quality control, in which a Vital support robotic simulator was used: Resusci Anne Simulator®.

For the advanced airway workshop, masks, gloves and Magill forceps were used. In addition to that, a laryngoscope, orotracheal intubation probe with metal guide, 10 ml syringe with fixing system, security aspiration system and a stethoscope were necessary.

Finally, for the Advanced Arrhythmia workshop the same material as for the Basic Arrhythmia one was used.

Table 2. ILS analyzed variables.

IMMEDIATE LIFE SUPPORT
Basic Life Support Skills.
1. Consciousness check.
2. Airway opening.
3. Breathing check.
4. Calling for help.
5. Activates the emergency system.
6. Localizes correct spot for cardiac massage.
7. Correct position for cardiac massage.
8. Carries out cardiac massage correctly.
9. Carries out insufflations correctly.
10. Carries out 30:2 correctly.
Basic Airway Skills
1. Selects the correct oropharyngeal cannula.
2. Positions correctly the oropharyngeal cannula.
3. Positions mask correctly.
4. Uses correctly the self-inflatable bag.
5. Ventilates correctly with the self-inflatable bag.
6. Selects the correct supraglottic device.
7. Positions correctly the supraglottic device.
8. Ventilates correctly with the supraglottic device.
Basic Arrhythmia Skills
1. Recognizes Ventricular Fibrillation.
2. Recognizes Ventricular Tachycardia (with and without pulse).
3. Recognizes Asystole.
4. Recognizes de Electrical Activity Without Pulse.
5. Correct indication of Defibrillation.
6. Carries out Defibrillation correctly.

2.3 Place of Performance:

All the training actions and evaluations were developed at the clinical simulation classrooms and laboratories of the School of Medicine, University of Granada.

2.4 Data Collection:

After the data were collected by the external evaluator, all variables were categorized as dichotomous; 0 was used for "carried out correctly" and 1 was used for "not carried out correctly". The data were tabulated in a spreadsheet and for both, text editing and data tabulation, Microsoft Office® office software (Redmond, Washington, EEUU) packages were used.

2.5 Statistical Analysis:

For the descriptive analysis, and to establish the initial database, Microsoft Office Excel ® (Redmond, Washington, EEUU) was used. For inferential analyzes two tests were applied: Z test for proportions and effect sizes and Pearson's Chi-square test to evaluate the influence of time in the abilities learned by the students. The two of them were

calculated using SPSS 15.0 (SPSS Inc, Chicago, IL, USA). 5% significance was accepted for all tests.

2.6 Analyzed Variables:

The considered essential competencies, determined by the ERC guides 2015, were the ones analyzed for this study (Table 2 and 3).

Table 3. ALS analyzed variables.

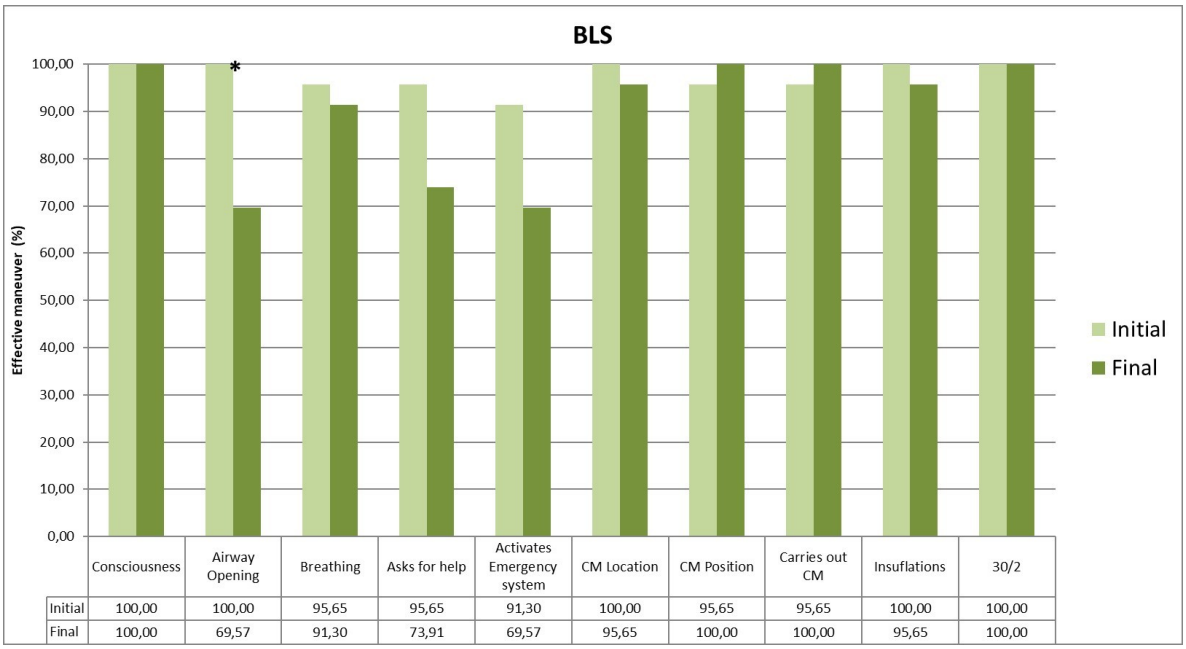
ADVANCED LIFE SUPPORT
CPR with quality control skills.
1. Localizes correct spot for cardiac massage. 2. Correct hands position. 3. Correct arms, shoulders and thorax position. 4. Correct frequency of thorax depression. 5. Correct thorax depression. 6. Correct length of insufflations. 7. Minimum interruptions of cardiac massage.
Advanced Airway Skills.
1. Selects the correct laryngoscope blade. 2. Selects the correct orotracheal intubation probe. 3. Carries out the correct technique for orotracheal intubation. 4. Checks the orotracheal intubation. 5. Detects failure in orotracheal intubation. 6. Fixes correctly the orotracheal intubation. 7. Selects a supraglottic device if there is a second failure in orotracheal intubation. 8. Positions correctly the supraglottic device.
Advanced Arrhythmia Skills.
1. Recognizes arrest arrhythmias. 2. Recognizes arrythmias that lead to arrest. 3. Recognizes life threatening arrhythmias. 4. Recognizes another kind of arrhythmias related to cardiopulmonary 5. arrest. 6. Carries out Defibrillation correctly. 7. Identifies the difference between cardio version and defibrillation. 8. Identifies the correct treatment of hypoactive arrhythmias.

3. Results.

3.1. Immediate Life Support:

ILS consisted on three different workshops. After the three of them had been evaluated and reevaluated, data showed the following results:

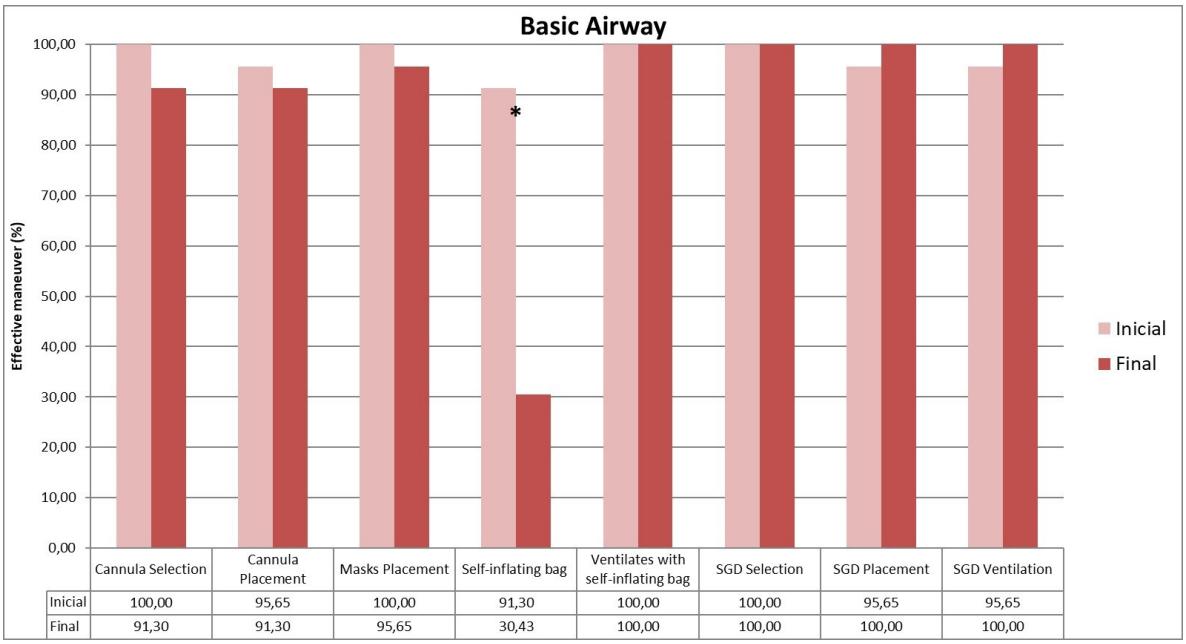
3.1.1. Basic Life Support: the correct airway opening was the most affected variable over time: an initial effective maneuver percentage of 100% was obtained. Yet, in the final evaluation there was a statistically significant reduction with 95% confidence, obtaining a percentage of 70% ($p < 0.05$). (Figure 1).



	Consciousness	Airway Opening	Breathing	Asks for help	Activates Emergency system	CM Location	CM Position	Carries out CM	Insuflations	30/2
Initial	100,00	100,00	95,65	95,65	91,30	100,00	95,65	95,65	100,00	100,00
Final	100,00	69,57	91,30	73,91	69,57	95,65	100,00	100,00	95,65	100,00

Figure 1. BLS evaluation graph. Comparison of results between initial and final evaluation.

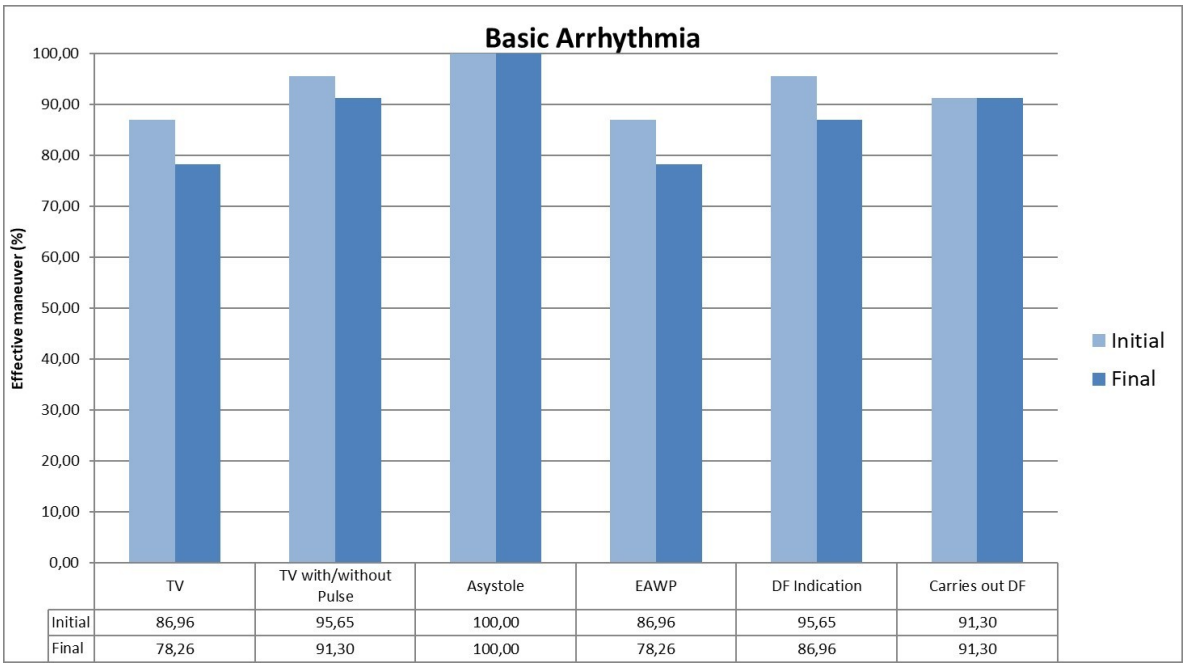
3.1.2. Basic Airway: during the initial evaluation, when measuring the ability to use the self-inflating bag, approximately a 91% effective maneuver was obtained. However, in the final evaluation the percentage dropped to 30%, revealing a statistically significant reduction of 59% ($p < 0.05$). (Figure 2).



	Cannula Selection	Cannula Placement	Masks Placement	Self-inflating bag	Ventilates with self-inflating bag	SGD Selection	SGD Placement	SGD Ventilation
Inicial	100,00	95,65	100,00	91,30	100,00	100,00	95,65	95,65
Final	91,30	91,30	95,65	30,43	100,00	100,00	100,00	100,00

Figure 2. Basic airway evaluation graph. Comparison of results between initial and final evaluation.

3.1.3. Basic Arrhythmia: losses were small and no particular variable gave significant drops (Figure 3).

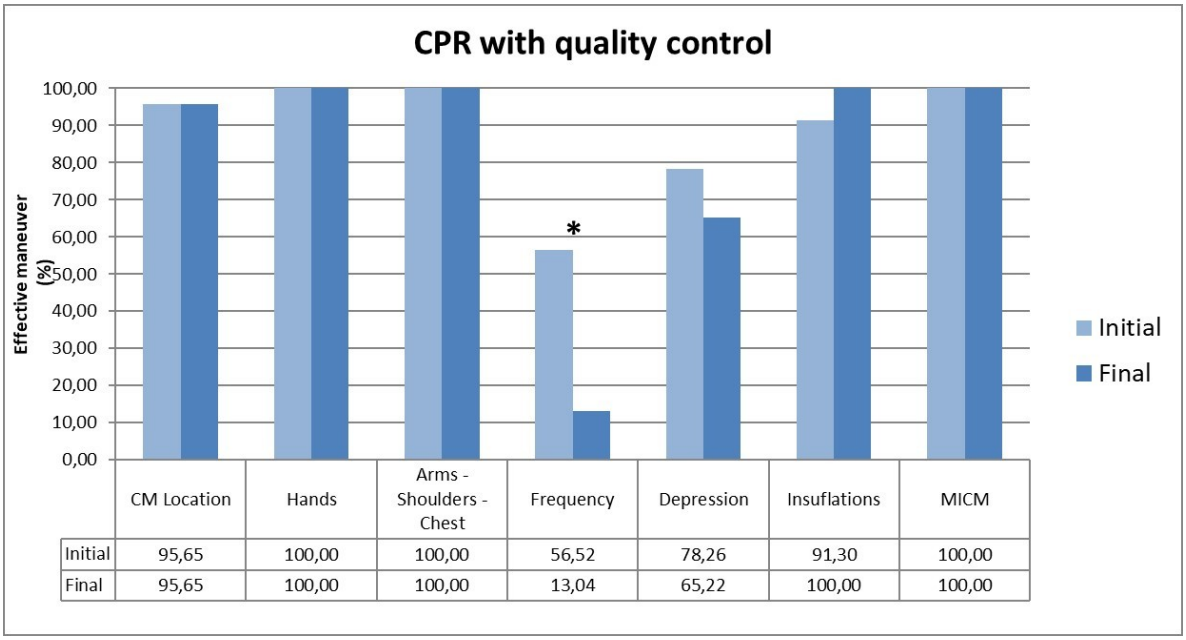


	TV	TV with/without Pulse	Asystole	EAWP	DF Indication	Carries out DF
Initial	86,96	95,65	100,00	86,96	95,65	91,30
Final	78,26	91,30	100,00	78,26	86,96	91,30

Figure 3. Basic arrhythmia evaluation graph. Comparison of results between initial and final evaluation.

3.2. Advanced Life Support:

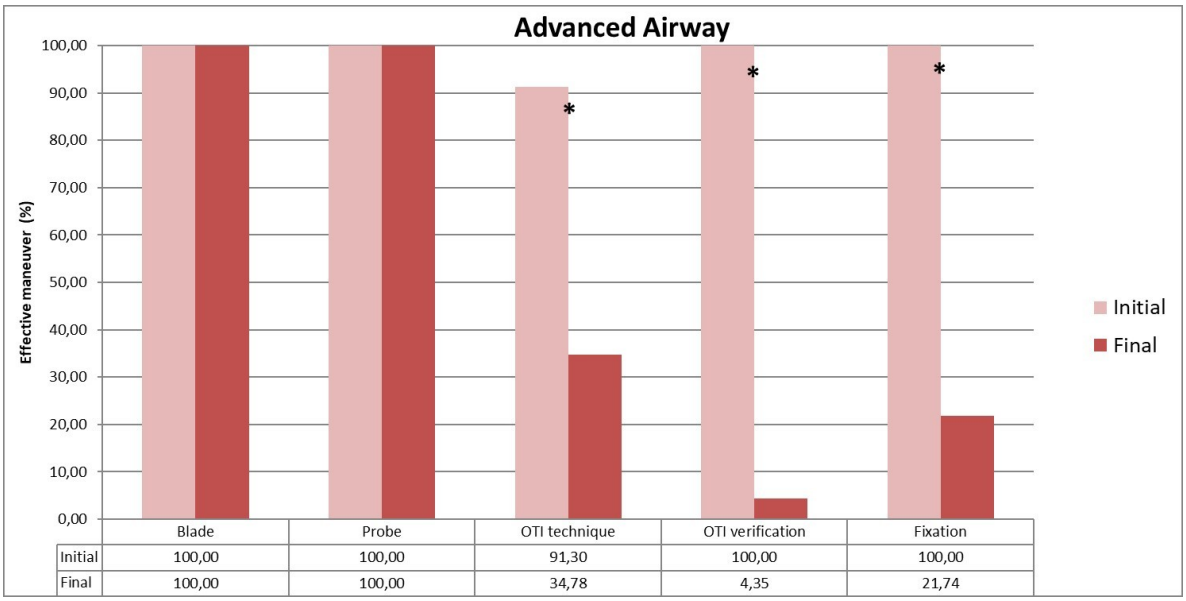
3.2.1. CPR with quality control: for the correct frequency variable in the initial phases, percentages close to 60% were obtained, being this the one that obtained the worst results. In the reevaluation, the percentage was slightly higher than 10%, obtaining a statistically significant reduction ($p < 0.05$). (Figure 4).



	CM Location	Hands	Arms - Shoulders - Chest	Frequency	Depression	Insuflations	MICM
Initial	95,65	100,00	100,00	56,52	78,26	91,30	100,00
Final	95,65	100,00	100,00	13,04	65,22	100,00	100,00

Figure 4. CPR with quality control evaluation graph. Comparison of results between initial and final evaluation.

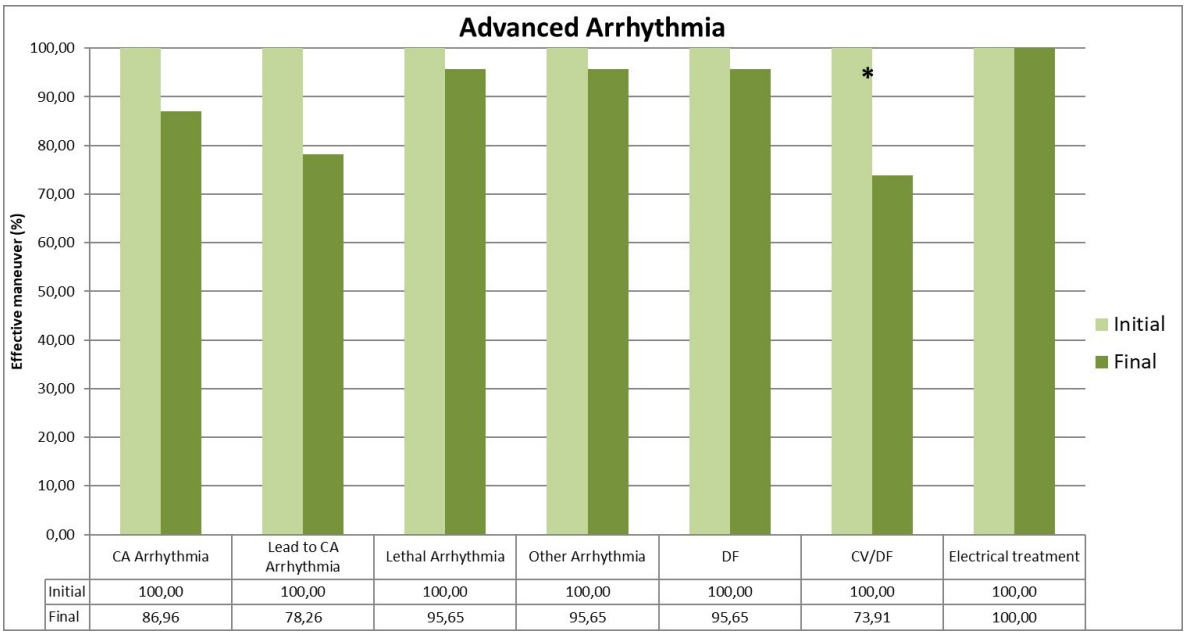
3.2.2. Advanced Airway: OTI technique, check and fixation gave important drops. Statistics assure that differences in these three variables were not due to chance with 95% confidence ($p < 0.05$) (Figure 5).



	Blade	Probe	OTI technique	OTI verification	Fixation
Initial	100,00	100,00	91,30	100,00	100,00
Final	100,00	100,00	34,78	4,35	21,74

Figure 5. Advanced airway evaluation graph. Comparison of results between initial and final evaluation.

3.3.3. Advanced Arrhythmia: Cardioversion vs Defibrillation - CV/DF) was the only variable giving a pronounced decrease (Figure 6).



	CA Arrhythmia	Lead to CA Arrhythmia	Lethal Arrhythmia	Other Arrhythmia	DF	CV/DF	Electrical treatment
Initial	100,00	100,00	100,00	100,00	100,00	100,00	100,00
Final	86,96	78,26	95,65	95,65	95,65	73,91	100,00

Figure 6. Advanced arrhythmia evaluation graph. Comparison of results between initial and final evaluation.

4. Discussion.

In Spain, BLS training in medical schools is framed within purely theoretical subjects, although there are real and effective attempts to incorporate it as a theoretical and practical subject. This is not the case concerning the teaching of ALS (6). Resident doctors are considered vital to perform BLS techniques correctly and even more the ALS ones, since they can face a cardiorespiratory arrest at any time. However, the ALS training offered by universities in Spain is far from optimal.

The possibility of including life support training in the curriculum has been previously raised, but there has been no debate on how to adapt it to a training program or on the resources required (7). CPR can be integrated into many parts of the curriculum, but it requires a general plan and adequate organization to be effective (7,8). Graham et al from the United Kingdom, studied several methods for RCP training. They concluded that standardizing the process would improve results (8).

There are many different techniques for teaching ALS and BLS in environments with limited resources. Simulation training is an integral part of resuscitation training and was shown to improve knowledge and skill performance compared to non-simulation training (2). A. Cortegiani et al. showed that the group of correct post-test responses was greater in the group that had received the high-quality simulation intervention compared to the group that had only received master classes. Furthermore, this group had a higher subjective perception of knowledge in the post-test (9). On the other hand, it has been shown that the performance of the resuscitation team improves, both in real cardiac arrest and in simulated intrahospital scenarios of advanced life support, when specific teamwork or leadership training is added to advanced level courses (2).

At the University of Granada, ALS is taught during the fifth year of the Medicine Degree. Our students had previously received training in BLS during the third year and were evaluated in an objective and structured competency exam (ECOE). Since then, they had not received any kind of recycling (either in person or online). That is, the majority of medicine students from the University of Granada join their specialized training with low knowledge related to Life Support. The training was blended; firstly an online training was given following the ERC 2015 guidelines and later, simulation training workshops were given. The wish for learning CPR techniques among medical students is high. In addition, the results of this work show that the level of acquisition is elevated and that most skills are maintained for three months.

Different studies show that the level of knowledge and skills in Life Support decreases between three and twelve months from the initial evaluation (2,10,12). However, in our study, we found out that three months after the initial evaluation, the oblivion curve was not very pronounced. Taking into account that 43 variables were evaluated in total, of which only 7 showed statistically significant differences, it can be affirmed that 83.7% of the measured variables remain.

BLS is the base of the reanimation world. As said before, students already had notions about this area, which gives credit to such positive results. The most remarkable change occurred in the correct airway opening. An initial effective maneuver percentage of 100% was obtained and yet, in the final evaluation we can see an important reduction. For the rest of the variables, we can deduce that little loses of ability had occurred over time (Figure 1). Concerning the data obtained in the Basic Airway workshop, it is remarkable that during the initial evaluation, when measuring the ability to use the self-inflating bag, approximately a 91% effective maneuver was obtained. However, in the final evaluation the percentage dropped to 30%. The results for the rest of the variables show that the average student had not just learned, but retained, a large percentage of the variables (Figure 2). The workshop consisted of Basic Arrhythmias followed the same positive pattern from BLS and Basic Airway. The students acquired an elevated ability during the workshop. This knowledge was then kept over time (Figure 3).

Concerning the ALS, CPR with quality control obtained intermediate results compared to the other two ALS workshops. The correct frequency was the variable which showed worst results. In the initial phases, percentages close to 60% were obtained, and

this was even enhanced over time. In the reevaluation, the percentage was slightly higher than 10%. For the rest of the variables the oblivion curve was not pronounced (Figure 4). Advanced Airway data showed the main considerable loss of ability over time. OTI technique, check and fixation gave dramatical drops, showing that time was a significant factor for the retaining of such complex maneuvers. (Figure 5). Finally, Advanced Arrhythmia obtained the best result over time. It must be pointed out that the students learned the information perfectly. Losses over time were reasonable, with just one of the variables (Cardioversion vs Defibrillation - CV/DF) giving a pronounced decrease (Figure 6).

It seems that each variable participates differently in the oblivion curve. The learning of the ALS should be reinforced for this subject, with special emphasis on the variables that suffered the greatest impact over time: OTI technique, check and fixation and correct frequency of the cardiac massage. Arriola Infante et al (5), offered a group of 26 sixth year medicine students, a regulated ALS course; then, evaluating the competences three months later obtained significant differences of which two agree with our study: correct frequency of cardiac massage and correct performance of the orotracheal intubation. Students have better learned the knowledge that makes up the ILS, probably due to the fact that it is less complex and more adapted to their educational level. Although both are relevant, it is especially important that our students never forget the ILS when they become residents. From the academic point of view and agreeing with the results of this study, it seems more interesting to offer training at the Schools of Medicine in ILS vs. ALS.

Finally, analyzing the conclusions of this study and the results of numerous authors who have worked on this issue, it seems clear the need to implement a regulated, structured and quality training in Life Support at Medical Schools. This measure should be accompanied with recycling courses, which should be planned using the information concerning the oblivion curve shown in this article and similar ones. They need not be face-to-face, but many could be done through virtual training (13).

5. Conclusions

- Main Conclusion: The competences that are integrated within the ILS present a higher level of acquisition and a lesser effect caused by the oblivion curve. They should be those that will become part of the curricular content of the specific life support subject for students of fifth and sixth year of the Degree in Medicine, UGR.

- Secondary Conclusions:
  - The level of acquisition of both cognitive and procedural skills in ALS and ILS acquired by subjects participating in the study is high.
  - Competencies with a steeper oblivion curve are often procedural in nature.
  - The students maintain in a better way the specific competences that are included within the ILS than those that belong to the ALS, and also present a less pronounced oblivion curve.
  - The methodological resources designed to facilitate the teaching / learning process of life support are useful at the School of Medicine (UGR).
  - The degree of acquisition of the main competences by the students is very high and most of them remain over three months.
  - In those competences in which the oblivion curve has been greater, as well as in those that show statistically significant differences, more emphasis should be placed on carrying out these training activities and on recycling them.
  - Among the competences that become part of the ALS, all those that are related to access to the airway through orotracheal intubation present a pronounced oblivion

curve, making us think that it is a competency development not suitable for transmission to medical students.

6. Limitations:

- Evaluators were not the same ones in the initial evaluations and the re-evaluations. Evaluators were resident doctors from the Clinical Hospital who came to help with this study out of their own free will. We divided the days between them all so that most of them didn´t have to come more than once.
- Evaluators didn´t have any teacher experience but they were given very exact instructions so that they didn´t have doubts when evaluating and all of them followed the same criteria.
- The sample was of only 23 students, as the Faculty of Medicine from the University of Granada does not own the means or the material to train more students per year. But the structure of this study was repeated during the two following years as well. Data is yet to be analyzed.
- Students applied for this subject freely. After their application, the administration from the Faculty of Medicine chose the best curriculums. We had no power of randomly choosing the sample of students.
- As the number of measurements increases, the Oblivion Curve gets much more reliable. But, in relation to the Life Support training, this phenomenon happens so fast that we had to use very short temporary sequence measurements, since otherwise it is most likely that most of the competencies would have been lost.

Authors' contributions:

- Antonio Cárdenas Cruz: Conceptualization, Methodology; Resources, Supervision, Project Administration; Eva Peregrina: Investigation, Writing Originial Draft; Dolores Cárdenas Cruz: Supervision; Isabel Santiago Suárez: Investigation, Writing Originial Draft; Miguel Ángel Martín Piedra: Software, Validation, Formal Analysis, Data Curation; Francisco Manuel Parrilla: Formal Analysis, Data Curation.

Financing: There was none.

Acknowlegments:
To the University of Granada and the Department of Medicine. To all the Medicine students from the University of Granada who took this subject and were an essential part of our study. To the hospital residents who were willing to help of their own free will.

Conflict of interest: The authors declare that no conflict of interest has occurred at the time of the development of the different phases of the study.

References.

1. Monsieurs KRG, 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, 1–80. https://doi.org/10.1016/j.resuscitation.2015.07.038
2. Monsieurs KG, Nolan JP, Bossaert LL, Greif R, Maconochie IK, Nikolau NI et al. European Resuscitation Council Guidelines for Resuscitation 2015- Section 10. Education and implementation of resuscitation. Resuscitation. 2015, 1-80. https://doi.org/10.1016/j.resuscitation.2015.07.038
3. Bakalos G, Mamali M, Komninos C, Koukou E, Tsantilas A, Tzima S, et al. Advanced life support versus basic life support in the prehospital setting: A metaanalysis. Resuscitation, 2011, Vol 82, 1130-1137. http://doi.org/10.1016/j.resuscitation.2011.04.006

4. Cárdenas Cruz L, Cárdenas Cruz A. (dir), Parrilla Ruiz FM (dir). Análisis de un programa de formación masiva en Soporte Vital Básico para la población general. Proyecto Salvavidas primera fase. [Doctoral tesis on the Internet] [Granada] Universidad de Granada; 2012.
5. Arriola Infante JE, Cárdenas Cruz A, Gómez Jiménez FJ, Cárdenas Cruz DP, Parrilla Ruiz FM. Analysis of the forgetfulness Curve for the main actions of the Advanced Life Support in the training of students of the Sixth Course of Medicine. Actual.Med, 2017, 102, 80-85. https://doi.org/10.15568/am.2017.801.or04
6. Cárdenas Cruz A, Parrilla Ruiz F, Cárdenas Cruz D, Gómez Jiménez FJ, Lobón Hernández JA, Romero Palacios PJ et al. Implementación de un Programa Reglado de Formación en Soporte Vital Avanzado dentro del mapa competencial de los futuros alumnos del Grado Superior de Medicina de la Universidad de Granada. Actual.Med.2014, 99, 27-30. https://doi.org/10.15568/am.2014.791.do01
7. Leah V, Whitbread M, Coats TJ. Resuscitation training for medical students. Resuscitation. 1998, 39, 87-90. https://doi.org/10.1016/s0300-9572(98)00126-9
8. Graham Ca, Guest KA, Scollon D. Cardiopulmonary resuscitation. Paper 1: survey of undergraduate training in UK medical schools. J Accid. Emergency Med.1994, 11, 162-164. https://doi.org/10.1136/emj.11.3.162
9. Cortegiani A, Russotto V, Montalto F, Iozzo P, Palmeri C, Raineri SM, et al. Effect of high fidelity simulation on medical students' knowledge about advanced life support. A randomized study. PLoS ONE. 2015, 1, 10. https://doi.org/10.1371/journal.pone.0125685
10. Yang CW, Yen ZS, McGowan JE, Chen HC, Chiang WC, Mancini ME et al. A systematic review of retention of adult advanced life support knowledge and skills in healthcare providers. Resuscitation. 2012, 83, 1055-1060. https://doi.org/10.1016/j.resuscitation.2012.02.027
11. Hammond F, Saba M, Simes T, Cross R. Advanced Life Support: retention of registered nurses´ knowledge 18 months after initial training. Aus Crit Care. 2000, 13, 99-104. https://doi.org/10.1016/S1036-7314(00)70632-1
12. Bukiran A, Erdur B, Ozen M, Bozkurt AI. 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 Mar; 40, 146-52. https://doi.org/10.1016/j.jen.2012.08.011
13. Lami M, Nair P, Gadhvi K .Improving basic life support training for medical students. Advances in Medical Education and Practice. 2016, 7, 241-242. https://doi.org/10.2147/AMEP.S102111
14. Nicol P, Carr S, Cleary G, Celenza A. Retention into internship resuscitation skills learned in a medical skill resuscitation program incorporating an Immediate Life Support course. Resuscitation. 2011, 82, 45-50. https://doi.org/10.1016/j.resuscitation.2010.08.035
15. Schlieber J, Augustijn C, Soar J, Jónsdóttir HJ, Lott C, Caruana M, et al. The Immediate Life Support course. Resuscitation, 2003, 57, 21-26. https://doi.org/10.1016/s0300-9572(03)00027-3