A STUDY ON ADVANCE CARDIAC LIFE SUPPORT KNOWLEDGE AND SKILLS AMONG HEALTH CARE PROFESSIONALS AND THEIR PREDICTING FACTORS DURING ACLS COURSE

BY

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TABLE OF CONTENTS

ABSTRAK

Pengenalan:

Profesional kesihatan perlu mempunyai ilmu pengetahuan dan kemahiran terkini yang baik dalam ‘Advance Cardiac Life Support (ACLS)’ untuk merawat kes serangan jantung. Oleh yang demikian, latihan ACLS telah di kenali sebagai satu piawaian untuk memberi ilmu pengetahuan dan kemahiran yang baik kepada mereka. Memandangkan data-data mengenai kursus ACLS yang dianjurkan di Malaysia adalah terhad, maka kajian ini adalah bertujuan untuk mengkaji tahap ilmu pengetahuan dan kemahiran berkenaan dengan ACLS dalam kalangan profesional kesihatan dan faktor-faktor yang berhubung kait dengannya semasa kursus ACLS dijalankan.

Metodologi:

Satu kajian prospektif telah dijalankan di Hospital Universiti sains Malaysia, Kelantan (antara tempoh Januari 2016 sehingga Jun 2017) di kalangan profesional kesihatan semasa kursus ACLS di jalankan. Borang soal selidik berkenaan dengan data demografik dan latar belakang profesional para peserta kursus dikumpulkan semasa bermulanya kursus dijalankan dan semua keputusan ujian MCQ sebelum kursus, ujian MCQ selepas kursus dan keputusan ujian praktikal CAS dikumpulkan dan dianalisa. Hubung kait di antara demografik dan latar belakang profesional para peserta kursus dengan keputusan akhir kursus kemudianya di analisa.

Keputusan:

Seramai 123 orang peserta kursus ACLS telah mengambil bahagian dalam kajian ini. Terdapat perbezaan yang signifikan diantara tahap ilmu pengetahuan sebelum dan selepas kursus ACLS dijalankan di kalangan peserta (t-statistik (df): 9.35 (121), $p<0.001$). Tahap ilmu pengetahuan dan kemahiran berkenaan ACLS di kalangan peserta adalah baik dengan majoriti peserta iaitu 78.9% lulus ujian keseluruhan. Dengan menggunakan ujian regrasi linear pelbagai, terdapat hubungkait yang signifikan di antara jantina ($p=0.002$), jawatan ($p=0.03$) dan keputusan ujian sebelum kursus dengan tahap ilmu pengetahuan dan kemahiran berkenaan dengan ACLS berdasarkan keputusan akhir kursus.

Kesimpulan:

Latihan berstruktur ACLS telah meningkatkan tahap ilmu pengetahuan dan kemahiran berkenaan dengan ACLS di kalangan profesional kesihatan dan mempunyai hubung kait yang signifikan dengan jantina, ilmu pengetahuan sebelum kursus, dan jawatan para peserta kursus.

ABSTRACT

Introduction:

Healthcare professionals are expected to have a good updated Advanced Cardiac Life Support (ACLS) knowledge and skills to manage cardiac arrest. Thus, ACLS training course is recognised as the gold standard to provide them with good knowledge and skills. In view of limited data regarding ACLS courses that were organised in Malaysia, this study aimed to determine the level of ACLS knowledge and skill among healthcare professionals and their predicting factors during an ACLS course.

Methods:

A prospective observational study was conducted in tertiary Hospital Universiti Sains Malaysia, Kelantan (January 2016 till Jun 2017) among healthcare professionals during an ACLS course. A questionnaire regarding candidates' demographic data and professional backgrounds was collected at the beginning of the course and all pre-course MCQ test, post-course MCQ test and practical CAS-test results were collected and analysed. The association between socio-demographics, professional backgrounds and final course results then were analysed.

Results:

A total of 123 ACLS course candidates were enrolled in this study. There was a significant difference between pre and post ACLS knowledge among candidates

following ACLS course (t-statistic (df): 9.35 (121), p<0.001). The level of ACLS knowledge and skills was good as a majority of 78.9% passed the overall test. On multivariate analysis, there were significant associations between gender (p=0.003), designation (p=0.027) and pre-test result (p=0.002) with the level of knowledge and skill shown by overall test results.

Conclusions:

Structured ACLS training improved the level of knowledge and skills among healthcare professionals and were significantly associated with gender, pre-course knowledge and professional designation.

Chapter 1

Introduction

1.1 INTRODUCTION

Advanced cardiac life support (ACLS) course was first introduced in 1974 by the American Heart Association and subsequently updated in 1980, 1986, 1992, 2000, 2005 and 2010.[1] This course is recognised as the gold standard to prepare healthcare professionals from multidisciplinary teams to manage both cardiac arrest and peri-arrest situations.[2] It provides a standardized approach to the management of cardiac arrest, including manual defibrillation, advanced airway, drug therapy, peri-arrest circumstances, and post-resuscitation.[2]

A healthcare professional is an individual who provides preventive, curative, promotional or rehabilitative health care services in a systematic way to people, families or communities.[3] Conducting ACLS trainings among healthcare professionals is very important as it is shown that such courses improves short and long term survival from cardiac arrest in hospital.[4] ACLS knowledge and skills are also very important to all healthcare professionals when dealing with cardiac arrest cases especially for those who are working in critical areas such as the emergency department and intensive care unit. Previous study have shown there was a significant increase in the return of spontaneous circulation (ROSC), survival to hospital discharge, and better 30-day survival with ACLS trained healthcare professionals versus non ACLS-trained health care professionals when dealing with cardiac arrest cases.[5]

In Malaysia, most of the tertiary hospitals offer ACLS training as it is essential for healthcare professionals. In HUSM, ACLS courses are organised by the emergency department four times a year. At the end of the course, all candidates will be assessed

based on theory and clinical examination and certificates will be provided for those who pass the exam. Unfortunately, some of the ACLS candidates failed to achieve their ACLS certification. Previous study showed that the failure rate among ACLS candidates was as high as 60%.[6] With regards to the level of knowledge among medical staff, few studies reported mixed results and further research and evaluation are needed.[7, 8]

Thus, the aim of this study was to determine the level of ACLS knowledge and skills among healthcare professionals in Malaysia. The factors predicting high level of knowledge and skills among them will also be identified. By doing this, it is hoped that additional attention and intervention can be given to healthcare professionals with risk of having lower knowledge and skills in ACLS.

Chapter 2

Objectives Of The Study

2.1 GENERAL OBJECTIVE

i. A study on ACLS knowledge and skills among health care professionals and their predicting factors.

2.2 SPECIFIC OBJECTIVES

i. To compare the ACLS knowledge among health care professional candidates following ACLS course in Hospital Universiti Sains Malaysia.

ii. To determine the level of knowledge and skills among health care professional candidates of the ACLS course in Hospital Universiti Sains Malaysia.

iii. To determine the factors predicting the ACLS knowledge and skills among health care professionals in Hospital Universiti Sains Malaysia

Chapter 3

Manuscript

3.1 TITLE: A STUDY ON ADVANCE CARDIAC LIFE SUPPORT KNOWLEDGE AND SKILLS AMONG HEALTH CARE PROFESSIONALS AND THEIR PREDICTING FACTORS DURING ACLS COURSE

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3.2 ABSTRACT

Introduction: Healthcare professionals are expected to have a good updated Advanced Cardiac Life Support (ACLS) knowledge and skills to manage cardiac arrest. Thus, ACLS training course is recognised as the gold standard to provide them with good knowledge and skills. In view of limited data regarding ACLS courses that were organised in Malaysia, this study was to determine the level of ACLS knowledge and skills among healthcare professionals and their predicting factors during an ACLS course. **Methods:** A prospective observational study was conducted in tertiary Hospital Universiti Sains Malaysia, Kelantan (January 2016 till Jun 2017) among healthcare professionals during an ACLS course. A questionnaire regarding candidates' demographic data and professional backgrounds was collected at the beginning of the course and all pre-course MCQ test, post-course MCQ test and practical CAS-test results were collected and analysed. The association between socio-demographics, professional backgrounds and the final course results were then analysed. **Results** A total of 123 ACLS course candidates were enrolled in this study. There was a significant difference between pre and post ACLS knowledge among candidates participating in the ACLS course (t-statistic (df): 9.35 (121), $p<0.001$). The level of ACLS knowledge and skills was good as a majority of 78.9% passed the overall test. On multivariate analysis, there were significant associations between gender ($p=0.003$), designation ($p=0.027$) and pre-test result ($p=0.002$) with the level of knowledge and skills shown by overall test results. **Conclusions:** Structured ACLS training improved the level of knowledge and skills among healthcare professionals and were significantly associated with gender, pre-course knowledge and professional designation.

3.3 INTRODUCTION

Advanced cardiac life support (ACLS) course was first introduced in 1974 by the American Heart Association and subsequently updated in 1980, 1986, 1992, 2000, 2005 and 2010.[1] This course is recognised as the gold standard to prepare healthcare professionals from multidisciplinary teams to manage both cardiac arrest and peri-arrest situations.[2] It provides a standardized approach to the management of cardiac arrest, including manual defibrillation, advanced airway, drug therapy, peri-arrest circumstances, and post-resuscitation.[2].

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passing the exam. Unfortunately, some of the ACLS candidates failed to achieve their ACLS certifications. Previous study showed that the failure rate among ACLS candidates was as high as 60%.[6] With regards to the level of knowledge among medical staff, few studies reported mixed results and need further research and evaluation.[7, 8]

Thus, the aim of this study was to determine the level of ACLS knowledge and skills among healthcare professionals in Malaysia. The factors predicting high level of knowledge and skills among them were also identified. By doing this, it is hoped that additional attention and interventions could be given to healthcare professionals with risk of having lower knowledge and skills in ACLS.

3.4 METHODOLOGY

This was a prospective cross-sectional study involving healthcare professionals who joined the ACLS course organised by the Emergency Department, Hospital Universiti Sains Malaysia. This study was conducted starting January 2016 until May 2017. All healthcare professionals who joined the ACLS course organized by HUSM within January 2016 to May 2017 with written consent and fulfilled the inclusion and exclusion criteria were taken as subjects. A total of 123 health care professionals had been included in this study. The study was approved by the Human Research Ethics Committee, School of Medical Sciences, Universiti Sains Malaysia (USM/JEPeM/15120538).

i- Designing the assessment tools

Multiple choice questions (MCQs) was used to assess healthcare professionals' knowledge while their skills were assessed through practical cardiac arrest assessment test (CAS-test). Theory questions (MCQs) and a practical cardiac arrest assessment test (CAS-test) regarding ACLS were selected from our ACLS data bank as the assessment tools. Three sets of theory questions were chosen as the pre-course assessment, post course assessment and remedial for those who failed. Each set of theory questions consisted of 30 questions using best of five questions. The best of five questions and CAS-test questions were assessed for content validity by the opinions of 3 experts. The CAS-test aimed to assess the candidates' abilities in airway management, patient assessment, defibrillation and basic life support. This CAS-test assessed performance based on 24 criteria. These criteria covered four domains: initial assessment and resuscitation (5 criteria) and cardiac arrest management-PEA (7 criteria); Ventricular fibrillation (11 criteria) and post-resuscitation care (1 criteria).Four-point scoring system was used to assess each performance criterion which had been validated in previous study by Napier

et al, 2008.[9] All CAS-Test assessors had been trained prior to assessment. Assessors used a written guidance as follows:

4- The highest score was awarded to excellent participants who made correct decision promptly and with confidence, demonstrating expert performance and potential as an instructor.

3- Acceptable performance would score 3. This is the usual level of competence attained by ACLS provider. They were able to make correct decisions, but might had some hesitations or lack of confidence.

2- Borderline performance. Minor errors in decision making hesitant, lack of confidence and required prompting or failed to perform a skill but recognized errors on subsequent questioning.

1- Unacceptable. Participants who made incorrect decisions or gave inappropriate treatment. Their decisions might have caused harm in a real life situation.

At the end of the CAS-test, instructors provided a global assessment as to whether their performance was acceptable or not (pass/fail) and an overall grade of performance (using the 4 point assessment scale as defineds above).

ii- Pre-course MCQs, ACLS course session and post course assessments

All ACLS candidates received an ACLS manual 4 weeks before the course. The 2-days course included lectures and practical sessions. Prior to the course, pre-course theory examination was given to the candidates as pre-course assessment. The results did not contribute to the final marks. At the end of the course, they were assessed by post-course theory questions and practical CAS-test.

The outcome of the candidates was determined based on whether they passed both their post-course theory questions and practical CAS-test. The passing mark for theory questions was more than 60% based on expert opinion following validation process. If a candidate failed, he or she could reattempt for each assessment and the respective marks were recorded. A maximum of two attempts for each assessment were allowed. In order to be an ACLS provider, the candidate has to pass both the post-course theory questions and CAS- Test.

Statistical analysis was done using Statistical Packages for Social Science (SPSS) version 22.0. Paired t-test was used to compare the pre-test and post-test results among candidates. The level of ACLS knowledge and skills was determined based on the overall ACLS course result, either they pass (good ACLS knowledge and skills) or failed (poor ACLS knowledge and skill). The outcome of this study was to have a good level of ACLS knowledge and skills by passing both post-theory test and CAS-test. Multiple logistic regression was carried out to determine the predictors of having a good ACLS knowledge and skills by passing the final course examinations. A p value < 0.05 was considered as statistically significant for all statistical analyses in this study.

3.5 RESULTS

There were a total of 6 ACLS courses conducted from 1st June 2016 till 30th May 2017 in Hospital Universiti Sains Malaysia. A total of 123 healthcare professionals were enrolled in this study during these courses which included doctors, medical assistants and nurses.

Demographic data (Table 1)

A total of 123 healthcare professionals participated in this study. 65 candidates (52.8%) were male and 58 candidates (47.2%) were female. The means Age was 30.35 years (SD = 6.17) and the mean years of service was 5 years (SD = 4.88). Only 8 candidates (6.5%) were non Malay and all the others were Malay (93.5%). There were slightly more paramedics compared to doctors [66 paramedics (53.7%), 57 doctors (46.3%)]. In terms of specialties, 73 candidates (59.3%) were from the emergency-based areas (Emergency department, internal medicine, cardiology and anesthesiology) and 50 candidates (40.7%) had specialized in non-emergency based (Local clinic, surgical based and others). Most of the candidates (72.4%) had never joined any ACLS courses before and only 27.6% had previous exposure to ACLS courses.

Comparison between pre and post course knowledge (Table 2)

There was a significant difference between pre and post ACLS knowledge among health care professional candidates participating in the ACLS course (t-statistic (df): 9.35 (121), $p<0.001$)). Post-test marks of ACLS knowledge were higher by 11.30 points compared to pre-test marks. This shows improvement of knowledge after intervention.

Level of knowledge and skills among health care professional candidates in ACLS course (Table 3)

The level of knowledge and skills among health care professional candidates in the ACLS course in HUSM was good as a majority of 78.9% passed the overall test. 80.5% of candidates passed the post course theory test and 89.4% passed the CAST-test.

Relationship between socio-demographics and level of ACLS knowledge and skills among health care professionals using simple and multiple logistic regression (table 4 and table 5).

Using univariate analysis, socio-demographics and professional background of candidates that were significantly associated with a good level of knowledge and skills were gender (p=0.023), designation (p=0.010), specialities (p=0.008), experience in managing ACLS case (p=0.047), pre course knowledge (p<0.001) and hospital type either government or non-government (p=0.008). Males had 3.98 times higher odds ratio in getting a good level of knowledge and skills as shown by the overall test (95%CI; 1.21, 13.14) compared to female. A high pre-course knowledge level and previous experience in managing ACLS cases were also associated with a significantly higher probabilities of passing the final test (OR 12.68 (95%CI; 3.37, 47.90) and (OR 2.96 (95%CI 1.01, 8.66) respectively) while those who specialised in emergency had significantly higher probabilities of having a good level of ACLS knowledge and skills (OR 5.97 (95%CI; 1.61, 22.19). Doctors had 6.63 times higher odds ratio in getting a good level of ACLS knowledge and skills (95%CI; 2.12, 20.67) while healthcare professionals who worked in the government sector had 6.81 higher odds ratio than those who worked in the non-government sector (95%CI; 2.37, 19.62)

In multivariate analysis (Table 1.6), there was significant association between gender (p=0.003), designation (0.027) and pre-test knowledge (0.002) with the level of ACLS knowledge and skills showed by the overall course results. Males had 5.43 times higher odds in getting good knowledge and skills (95%CI; 1.79, 16.56) compared to females. Those who passed the pre-test exam, had 8.44 higher odds in getting a good outcome (95%CI; 2.18, 32.63). For doctors, they had 4.10 times higher odds in getting good ACLS knowledge and skills (95%CI; 1.17, 14.36) compared to paramedics.

3.6 DISCUSSION

Advanced cardiac life support (ACLS) training was introduced as a systematic approach to the treatment of cardiac arrest by professional responders. It had been proven that ACLS trainings for healthcare professionals caused reduction in cardiac arrest deaths and an increased the survival-to-hospital-discharge.[4] Our study showed that there was a significant increase of 11.30 points scores between pre and post ACLS theory exams in the ACLS course. These results were in accordance with previous study by Thorne C et al.,2015 that showed an improvement of knowledge after an ACLS course.[10] This could be due to several reasons including smaller number of instructors and candidates ratio. In every ACLS course organized by HUSM, the average total candidates is only about 10-20 people. They were given a lecture by experienced and certified ACLS instructors and teaching session were interactive where candidates could openly ask and discuss any doubts they had. Previous studies showed that a higher instructors to candidates ratio may result in a higher retention of knowledge.[11, 12] In our courses, after lectures, they would be divided into 3 small groups for practical teaching sessions such as BLS station, airways station, emergency drug station and also CAS-test mega-code station. This small number of candidates in each teaching session, interactive teaching, and experienced course instructors had significantly improved the effectiveness of this course thus lead towards an improvement in term of candidates' ACLS knowledge.

In our study the level of ACLS knowledge and skills was classified based on the final ACLS course assessment results. Candidates who passed the final ACLS course assessment were classified as having good ACLS knowledge and skills whereas candidates who failed were considered as having poor ACLS knowledge and skills. In our study, it was shown that the level of ACLS knowledge and skills among healthcare

professional during the ACLS course in HUSM was good as a majority of 78.9% passed in the overall course results. 80.5% of candidates passed the post course theory test and 89.4% passed the CAST-test. This was slightly lower compared to previous studies in Italy that showed a final passing rate of 95.1% during an ACLS course by C. Sandroni et al., 2010 and 97% by C. Semeraro F et al., 2008.[13, 14] This was probably because in their studies, all the ACLS courses candidates were doctors whereas in our study the candidates also included paramedics, whom passing rate was lower compared to doctors. In our study the passing rate among doctors was 93.3% whereas passing rate among paramedics was 66.7%. This might contribute to the lower overall passing rate in our ACLS course. In contrast, a study done in Thailand demonstrated that only 15.7% of the physicians had sufficient ACLS knowledge which were far less than ours.[7] However, this insufficient or low level of ACLS knowledge could be explained by the different methodology used.[15] We believe that the level of ACLS knowledge and skills can be further improved by giving the ACLS course candidates their study materials earlier, so that they would be well prepared before coming to the course. This includes giving them the ACLS video lectures and CAS-test demonstration video. The online learning had also been said to improve long term memory retention among doctors as proven through E-learning ACLS course.[10, 16]

There were several studies done before on the association between the level of ACLS knowledge and skills with candidates' demographic factors and professional backgrounds during an ACLS course, but none in Malaysia so far. In our study, gender, designation and pre-course knowledge were the most important predictors to determine good ACLS knowledge and skills shown by the overall course results. Interestingly, in our study, males were showing a significantly good level of ACLS knowledge and skills compared

to females, while in previous study conducted by Sandroni et al., 2010 in Italy, it was noted that females had a significantly higher pass rate in ACLS course.[13] This result could be due to males being more confident in practicing ACLS with positive attitudes as reported by Ralapanawa et al., 2016.[17] Bear in mind that this condition might contribute to a higher failure rate in CAS-test among female candidates compared to males in our study (0.15% vs 0.05%). Hence, it is very important to explore and identify the factors on this issue in future research and help the female candidates develop more self-confidence to improve their practical skills.

In our study, doctors were significantly associated with good ACLS knowledge and skills compared to paramedics. Similarly, in 2011, a study conducted by Passali et al., on ACLS knowledge showed that the doctors significantly had better ACLS knowledge on advanced life support resuscitation guidelines compared to nurses.[18] Other studies by C.J. Thorne et al., 2015 and Semeraro et al., 2015 showed that doctors had higher passing rates in conventional ACLS courses compared to nurses.[10, 12] This result might be due to the relationship between theoretical resuscitation knowledge and professional experience. Most of the paramedics in our study were trained more in BLS courses previously (95% of paramedics had attended BLS courses before) but not in ACLS (only 31.3% of paramedics had attended ACLS courses before) as they were likely to be the first responder in cases where patients suffer from cardiac arrest. They also had lack of experience in managing ACLS cases compared to doctors as shown in our study where only 57.8% of paramedics compared to 86.4% doctors had experience in managing ACLS cases. This knowledge and skills gap was leading towards low theoretical marks among paramedics based on ACLS guidelines. Therefore, it is imperative for paramedics to

possess the right skills to save a life and there should be a well-structured curriculum to require, support and teach them about ACLS.

In our study, we administered pre-course MCQs to assess the candidates' ACLS knowledge and it showed significant association with the level of ACLS knowledge and skills. This finding was in accordance with Sandroni et al., 2010 who documented high pre-course knowledge as a significant independent predictor of success for medical doctors participating in ACLS courses.[13] We assumed pre-course knowledge to be influenced by several factors. First, it depended on the candidates' preparedness by doing revision on ACLS topics using the notes provided a month earlier before they actually attend the course. Second, it depended on a candidate's professional designation because we expected higher pre-course knowledge among who were more likely to be involved in managing cardiac arrests situations, such as the anesthesiologists, cardiologists and emergency department staffs. This was supported by previous study that showed the impact of professional profile and resuscitation knowledge on course outcomes which were anticipated by higher pre-course MCQs results.[13, 19] Therefore, in order to improve pre course knowledge, we should provide ACLS notes earlier prior to the course. Other than that, pre-course MCQs may also be used to identify those who are at risk of failing the ACLS course thus allowing extra attention and training to them during the session.

Despite the strengths, a few limitations were identified in this study. The results may not represent the true level of ACLS knowledge and skills in the full population of health care professionals in the country since it was a single and unicentre cross-sectional study. Larger, multicentre studies maybe needed to strengthen the findings in this study. Other than that, we only assess the level of ACLS knowledge and skills and their predicting

factors during the ACLS course. It would be interesting if this study is not done in the ACLS courses setting, so that we can assess the baseline ACLS knowledge and skills among healthcare professionals. Furthermore, we assessed the level of ACLS knowledge and skills based on the overall ACLS course results, which was a combination of both theory and practical parts in the ACLS training. It would be more specific if the theory and skills parts were assessed separately for their predictive factors so that we can know in detail regarding both components.

3.7 CONCLUSION

In conclusion, this study showed that the level of ACLS knowledge and skills among health care professionals during an ACLS course was good. Furthermore, following the ACLS training program, their level of knowledge and skills had improved significantly prior to interventions. Gender, professional backgrounds and pre-course knowledge, as measured by the pre-course MCQs, were independent predictors of good ACLS knowledge and skills as shown by the successful overall course results.

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