COMPARING THE EFFECTIVENESS OF VIDEO SELF-INSTRUCTION VERSUS TRADITIONAL CLASSROOM INSTRUCTION FOR LEARNING CARDIOPULMONARY RESUSCITATION SKILLS AMONG FIRST YEAR MEDICAL STUDENTS IN UNIVERSITI SAINS MALAYSIA

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LIST OF SYMBOLS, ABBREVIATIONS OR NOMENCLATURE

OHCA	Out of hospital cardiac arrest
CPR	Cardiopulmonary resuscitation
BLS	Basic life support
VSI	Video self-instruction
TCI	Traditional classroom instruction
AHA	American Heart Association
ILCOR	International Liaison Committee on Resuscitation
NCORT	National Committee on Resuscitation Training
EMS	Emergency Medical Services
US	United States
USM	Universiti Sains Malaysia
SD	Standard deviation
CGPA	Cumulative Grade Point Average
SPSS	Statistical Package for the Social Sciences
HREC	Human Research Ethics Committee
CONSORT	Consolidated Standards of Reporting Trials

ABSTRAK

Pengenalan:

Serangan jantung luar hospital atau Out of Hospital Cardiac Arrests (OHCA) menjadi perhatian awam masa kini namun kesedaran mereka untuk melakukan resusitasi kardiopulmonari (CPR) berada di tahap yang sangat rendah. Majoriti pelajar perubatan juga menghadapi masalah yang sama disebabkan pendedahan CPR melalui kurikulum berada pada tahap minimum. Kursus CPR memerlukan kos yang tinggi, memakan masa, dan bergantung kepada kesediaan serta keupayaan tenaga pengajar. Kajian ini bertujuan untuk mengetahui hubungan antara tahap prestasi keseluruhan CPR yang kompeten antara dua modul pengajaran iaitu modul arahan kendiri video (VSI) dan modul pengajaran kelas tradisional (TCI).

Kaedah:

Kajian intervensi prospektif secara rawak ini melibatkan mahasiswa baru di Kampus Kesihatan, Universiti Sains Malaysia (USM) dari November 2018 hingga Januari 2019. Data yang dikumpulkan merangkumi skor lulus-gagal yang mewakili keseluruhan prestasi CPR, kemahiran individu dan kesediaan untuk melakukan CPR sebelum dan sesudah modul latihan dikalangan ahli keluarga dan orang yang tidak dikenali. Peserta secara rawak dibahagikan kepada dua kumpulan, VSI dan TCI. Penilaian latihan pasca kompetensi peserta CPR telah dilakukan. Faktor-faktor yang berkaitan dengan keengganan melakukan CPR dikalangan orang asing dan ahli keluarga dinilai dalam soal selidik.

Hasil: Seramai 99 peserta dianalisa. Terdapat 50 peserta VSI dan 49 TCI. Skor dan kadar lulus min yang setanding untuk kedua-dua VSI (3,69, 90%) dan TCI (3,91, 96%) dicatatkan (p = 0,436). Peserta VSI menunjukkan prestasi yang setanding dengan TCI dalam 8 daripada 12 kumpulan kemahiran CPR individu. Kedua-dua modul menunjukkan peningkatan yang signifikan dalam kesediaan untuk melakukan CPR dari sebelum hingga selepas latihan untuk senario yang berbeza (p <.001). Kesediaan untuk melakukan CPR untuk orang asing (p = 0.999) dan ahli keluarga (p = 0.117) antara kedua-dua modul adalah setanding. Kekurangan latihan dinyatakan sebagai faktor penghalang utama untuk melakukan CPR bagi majoriti peserta.

Kesimpulan:

Modul latihan VSI CPR adalah kaedah yang berkesan untuk membantu pelajar menjadi cekap dan bersedia melakukan CPR dan setanding dengan modul latihan TCI CPR. Modul ini boleh digunakan sebagai bahan bantu mengajar utama atau tambahan bagi pelajar bukan sahaja di institusi pengajian tinggi, malah untuk orang awam yang menghadapi kesukaran untuk mengakses informasi ini. Utiliti modul latihan VSI CPR yang terbaik adalah ketika digunakan sebagai bahan sokongan semasa pengetahuan CPR standard yang mudah diakses, menjimatkan kos dan masa.

Kata kunci:

Resusitasi kardiopulmonari, Sokongan Hidup Asas, Alat bantu pengajaran, Kemahiran klinikal

ABSTRACT

Introduction: Out of Hospitals Cardiac Arrests (OHCA) is a current concern however public awareness to perform bystander cardiopulmonary resuscitation (CPR) is poor. A majority of medical-based students face the same problem due to minimal exposure in their curriculum. Existing CPR teaching courses are costly, time consuming, instructor dependent and subject to availability. This study was to determine association between the acquisition of a competent overall CPR performance and two teaching modules, video self-instruction (VSI) module and the traditional classroom instruction (TCI) module.

Methods: This randomized prospective interventional study involved freshmen of the health campus in Universiti Sains Malaysia (USM), from November 2018 until January 2019. Data collected included pass-fail scores representing the overall CPR and individual skill performance, and willingness to perform CPR before and after the training module for strangers and family members. Participants were randomized into two groups, VSI and TCI. Post training assessment of participants CPR competency was done. Factors associated with reluctancy to perform CPR for strangers and family members were assessed in a questionnaire.

Results: A total of 99 participants were included. There were 50 VSI and 49 TCI participants. Comparable mean passing scores and rates for both VSI (3.69, 90%) and TCI (3.91, 96%) were recorded ($p = 0.436$). VSI participants performed comparably with their TCI counterparts in 8 out of 12 individual CPR skill sets. Both modules demonstrated significant improvement in willingness to perform CPR from before to after training for different scenarios ($p < .001$). Willingness to perform CPR for strangers ($p = 0.999$) and

family members ($p = 0.117$) between both modules were comparable. Lack of training was noted to be the main hindrance factor to perform CPR for the majority of participants.

Conclusions:

The VSI CPR training module is an effective method to help students to be competent and willing to perform CPR and is comparable to the TCI CPR training module. It can be used as an independent or supplementary teaching tool for first time learners not only for students in higher learning institutions, but also for laypeople who have difficulties to access this knowledge. The VSI CPR training module's greatest utility as when it is used as a standardized CPR refresher material that is easily accessible, as well as cost and time effective.

Keywords

Cardiopulmonary resuscitation, Basic Life Support, Teaching materials, Clinical skill

1.0 **INTRODUCTION**

Heart disease is still the leading cause of death for the non-communicable diseases category in the modern world and sudden cardiac arrest is the third leading cause of death in industrialized nations, resulting in more than 700 000 deaths in Europe and the USA annually (Hayashi, Shimizu & Albert, 2015; Mozaffarian *et al.*, 2015; Sanchis-Gomar *et al.*, 2016; Böttiger *et al.*, 2018) This makes the out-of-hospital cardiac arrests (OHCA) a growing concern (Berdowski *et al.*, 2010; McNally *et al.*, 2011; Kitamura *et al.*, 2012). Numerous studies across the globe, including the Pan-Asian region have shown that cardiopulmonary resuscitation (CPR) done at the scene of an OHCA increases patients survivability (Ong *et al.*, 2011). However rates of bystander CPR varies significantly across the globe, ranging from 5% to 80% (Sasson *et al.*, 2010; Ong *et al.*, 2011, 2015; Böttiger *et al.*, 2018).

Collective data shows that CPR awareness among the public is not widespread. Training cost, time allocation, logistics, lack of learning motivation, and heavy information load all contribute towards the difficulties of learning CPR (Papalexopoulou *et al.*, 2014). Reluctance of performing CPR among those who have went for CPR training also needs to be addressed. One of the factors that contribute to this problem is the fear of performing CPR wrongly due to the large time gap from the last CPR course they have attended (Bogle *et al.*, 2013). Studies also shows that clinical psychomotor skills that are obtained starts to decay rapidly after the course, especially when not in use (Oermann, Kardong-Edgren & Odom-Maryon, 2011). These points out towards the need to emphasize on not only the initiation of the CPR training, but its continuous education.

On the other hand, the same issue is also prevalent among medical-based students worldwide, despite the fact that its awareness to medical personnel should be a pre-requisite for entering into this field (Yunus *et al.*, 2015; Ghauri *et al.*, 2019). Several local studies done on different groups of medical-based students in several tertiary education institutes in

Malaysia shows poor attitudes towards CPR in general (Chew & Yazid, 2008; Chew *et al.*, 2011; Rahman *et al.*, 2013; Shin Tyan *et al.*, 2019). Junior doctors, or housemen are expected to handle resuscitations on their first day, but most are inept at performing CPR due to lack of exposure during their study years (Zaheer & Haque, 2009; Yunus *et al.*, 2015; Ghauri *et al.*, 2019). Busy work schedules and lack of appropriate resources hinder them to attend courses. Although doctors may still learn resuscitation skills in the clinical setting, there is little opportunity to correct poor techniques (Zaheer & Haque, 2009; Yunus *et al.*, 2015; Ghauri *et al.*, 2019). Given these scenarios, training in CPR has become a standardized and mandatory component of all medical school undergraduate curriculums. However, the time allocated within the curriculums are limited and spaced too far apart from each training based on current syllabus.

A different approach to learn and refresh CPR knowledge is needed to help alleviate this problem. This method also needs to yield successful results comparable to the preexisting traditional approach towards learning CPR. Our main goal in this study is to incorporate video self-instruction (VSI) as an alternative to traditional classroom instruction (TCI) for CPR skills acquisition and subsequent refresher courses in a group-based learning.

Although these numerous studies in the past has shown that a VSI module for learning CPR skills has produced equally optimal results in performing post training CPR, none of these studies were done in a group setting. More studies need to be done to recreate the success of VSI in group settings to fit the premises of medical education, and our study calls to fill this gap.

CHAPTER 2.0 STUDY PROTOCOL

2.1 INTRODUCTION

Heart disease is still the leading cause of death for the non-communicable diseases category in the modern world and out-of-hospital cardiac arrests (OHCA) is a growing concern (Berdowski *et al.*, 2010; Ismail, 2016). Studies has shown that CPR done at the scene of an OHCA increases survivability, however rates of bystander CPR are low across the globe (Sasson *et al.*, 2010; Ong *et al.*, 2015; Rajan *et al.*, 2016; Cheskes *et al.*, 2017; Böttiger *et al.*, 2018).

Bystander CPR statistics around the globe varies, and most cases of OHCA happens at home. Older adults who are usually present on scene are usually not equipped with CPR knowledge. Collective data shows that CPR awareness among the public is not widespread. Training cost, time allocation, logistics, lack of learning motivation, and heavy information load all contribute towards the difficulties of learning CPR (Papalexopoulou *et al.*, 2014). Reluctance of performing CPR among those who have went for CPR training also needs to be addressed. Studies also shows that clinical psychomotor skills that are obtained starts to decay rapidly after the course, especially when not in use (Oermann, Kardong-Edgren & Odom-Maryon, 2011).

A different approach to learn and refresh CPR knowledge is needed to help alleviate this problem. This method also needs to yield successful results comparable to the preexisting traditional approach towards learning CPR. Numerous studies in the past has shown that a video self-instruction (VSI) module for learning CPR skills has produced equally optimal results in performing post training CPR during assessments (Park & Park, 2009; Roppolo *et al.*, 2011; Buch *et al.*, 2014; Assadi *et al.*, 2015; Coyne *et al.*, 2018; Onan *et al.*, 2019; Yerim & Kim, 2019)

Our main goal in this study is to incorporate VSI as an alternative to TCI for CPR skills acquisition and subsequent refresher courses. Besides that, we would also like to assess its effectiveness among medical students, as well as to get feedback from the participants with regards to their insights regarding the method.

2.2 PROBLEM STATEMENT & STUDY RATIONALE

CPR is a vital skillset for everyone, especially lay people as most OHCAs happens at home. The public nowadays are encouraged to learn basic CPR by attending courses that are organized by licensed medical institutions. However, the standardized CPR courses that are available are time-consuming, and sometimes difficult for the public to learn due to heavy learning material. This discourages the public to sign up for these courses, despite knowing the importance of CPR (De Buck *et al.*, 2015).

On the other hand, the same issue is also prevalent among medical-based students worldwide, despite the fact that its awareness to medical personnel should be a pre-requisite for entering into this field. Several local studies done on different groups of medical-based students in several tertiary education institutes in Malaysia shows poor attitudes towards CPR in general (Chew & Yazid, 2008; Chew *et al.*, 2011; Rahman *et al.*, 2013; Shin Tyan *et al.*, 2019). Junior doctors, or housemen are expected to handle resuscitations on their first day, but most are inept at performing CPR due to lack of exposure during their study years (Zaheer & Haque, 2009; Meena Kumari *et al.*, 2014; Yunus *et al.*, 2015; Ghauri *et al.*, 2019) Busy work schedules and lack of appropriate resources hinder them to attend courses. Although doctors may still learn resuscitation skills in the clinical setting, there is little opportunity to correct poor techniques (Zaheer & Haque, 2009; Avabratha *et al.*, 2012). Given these scenarios, CPR training has gained importance in schools, and ultimately become a standardized and mandatory component of medical undergraduate programs

(Ecker, Schroeder & Böttiger, 2015; Sorets & Mateen, 2015; Del Rios *et al.*, 2018; James *et al.*, 2019). However, the time allocated within the curriculums are limited and spaced too far apart from each training based on current syllabus.

For those who managed to enroll themselves into a CPR course, the skills gained can only be sharpened through subsequent refresher courses (Tanigawa *et al.*, 2011; De Buck *et al.*, 2015). This is relevant because the opportunity to perform CPR in public rarely presents itself. However, the lack of initiative to attend any further refresher courses due to cost and time constraints contributes to the poor performance of CPR over time in these group of people.

Despite numerous CPR demonstrations being held in public places, it is generally unfavored by the general public (Fratta *et al.*, 2020). There is limited time for self-practice and lack of facilitator guidance for those who participate due to inconducive venue choice and crowd control is difficult to achieve. This would lead to ineffective information conveyance. These demonstrations serve better as an awareness campaign rather than a training ground for effective CPR.

CPR is regarded to be crucial to save lives but unfortunately there is still lack of interest in learning it. However, the unwillingness to perform CPR when the need arises is another problem among those who underwent training (Cho *et al.*, 2010; Enami *et al.*, 2010; Urban *et al.*, 2013; Cheng-Yu *et al.*, 2016; Pei-Chuan Huang *et al.*, 2019). One of the factors that contribute to this problem is the fear of performing CPR wrongly and forgetting the steps. This is mainly because of the time gap from the last CPR course they have attended.

This study is driven towards creating a time and cost-effective, user-friendly VSI with concise info for learning CPR skills which we hope to be as good as, or better than the TCI in teaching effective CPR. We acknowledge the fact that the TCI CPR courses are the accepted standard for conveying necessary information and skills for performing good quality CPR.

However, due to the problems discussed above, we believe that the VSI CPR Module can overcome the limitations of the TCI CPR course, and at the same time maintain the same level of outcomes.

Both modules will be having the same content, however the main difference between them is the mode of delivery, duration and emphasis weightage of content. The TCI module gives equal emphasis on all theoretical and practical topics of the CPR learning module. The VSI module covers all theoretical topics as well, however it emphasizes on the practical aspect of performing optimum level of CPR.

The VSI module is considerably shorter than the TCI module, and it removes the instructor variability by eliminating the need of a human trainer (Nielsen *et al.*, 2012; Hsieh *et al.*, 2016). The absence of instructor variability ensures that the language used in the video is simple enough for the public with very minimal usage of medical jargon whenever possible.

The VSI module is a video which is easily accessible via the internet and is readily viewed on any console (Lehmann *et al.*, 2016). The VSI module can even be distributed on portable media, ready to be accessible in areas with basic viewing consoles despite having poor internet coverage. The cost for distribution of this module towards the general population is very minimal as well, if compared to the cost of organizing a standard basic life support course (Choi *et al.*, 2010).

Our modules will be tested among newly enrolled first year students of Hospital Universiti Sains Malaysia, Kelantan. They are chosen because they have not yet received any formal training in CPR within their education syllabus.

Results in numerous previous studies favors the use of VSI to help achieve better CPR performance among the participants (Chung *et al.*, 2010; Panchal *et al.*, 2014; Assadi *et al.*, 2015; Beskind *et al.*, 2016; Blewer *et al.*, 2016; Hsieh *et al.*, 2016; Ikeda *et al.*, 2016).

However, most of those studies are done in a private setting, in which the student views the video and practices in a private setting (Chung *et al.*, 2010; Assadi *et al.*, 2015). More studies need to be done to recreate the success of VSI in group settings to suit the classroom nature of medical education, and our study calls to fill this gap.

Optimistically, the analysis and results of this study will be a step towards the acceptance of VSI modules for learning CPR which are easily accessible, time and cost effective, and simple to understand not only for medical-based students, but also for all layers of the general public.

2.3 RESEARCH QUESTIONS

1. Is there a significant difference between competency levels of CPR performance among medical students after VSI course and TCI CPR course?
2. Is there a significant difference between the willingness level of medical students to perform CPR in real life before and after intervention for both modules?

2.4 OBJECTIVES

General

To study the effectiveness of video self-instruction (VSI) in learning CPR versus traditional classroom instruction (TCI) among medical based students in USM.

Specific

1. To compare the competency levels of CPR performance after the VSI CPR course versus TCI CPR course among medical based students in USM.
2. To compare willingness levels of performing real-life CPR before and after both VSI and TCI CPR courses among medical based students in USM.

3. LITERATURE REVIEW

Modern cardiopulmonary resuscitation has its early beginnings from studies done by Peter Safar and Kouwenhowen back in the 1960s (Truong, Low & Kern, 2015). To date back, the synchronized usage of chest compressions, ventilations, and electrical defibrillation to be incorporated into the CPR algorithm as we know of today has only been 20 years.

Global recognition towards resuscitation advancements is made possible through the formation of the International Liaison Committee on Resuscitation (ILCOR) in 1992 (Kleinman *et al.*, 2018; Neumar & Perkins, 2018; Kiguchi *et al.*, 2020). The ILCOR serves as a platform for coordinating evidence-based review of resuscitation science, which will be presented in 5-yearly consensus conference. As of today, various recommendations for CPR has been created by different regional organizations throughout the world, based on the ILCOR recommendations. In Malaysia, the National Committee on Resuscitation Training (NCORT) is responsible for the guidelines currently used for resuscitation training for the Ministry of Health.

The first documented out-of-hospital resuscitation took place in 1960, and studies has shown that if CPR is started within 4 minutes, survival rates greatly increases (Mozaffarian *et al.*, 2015; Ong *et al.*, 2015; Böttiger *et al.*, 2018). However, OHCA incidences and outcomes around the world vary, and data regarding bystander CPR is lacking in most countries (Berdowski *et al.*, 2010; Kiguchi *et al.*, 2020).

In 2011, the US alone had more than 300000 people experienced EMS-assessed OHCA cases, in which only 19300 cases had been bystander witnessed. About 69.5% of the OHCA cases reported happens at home, and 7.2% happens in public places. In 2013, bystander witnessed OHCA comprises 38.7% of all cases reported. Bystander CPR rates, however vary by a large margin from 10% to 65% depending upon locality (Mozaffarian *et al.*, 2015).

In Malaysia, cardiovascular disease is still the leading cause of mortality (Amiri *et al.*, 2014; Su *et al.*, 2015; Noor Hassim *et al.*, 2016). There is minimal data regarding national incidence of out-of-hospital cardiac arrest and bystander CPR rates. However, a few small studies conducted in Kelantan, Sarawak, Selangor and the Federal Territory of Kuala Lumpur shows dismal bystander CPR efforts (Keng Sheng *et al.*, 2008; Sains, Idzwan Zakaria & Hisamuddin Nik Ab Rahman, 2008; Chew & Chan, 2011; Rahman *et al.*, 2013; Karuthan *et al.*, 2019; Liaw *et al.*, 2020). The need for bystander CPR is important in our country due to the problem of long ambulance response time. It is caused by traffic crowding on main motorways in big municipalities and also inefficient communication skills during emergency calls (Chew & Chan, 2011; Said Nurumal & Sheikh Abdul Karim, 2015; Alharbi *et al.*, 2016)

CPR training should be a priority for people who would be present on the OHCA scene (Mozaffarian *et al.*, 2015). A typical witness to an OHCA is over 50 years old, but a typical learner in a CPR course is about 20 years old. Studying or working young adults in their twenties and thirties are less likely to witness a cardiac arrest as most of the cases occurs at home (Berdowski *et al.*, 2010; Dobbie *et al.*, 2018).

Inaccessibility towards receiving a CPR class is a major problem for older generations, independent entrepreneurs, and pensioners because course are usually held at a workplace (Sipsma, Stubbs & Plorde, 2011; Anderson *et al.*, 2019). Courses offered outside of the workplace are also predominantly attended by working class individuals who require CPR training to fulfill a job requirement (Yip *et al.*, 2011). The long duration of a standard CPR course and travel time to reach the training center, are regarded as inconveniences especially for working adults who have multiple priorities.

Usage of scientific medical jargon and heavy information content which is unrelated to CPR performance makes the course challenging to follow and may discourage participants to return for refreshers (Iserbyt & Byra, 2013). Significant delays between teaching instructions and the time-limited opportunity for manikin practice adds to the level of course difficulty.

Reluctance to perform CPR in emergency situations by trained laypersons must also be addressed. Hygiene issues prevents mouth to mouth resuscitation, and the fear of not doing the procedure correctly or social embarrassment contributes to poor CPR rates among bystanders (Tanigawa *et al.*, 2011; Lu *et al.*, 2016). This issue is a problem within our community as even when online guidance over the phone is given, a bystander is not likely to perform CPR (Chew & Chan, 2011; Said Nurumal & Sheikh Abdul Karim, 2015).

There is no specific study regarding factors affecting acquisition of base knowledge on CPR. However, CPR is more likely to be performed by trained bystanders who have more than a high-school education level, and who has had CPR training within the past 5 years (Tanigawa *et al.*, 2011).

Standard TCI courses have no strict outline; thus the quantity of practice time determined by the instructor may vary from the recommendation (El-Jawahri *et al.*, 2015). Presentation inconsistencies among different trainers based on their respective teaching styles can affect hamper learning during the course

Video self-instruction (VSI) learning focuses on essential topics and practice as you watch approach, which allows for more practice time (Cabrini *et al.*, 2010). It is a proven method for CPR training both younger and older generations in a shorter time compared to a traditional course.

VSI has the potency to develope greater skill competence than traditional classroom methods without an instructor or textbook. VSI can be viewed in private conveniently, as it

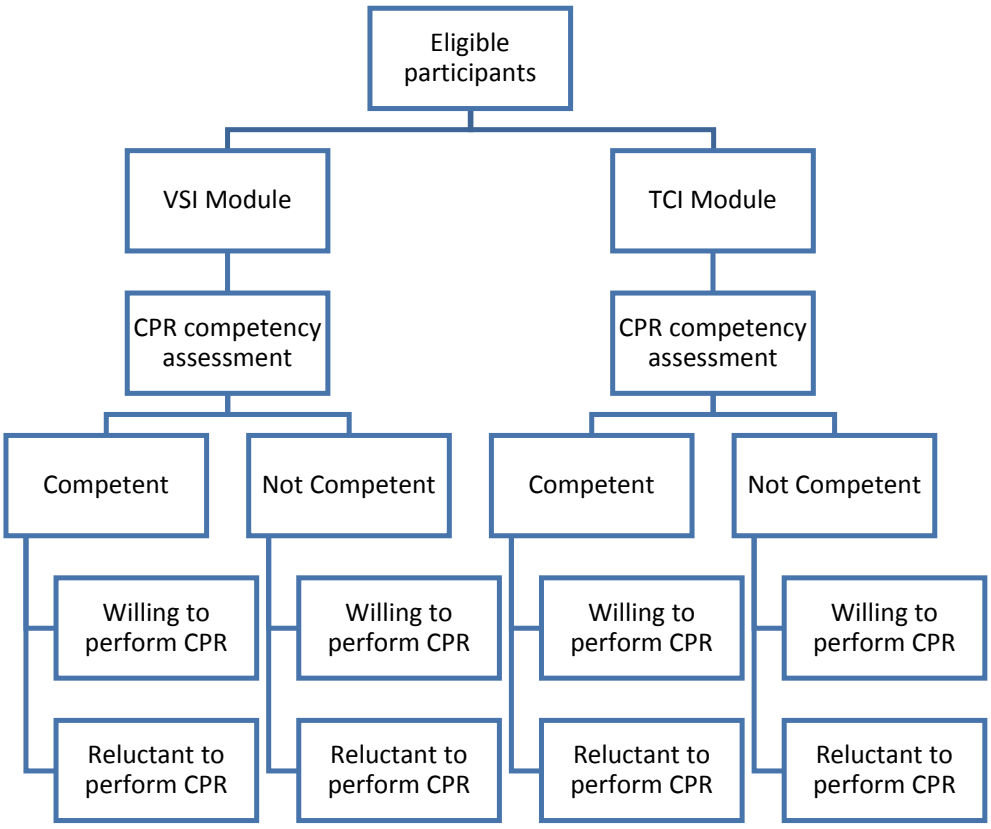
eliminates the psychological stress of public learning and allows self-directed style of learning thus making it possible to learn at any time and pace with repetition made possible at no additional cost (Cason & Stiller, 2011; Godfred *et al.*, 2013; Blewer *et al.*, 2016). The usage of concise information, clear instructions and simple language in the teaching video, coupled with repetitive practice contributes to skill mastery in performing effective CPR (Cabrini *et al.*, 2010).

Previous studies have shown that VSI could facilitate CPR learning as well as TCI in private settings (Chung *et al.*, 2010; Assadi *et al.*, 2015). However, further research is needed to evaluate the proven VSI method in the classroom setting and for training of medical professionals in CPR and other skills

As of now, there are not many studies to test whether the success of VSI can be replicated in group settings. Goal of this study is to test the effectiveness of VSI for CPR teaching as an alternative educational material that is readily accessible not only by medical students, but also for all ages.

2.6 **METHODOLOGY**

2.6.1 CONCEPTUAL FRAMEWORK



2.6.2 RESEARCH DESIGN

This is a randomized prospective interventional study. The main goal for the study is to compare the level of knowledge and skills in performing CPR among first year medical students in both VSI and TCI groups, and their willingness levels in performing real-life CPR after undergoing either modules. We are also going to study the possible factors contributing towards the outcomes of both of the learning methods as well as the perception of the participants towards both styles of CPR learning.

2.6.3 STUDY AREA

Universiti Sains Malaysia (USM), Health Campus Kubang Kerian, Kelantan.

2.6.4 STUDY POPULATION

Reference population

First year medical-based students in Kelantan

Study population

First year medical-based students enrolled in USM Health Campus Kubang Kerian Kelantan.

Study participants

First year medical-based students enrolled into USM Health Campus Kubang Kerian Kelantan, who fulfill the inclusion and exclusion criteria.

2.6.5 SAMPLING FRAME

Study is going to be performed from September 2018 to September 2019. This period is most suitable as the orientation period has already ended so as to not interfere with their activities and there is ample time before the formal CPR training lessons begins for them to prevent sample contamination.

2.6.6 SUBJECT CRITERIA

Inclusion criteria

First year students enrolled in USM Health Campus, with written consent.

Exclusion criteria

1. First year students without written consent.
2. First year students who do not participate in the assessment.
3. First year students who enrolled for the study but opted to drop out for any reasons, before completion of the study.
4. First year students who possesses any form of certification for any CPR courses they have attended before.

2.6.7 SAMPLE SIZE ESTIMATION

The power and sample size calculator software created by The Department of Biostatistics, Vanderbilt University is used to estimate the sample size.

Based on the first objective, we want to determine the association between the type of module and competency level. We used the 2-proportion formula and corrected chi-square to determine the appropriate sample, Taking a = 0.05, power of 0.8, value of p0 is 0.42 based on previous studies and value of p1 is estimated at 0.70 (0.66 from previous studies) , and taking into account a possible 10% dropout, our estimated sample size is 54 per group.

Based on our second objective, we want to know is there a significant difference in the improvement of willingness to perform CPR before and after training between both groups. We are comparing paired proportions using the online calculator at www.statulator.com. Based on the reference study, we specified proportions in the discordant pairs (P_{10} and P_{01}) for each of the conditions (willingness to perform CPR to acquaintance, willingness to perform CPR in strangers) for both modules (VSI, TCI). Taking the values of a = 0.05, power = 0.8 for the two-sided hypothesis with equal group sizes, estimated sample size is only 27 per group to be statistically significant.

Hence, we selected the bigger number as our sample size, based from the first objective.

Results and Interpretation

Assuming that 0% of the pairs switch from positive to negative and 30% from negative to positive, and after applying continuity correction, the study would require a sample size of: 27 pairs to achieve a power of 80% and a two sided significance of 5% for detecting a difference of 0.30 between the discordant proportions. In other words, if we select 27 pairs and determine that 0% and 30% of the pairs are discordant, we would have 80% power to declare that the paired proportions are significantly different, i.e. have a two-sided p-value of less than 0.05 (Dhand, N. K., & Khatkar, 2014).

Note: Statulator used the input values of a power of 80% and a two-sided level of significance of 5% for sample size calculation and adjusted the sample size for continuity.

2.6.8. SAMPLING METHOD & SUBJECT RECRUITMENT

For this study, we will be using block randomization method to randomize participants into the two modules. The sampling would take place after a briefing regarding the study is done with participants.

The participants will be divided randomly into two groups, one group would be undergoing the VSI module and the other going for the TCI module. Participants would be blinded towards the type of module that they have been assigned to. Participants would only be informed of their designated modules on the day of the training when they will be placed in their respective rooms.

2.6.9 RESEARCH TOOLS

	Research tools
General objective *To study the effectiveness of video self-instruction (VSI) in learning CPR versus traditional classroom instruction (TCI) among medical-based students in USM.*	Appendix A : Overall CPR Rating Definitions Appendix B : Individual CPR Skills Checklist Appendix C : Individual CPR Skills Definition Appendix H : TCI and VSI Module Content Appendix G : Evaluator Script for use during assessment
Specific objective 1 *To compare the competency levels of CPR performance after the VSI CPR course versus TCI CPR course among medical-based students in USM*	Appendix D: Overall CPR Rating Score Sheet Appendix E: Individual CPR skills score sheet

Specific objective 2 *To compare willingness levels of performing real-life CPR before and after both VSI and TCI CPR courses among medical-based students in USM*	Appendix F : Evaluation questionnaire

2.6.10 OPERATIONAL DEFINITION

1. Cardiopulmonary resuscitation

CPR is an emergency procedure that combines chest compressions with artificial ventilation to provide spontaneous blood circulation and breathing in a victim who is in cardiac arrest as a temporary measure to preserve intact brain function. Latest guidelines focus on early and high-quality chest compressions over artificial ventilation.

2. Video-self instruction

A form of teaching method which imparts a specific information (usually skills) through the means of a pre-recorded video played on a screen, in which a detailed step-by-step guide is clearly shown for the viewer to observe and emulate on his/her own.

3. Traditional classroom instruction

A form of teaching method held in a designated space which imparts real time information from an instructor, in which the students may actively engage with the instructor at any time, if any hands-on guidance is needed.

2.7 DATA COLLECTION METHOD

Data collection

There are 3 phases in this study.

Phase 1: Designing the assessment tools and modules for VSI and TCI

2 scoring sheets for assessment will be used. The first form is a 5-point ordinance score form where it will be used by an observer during the assessment to generally assess the overall performance of the participant. The ordinance score will range from 1 to 5, 1 being not competent, 2 of questionable competence, 3 being competent, 4 being very good, 5 being outstanding. (Appendix A).

The second form is a scoring sheet in which the assessor will determine adequacy or inadequacy in 12 skills in CPR (Appendix B, C). Both of the scoring forms have already been validated by a pilot study and has been used in various similar studies (Chung *et al.*, 2010; Godfred *et al.*, 2013; Assadi *et al.*, 2015; Blewer *et al.*, 2016). We, however adjusted 2 elements as to keep updated in accordance to the latest AHA guideline for CPR 2015 after approval from our panel of content experts, comprising of 3 emergency physicians.

A questionnaire form will be used to gather information regarding the participant data, as well as possible factors that might influence the outcome for each of them. This questionnaire will also have questions that assesses the personal perception of the participant regarding learning CPR methods and willingness to perform CPR for family or strangers (Chung *et al.*, 2010).

The TCI module for teaching CPR will be a 4-hour CPR course modelled based on the standard BLS course in which the contents are based on the AHA 2015 guidelines for CPR, which will be verified by our panel of content experts. This course will be teaching

adult single rescuer CPR and airway obstruction management. Details of the TCI module is further elaborated in Appendix H.

The VSI module for teaching CPR will be created within the emergency department, in which will mainly teach about ventilation and chest compression techniques. The remaining of the video will describe when CPR is indicated and also the theoretical aspects of resuscitation. This video will also be reviewed by our expert panel for content adequacy. Details of the VSI module is further elaborated in Appendix H.

We will be using a standard Laerdal® Resusci Anne Simulator manikin for both of the practice and assessment sessions. The Laerdal® Resusci Anne Simulator manikin is a life-sized mannikin with full representation of the whole body of a human being. It is primarily used as a training simulator for BLS courses throughout the country.

Instructors are going to be recruited via invitation to the post-graduate doctors of the Emergency Medicine department. The invitation described the study only in general terms, and during screening, instructors were told that they might serve in any of the following roles: trainer (teaching the TCI CPR course); facilitator (helping subjects as they learned CPR during the TCI CPR course); and examiner (testing subjects' CPR skills). Instructors did not know until they appeared for training what their role(s) would be. In total we need 10 instructors – 1 trainer, 4 facilitators, and 5 examiners. One instructor may only fulfill one role at a time to reduce bias. All instructors must have at least 2 years of working experience in the emergency department and has undergone a BLS course at least once. We chose this criterion as a standard to ensure that all instructors would be qualified to teach BLS if they were assigned to that intervention, and also to allow a common frame of reference for observations of a layperson's CPR learning experience.

In order to reduce the inter-observer variability in scoring the ordinal scale between the evaluators during the assessment, instructors each attended training sessions in which

general issues such as safeguards to experimental reliability (e.g., not discussing the study with other instructors or with subjects) and ethical treatment of subjects were discussed. The evaluators will be introduced to the scope of the study, paying special attention to the study methods. The assessment sheets will be presented to the instructors and scoring criteria will be standardized. Later, separate training sessions for the specific roles were held such that instructors were aware only of information relevant to their own roles. Sessions included scenarios and discussion to ensure that instructors understood and could comply with their roles.

Phase 2: Intervention

The study is going to be held in the Department of Emergency Medicine of Universiti Sains Malaysia. Letter of approval from the Dean of School of Medical Sciences for the choice of site has already been requested and obtained.

Participants are recruited from first year students of Universiti Sains Malaysia Health Campus. After discussing with the medical education coordinator, a date will be selected in the final week of September. This period is most suitable as the orientation period has already ended so as to not interfere with their activities and there is ample time before the formal CPR training lessons begins for them to prevent sample contamination.

A briefing will be held to introduce and outline the study course. Every student is going to be invited to participate. Participants would be informed that they were going to be randomly assigned to one of two training techniques. Written consent will be taken from all participants. Emphasis upon voluntary participation will be encouraged and there will not be any coercion for them to join the study. No penalties will be incurred towards the students who does not give their consent. Reassurance will be given that this study is purely voluntary,

and their CGPA will not be negatively affected in any way should they choose not to participate.

Block randomization technique will be used to assign students to VSI or TCI training, in which participants will not be informed of which module they are getting until they are guided into their designated areas for training. Training and assessment will be done on the same day itself. The training sessions for both modules will be conducted simultaneously in the morning session, while the assessment will take place in the afternoon session.

Each VSI participant will be then divided into groups of 8 people each. Each group will be distributed into several tutorial rooms in the Emergency department, each equipped with a projector and a computer, with a practice manikin. Each group will have the opportunity to view the video module together and will follow the instructions shown in the video. The groups may rewind or pause the video at any time, provided they are still within the 2-hour time limit. After the VSI training is complete, both the videotape and manikin will be collected to that subjects could not use them for further review and practice.

Each TCI participant will be subjected to a 4-hour course with the guidance of a certified instructor using the prepared module. The TCI course will be held in the main simulation room of the Emergency Department. The duration and timing of the lectures and on-hands training is up to the instructors' discretion, as long as the course is completed within the 4-hour limit. During the training, facilitators will be available to guide the participants. This group will be designated as our control group.

To minimize inappropriate exposure to information about the study to the participants and the instructors, we have incorporated a few measures. The study space included several separated rooms, 6 of which will be used for the VSI module. The main simulation room will be used for the TCI module. A quarantine room will also be prepared. Appropriate media will be played in the quarantine room to distract possible incidental transfer of sound from the

other rooms. Signs will be put up in the quarantine room to discourage discussion among participants. A study instructor will be supervising the quarantine room to remind participants when necessary to discourage discussion. Both subjects' and instructors' informed consent included an agreement not to discuss the study with others. Study materials and rooms were concealed from view when not in use.

Phase 3: Assessment

The outcome of the participant is determined in a post-training assessment test. After both modules, all participants are kept in a quarantine room where they are refrained from actively participating in discussions with others. Participants from both groups are going to be randomized to each examiner for the assessment. Examiners are blinded to the module that was assigned to each participant.

At the start of each assessment, each participant is going to be briefed on the scenario (Appendix G). The same Laerdal Resusci-Anne Simulator manikin is going to be used as aid to evaluate individual CPR skills. A 5-point ordinal scale is going to be used for scoring, and in addition to that, observers will rate each of 14 individual CPR skill steps as adequate or inadequate according to the previously drafted scoresheet.

After the assessment, participants will be asked to complete a questionnaire (Appendix F) in which they were asked about their demographic data, prior CPR training, if any. It will also include an additional set of questions to measure CPR related self-efficacy and concerns, as well as their personal opinions regarding the study itself. The participants will also get a private feedback session in which they will be told about their performance in their assessment. They will be told where they scored well and what mistakes they committed during the assessment.

This marks the end of the data collection portion with the participants, as the time frame for both intervention and assessment parts are expected to be completed within a single day.

2.8 STUDY FLOWCHART