An-Najah National University

Faculty of Graduate Studies

EVALUATION OF DOCUMENTATION QUALITY AND CLINICAL PERFORMANCE THROUGH REAL-TIME TABLET-BASED CARDIAC ARREST RESUSCITATION DOCUMENTATION

By

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Supervisor

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This Thesis is Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Critical Care Nursing, Faculty of Graduate Studies, An-Najah National University, Nablus - Palestine.

2024

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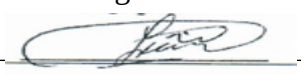
Dr. Farid Ghrayeb	
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Dedication

This thesis is dedicated to my beloved family, whose unwavering support and encouragement have been the cornerstone of my academic journey. To my parents and wife, who have always believed in me and provided the foundation for my aspirations, thank you for your endless love and sacrifices.

To my esteemed supervisor, Dr. Aidah Abu Elsoud Alkaissi, whose guidance, wisdom, and patience have been invaluable throughout this research. Your mentorship has not only enriched my academic experience but also inspired me to strive for excellence.

To my colleagues and friends who have shared this journey with me, your support and camaraderie have been a source of strength and motivation.

And finally, to all the healthcare professionals dedicated to saving lives, may this work contribute to the improvement of clinical practices and the quality of care provided to patients.

Nouraldin Ibrahim Mohammad Talbishi

Acknowledgment

First and foremost, I would like to express my deepest gratitude to Dr. Aidah Abu Elsoud Alkaissi, my esteemed supervisor, for her invaluable guidance, support, and patience throughout this research. Her expertise and encouragement have been instrumental in the completion of this thesis.

To my family, whose unconditional love and support have been my foundation, thank you for always believing in me and encouraging me to pursue my dreams. To my parents, in particular, your sacrifices and unwavering faith have been my greatest source of strength.

I am deeply grateful to my colleagues and friends for their support, camaraderie, and the many stimulating discussions we've had. Your friendship and encouragement have made this journey more enjoyable and fulfilling.

Special thanks to the healthcare students and professionals who participated in this study. Your dedication to your work and willingness to contribute to this research have been essential to its success.

Lastly, I would like to acknowledge the various institutions and organizations that provided the necessary resources and support for this research. Your contributions have been invaluable in making this work possible.

Thank you all for your support and encouragement.

Nouraldin Ibrahim Mohammad Talbishi

Declaration

I, the undersigned, declare that I submitted the thesis entitled:

EVALUATION OF DOCUMENTATION QUALITY AND CLINICAL PERFORMANCE THROUGH REAL-TIME TABLET-BASED CARDIAC ARREST RESUSCITATION DOCUMENTATION

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

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EVALUATION OF DOCUMENTATION QUALITY AND CLINICAL PERFORMANCE THROUGH REAL-TIME TABLET-BASED CARDIAC ARREST RESUSCITATION DOCUMENTATION

By

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Abstract

Background: Traditional paper-based resuscitation documentations are well known for their lack of accuracy, often failing to capture the requisite level of details needed for appropriate documentation of a rapid cardiopulmonary resuscitation (CPR). The objective of this study was to assess the sensitivity and time discrepancy of a real-time tablet-based cardiac arrest resuscitation documentation application compared to the traditional paper-based resuscitation documentation. Additionally, the study also assessed the effect of using a metronome on meeting the recommended number of compressions while performing CPR.

Methods: The study was conducted at Bethlehem University's Clinical Simulation and Life Support Center and An-Najah National University's Life Support Training Center. Cardiac arrest situations were simulated during Advanced Cardiovascular Life Support (ACLS) training courses for which the study team (n = 72 participants) started a rapid ACLS scenario that consisted of 25 sequential steps/events that were based on the Adult Cardiac Arrest Algorithm of the American Heart Association (AHA). Each step/event was documented using the traditional paper-based resuscitation documentation method and the real-time tablet-based cardiac arrest resuscitation documentation application. The sensitivity and time discrepancy of the two methods in documenting CPR steps/events, ventricular fibrillation (VF), defibrillations/shocks, medication administrations, and return of spontaneous circulation (ROSC) were compared.

Results: This study evaluates the effectiveness of a real-time tablet-based cardiac arrest resuscitation documentation application compared to the traditional paper-based method during Advanced Cardiovascular Life Support (ACLS) scenarios. The tablet-based

method demonstrated significantly greater sensitivity in accurately documenting key resuscitation events, including CPR pauses, defibrillation, medication administration, and cardiac rhythms (p-values ranging from <0.001 to 0.031). Furthermore, time discrepancies in documenting 25 critical events were significantly reduced when using the tablet-based application ($p < 0.001$). Additionally, the use of a metronome was strongly associated with achieving the recommended number of chest compressions ($p < 0.001$). These findings suggest that the tablet-based system enhances the precision and timeliness of resuscitation documentation, potentially improving clinical outcomes in cardiac arrest management.

Conclusions: The findings of this study showed that using the real-time tablet-based cardiac arrest resuscitation documentation application improved the accuracy, sensitivity, and timeliness of resuscitation documentation compared to traditional paper-based methods. Similarly, the use of a metronome improved meeting the recommended compression rates while performing CPR. These findings indicated that the use of digital tools can improve the quality of emergency care. The findings highlight the importance of integrating modern and innovative technologies in ACLS and CPR practices. Improving documentation practices can allow healthcare providers and decision-makers to identify and address local challenges in emergency care practice and improve the outcomes of the patients.

Keywords: Cardiopulmonary resuscitation; Cardiac arrest documentation; Code sheet; Tablet applications.

Chapter One

Introduction and Theoretical Background

1.1 Introduction

In the modern healthcare practice, there have been tremendous developments that have resulted in significant implications (Shoaib & Becker, 2022). These developments have improved how patient care is offered and how healthcare professionals are responsive to their own concerns and the concerns of the patients. The recent developments include the utilization of technology in conducting specific medical/clinical procedures (Negro-Calduch, Azzopardi-Muscat, Krishnamurthy, & Novillo-Ortiz, 2021). The use of the technology has enabled healthcare professionals to offer direct healthcare that is evidence-based and result in positive patient outcomes. This has created a scenario that involves measuring up the effects of the traditional or local information system and technological measures like real-time tablet-based documentation applications (Senbekov et al., 2020).

The Full Code Pro App (FCP 3.0) was developed by the American Heart Associations as a complimentary and user-friendly smartphone application that enables healthcare providers to promptly record vital interventions during cardiac arrest resuscitation incidents. This application allows healthcare practitioners to prioritize patient care while ensuring accurate and thorough documentation (Grundgeiger et al., 2016; Joseph, Sulmonte, DeSanto-Madeya, Koeniger-Donohue, & Cocchi, 2022; Peace, Yuen, Borak, & Edelson, 2014; Stewart, 2014). This software allows for effortless recording during live events. Additionally, it streamlines data input and aids providers in enhancing the accessibility and accuracy of documentation. Providers' logging of information enhances the comprehensiveness of data for the purposes of evaluation, debriefing, and improving the quality of resuscitation.

The Full Code Pro App (FCP 3.0) was designed to be used by paramedics, emergency medical technicians, emergency department nurses, emergency room doctors, and other healthcare personnel working both within and outside of hospitals. Over the years, the Full Code Pro App (FCP 3.0) has gained popularity and partially replaced traditional methods of data documentation (Grundgeiger et al., 2016; Peace et al., 2014).

The Full Code Pro App (FCP 3.0) has been used by various healthcare professionals, agencies, research organizations, and healthcare organizations over the recent past years (Grundgeiger et al., 2016; Peace et al., 2014). Currently, the Full Code Pro App (FCP 3.0) is being used in monitoring and documentation of vital interventions during cardiac arrest resuscitation incidents. The approach to documentation has many advantages that were promoted in certain hospital settings and departments including intensive care units and emergency units.

Previous studies have shown that the use of real-time tablet-based documentation applications including the Full Code Pro App (FCP 3.0) improved the sensitivity of documentation, reduced time discrepancy, documentation completeness, and precision of intervention delivery times in documenting cardiopulmonary resuscitation (CPR) steps/events (Grundgeiger et al., 2016; Joseph et al., 2022; Peace et al., 2014; Stewart, 2014). This included improving adherence to defibrillation/shock guidelines, adrenaline (and other medications) administrations, and return of spontaneous circulation (ROSC).

Therefore, to assess the documentation quality, we compared the precision of intervention delivery times, documentation completeness, and final documentation time. To assess clinical performance, we compared adherence to guidelines for defibrillation and adrenaline administration, the no-flow fraction, and the time to first defibrillation.

1.2 Background

Healthcare simulation training is quickly becoming a more and more popular way for nurses, doctors, and other allied healthcare professionals to sharpen their skills (Viglialoro et al., 2021). The simulation uses various equipment to replicate real-life scenarios in order to provide stress-free training on clinical judgment, technique, and teamwork. The advantages of simulation are numerous. It is an extremely effective way for professionals to gain the required experience without being exposed to any risks or harm (Viglialoro et al., 2021).

Care is influenced by comprehensive real-time monitoring of interventions during a cardiac arrest scenario in multiple ways. The American Heart Association states that Full Code Pro has a higher potential to improve patient outcomes than standard post-procedure documents (Grundgeiger et al., 2016; Joseph et al., 2022; Peace et al., 2014; Stewart, 2014). By guaranteeing that healthcare personnel can perform precise

interventions and documentation, it streamlines the process of entering patient data (Su et al., 2015). Heart arrest is one medical ailment that calls for quick intervention to save the patient's life. Paper records following operations like resuscitation have historically been widely accepted by healthcare professionals and organizations. It has been shown that this approach has some degree of inaccuracy and insufficient data coverage (Grundgeiger et al., 2016; Joseph et al., 2022; Peace et al., 2014; Stewart, 2014). Even though the methodology has existed over these years, international guidelines/protocols have been developed to stipulate how cardiac resuscitation should be done. The protocols have been guided by the need for the establishment of accurate data that would aid research processes, quality assurances, and aid comparisons (Grundgeiger et al., 2016; Peace et al., 2014; Su et al., 2015).

According to the International Liaison Committee on Resuscitation, specific advantages accrue from having such documentation methods (Jacobs et al., 2004). The committee relates it to ensure proper communication among the health care professionals. Instead of relying on one-on-one information sharing, the stored patient information on the application acts as a reference point. The committee also attributes the concerns for the proper documentation to aid in medico-legal pursuits that a patient might hold against a healthcare provider or organization. In this case, the documentation acts as a point of interest to re-evaluate the specific areas and points of intervention. According to the National Health Service (NHS), the clinical setting is structured so that health professionals have to be accountable for the efforts directed to patients by documenting them into paper or electronic means. The validity of the patient information is dependent on the quality of the information documented (Jacobs et al., 2004; Sedgwick, Awosoga, & Grigg, 2019). The existence of research has demonstrated that there are often several occasions that documented patient information has always been inaccurate due to factors like memory and distorted perception of time. Also, during specific times like resuscitation, there is often less time to participate in proper documentation due to the urge to save a patient (Jacobs et al., 2004; Sedgwick et al., 2019).

In some past studies, information technology has been utilized to improve the quality of information entailing cardiac arrests (Grundgeiger et al., 2016; Peace et al., 2014). They have employed an individual to make sure that the process of documentation is informed. In specific settings, especially in Germany, the emergency response team is

structured so that one person continuously records the data. The role has always been left to an anesthesiologist (Grundgeiger et al., 2016). Tablet-based approaches have been evaluated by comparing them with paper-based and simulated resuscitation (Grundgeiger et al., 2016; Peace et al., 2014). It is interesting that in all these studies, the professional involved in the documentation was not an active member of the patient's resuscitation. Therefore, there is no evidence of how documentation has an impact on clinical performance. Another study was geared towards assessing the real-time use of the tablet in documenting patient information among a group of healthcare professionals (Peace et al., 2014). The study compared tablets to the conventional methods. Among the healthcare professionals assessed included nurses and emergency medicine technician. The former noted that tablet use experiences various challenges, including power supply and small training on their use. On the other hand, the emergency medicine technician noted that conventional methods are much time consuming and can easily be altered (Grundgeiger et al., 2016; Peace et al., 2014).

1.3 Problem statement

The goal of healthcare interventions is to guarantee that they produce favorable results for patients. One medical practice that needs to be guided by evidence-based therapies that improve patient outcomes is cardiac resuscitation (Perkins et al., 2015). Using the Full Code Pro App to ensure that particular measures are implemented through electronic methods is one example of such an intervention. According to research by Montagna et al., 2020 the majority of cases that arise from using optimal procedures during resuscitation frequently mirror the results of patient care. This gives the emergency personnel a sense of order and ensures that information is exchanged among them. The World Health Organization states that when caring for patients, particularly those who experience cardiac arrests, emergency medical personnel—particularly emergency medicine technicians—must take into account a number of factors. They must have the abilities to recognize cardiac demands by making notes on particular therapies (Scheibe, Reichelt, Bellmann, & Kirch, 2015). The organization claims that guidelines that outline particular procedures and steps involved in inpatient care serve as a guide for both the hospital emergency team and the emergency medicine technician. These protocols guarantee that the cardiac care process is well-informed and positively reflects in the care that follows (Scheibe et al., 2015).

According to Montagna et al., 2020 real-time trauma tracking and documentation are essential in disease outcomes. The presence of real-time interventions like the Full Code Pro is beneficial in ensuring that healthcare personnel can provide proper documentation. They become able to note down the specific steps taken in each of the levels of the resuscitation process. This proceeds in a system that encourages the input of all members of the team and that they have to be headed by a team leader. According to Hill et al, the team leader must make sure that the real-time interventions are done in a manner that can be used in future decision-making processes (Hill, Gerace, Oster, & Ullah, 2018). Health care professionals become able to be accountable to themselves in terms of their interventions and make sure that they can be answerable to legal pursuits. On the other hand, a study done by Jagannath et al, showed that both paper-based approaches and the novel electronic methods work best when put together (Jagannath, Sarcevic, Multak, & Myers, 2021). The study suggests that most healthcare organizations advise both types of documentation in cardiac care since they contribute to a degree of patient information (Jagannath et al., 2021). Paper-based approaches are livelier to read and refer to and are often liked by other employees compared to the other.

Several advantages accrue from the use of paper-based approaches in cardiac resuscitation. A study done by Jagannath et al, indicates that a paper-based approach provides a comprehensive summary of the interventions during the process (Jagannath et al., 2021). Even though this aspect is often used to pin down the approach, it is much more accurate in providing information in a summarized way. As compared to electronic approaches, paper-based approach acts a reflection of the entire actions given to a patient. Similarly, a comparative study done by Sterpu, Lindman & Björkhem-Bergman, indicates that the future of interventions done during a resuscitation process is livelier in a paper-based approach because of the possibility of reduced tampering of information (Sterpu, Lindman, & Björkhem-Bergman, 2019). Compared to electronic applications like the Full Code Pro, conventional measures provide little room for duplication or manipulation of data until the electronic ones are closed. Electronic sources of information are much easier to manipulate (Sterpu et al., 2019).

Even though such studies give credit to the use of paper-based approaches, various scientific articles discourage the use of such measures, especially during cardiac resuscitation. According to a study done by Ashish et al, the process of neonatal resuscitation is an immediate circle of interventions that requires robust measures like Full Code Pro (Ashish et al., 2021).

The approach helps ensure that all the emergency procedures are put down, especially those that entail the administration of adrenaline (Ashish et al., 2021). This has to be put into place to make sure that the rushing effect of the process is well captured. The study attributes the human nature of forgetfulness to be the main weakness associates with paper-based approaches. Therefore, care has to be taken to ensure that a paper-based approach is only used to cover procedures with a low level of emergency. Another study done by Morgan et al, indicates that most patient outcomes related to cardiac resuscitation are often associated with proper care given to patients (Morgan et al., 2018). For instance, to establish the impact of documentation on long-term care given to patients, there is a need to have a long-term documentation approach (Morgan et al., 2018). In this case, electronic interventions become a feasible method as the health care providers can easily refer to old interventions more conveniently.

1.4 Review of the relevant literature

A number of academic studies review and analyze the utilization of traditional techniques as well as tablet-based programs such as Full Code Pro. These academic journals and papers are grounded in evidence-based viewpoints that acknowledge the use of instruments for patient data storage. The research attempts to educate medical professionals about the shortcomings in patient data documentation practices (Susanto, 2018). As such, it serves as a source of knowledge to educate medical personnel about the advantages of using contemporary techniques for cardiac care documentation as opposed to outdated ones. They range from those that directly compare the consequences of the two measures to those that inform clinical management on cardiac resuscitation (Susanto, 2018).

The usage of tablet-based leads in a range of patient outcomes, per a study by Peace et al (Peace et al., 2014). According to the study, using a traditional paper-based methodology is linked to a number of data errors, which makes it a slower way to

perform resuscitation. The purpose of the study is to determine whether using tablet-based techniques, such as Full Code Pro, may enhance current traditional or conventional techniques (Peace et al., 2014). In order to accomplish this goal, the study evaluated medical professionals, particularly nurses, to make sure they performed the simulated resuscitation procedure using both the traditional approach and the tablet application. Afterwards, the activities were recorded and contrasted with a gold standard, which included a CPR machine. The study was also utilized to track the administration of medication and the defibrillation procedure.

Following the methodology, the investigation discovered a number of issues with applying the two parameters. On the gold standard record, about 199 interventions were made. Of these records, about 102 were created using tablet technology, and roughly 78 were created using a paper-based approach throughout the interventions. Fascinatingly, 19 situations split the spoils between the two strategies. Nine nurses were involved in the procedure, which took place in more than eighteen simulated resuscitation procedures. In comparison to other treatments such as the paper-based method, which yielded a sensitivity rate of 68%, the tablet-based strategy statistically matched 88% of the sensitivity rate. The study concluded that there is a significant degree of inaccuracy associated with conventional techniques. When it comes to reporting precise intervention times, they are also less accurate than tablet-based methods like the Full Code Pro. Furthermore, the study discovered that the application of the tablet-based strategy can enhance resuscitation, which in turn increases the capacity to carry out clinical interventions and participate in research endeavors (Peace et al., 2014).

Similarly, a study done by Grundgeiger et al., 2016 indicated that data inaccuracies could overshadow the process of documentation. The study relates cardiac resuscitation to a process associated with the entry of data that can implicate the quality of care accorded to patients. The study was guided by studying the impact of tablet applications in real-time resuscitation documentation as utilized by an emergency leader to show quality. This also entailed assessing the efficiency of the emergency team. Through the use of the local hospital information system, senior anesthesiologists utilized tablet applications during simulated resuscitation process or user documentation at the end of the resuscitation. All the particulars were put into record where the study assessed the level of documentation. This was accomplished by comparing the completeness of the

documentation, accuracy of the intervention times, and the last time of documentation (Grundgeiger et al., 2016).

Additionally, to compare the impact on the team's clinical performance, the study assessed the usability of the defibrillation protocols, the timing of the first defibrillation, and a no-flow fraction. Therefore, both the team and their leader were made ready for accurate data collection processes. With the results comparing tablet application and the use of the hospital's conventional methods on the documentation interventions, the study came out with marked results (Appuhamy & Hewage, 2021). It found out that the utilization of the tablet-based approach had many significant benefits on the documentation time, intervention time, and no-flow fraction. Therefore, the study established that tablet application results in high data quality in the process of resuscitation. The study also found that incorporating a well-designed application has a positive effect on the emergency team and specific effects like clinical competence and interventions (Appuhamy & Hewage, 2021).

On clinical performance, the study found that there was no difference in data between the present method of documentation and the tablet application concerning the administration of adrenaline (Tapiero et al., 2020). This was also exhibited in the defibrillation process among the emergency team as they failed to master the new documentation methods. Also, the local documentation methods proved much more effective even with the presence of the tablet application in the process (Tapiero et al., 2020). The majority of the emergency team showed an increased desire to work with the conventional records methods, with some specifying certain merits. They attributed the facility's practice to more awareness and acquaintance and said they provide accurate steps that adhere to the set resuscitation protocols. The four stepwise effects of the intervention, including clinical performance, resuscitation documentation, and resuscitation documentation quality, proved various results that inform the resuscitation. A concurrent study acknowledged the need to deliver drugs promptly during cardiac resuscitation, especially in neonates. There should be a better mobile application that would facilitate the fast administration of vasoactive drugs (Tapiero et al., 2020).

According to a study done by Siebert et al., developing a mobile application is essential in making sure that neonates can acquire enough amounts of drugs at the correct time (Siebert et al., 2017). To come up with accurate data, the study came up with a mobile

device app named Pediatric Accurate Medication in Emergency Situations. The app has gained much insight into clinical practice over the years in a variety of clinical settings. The study aimed to investigate the effect that the mobile app has on the preparation of pediatric drugs and the delivery time (Siebert et al., 2017). It also investigates the ability of the method to reduce medication errors compared to the commonly used conventional approaches (Jacob, Sanchez-Vazquez, & Ivory, 2020). Through a random sampling technique, the study compared the mobile app to conventional methods in 12 subjects. Through the utilization of the control groups and the preparation of infusion of dopamine and norepinephrine, the study noted various results. The study specifically pointed out that Pediatric Accurate Medication in Emergency Situations proved more effective in reducing medication errors. The majority of the nurses out of the 20-sample size reported willingness to utilize the method. However, the uniqueness of the mobile app made them report an inability to understand how it is fully used (Jacob et al., 2020).

A study conducted by Avila-Alvarez et al. appreciated the importance of proper documentation in healthcare (Avila-Alvarez, Davis, Kamlin, & Thio, 2021). These include acting as the trigger for research processes, legal pursuits, and quality improvement measures. The study was guided by an aim that entailed evaluating the accuracy of the various documentation measures in the delivery. The delivery room should have strict guidelines that allow nurses and physicians to offer quality care that provides information from the moment they are born. With the literature search done via MEDLINE, the study identified related articles that provide detailed data on the documentation of newborn resuscitation (Avila-Alvarez et al., 2021). Among the articles was the use of video recording to cover the process of child resuscitation. Even though the study attributed video recording to various beneficial effects, some areas still needed some form of intervention (Susanto, 2018). This includes sites related to the start time of monitoring heart rate and offering respiratory support. This made the method less effective in providing more informed measures on the process of resuscitation (Susanto, 2018).

On the other hand, a study done by Heathcote, Jones & Clarke (2018) indicates that the timing and documentation interventions are essential in making sure that newborns are evidence-based and happen in real time (Heathcote, Jones, & Clarke, 2018). Due to the nature of neonates, they require more fast interventions compared to adults, which are

well put into place and on paper. Therefore, the measures of resuscitation in neonates should be timed by the emergency team to result in significant implications. To ascertain this aspect, the study was guided by an aim that examined the on-time/real-time interventions accorded to children who did not require extended forms of resuscitation. At the facility, about 30 neonates had achieved an APGAR score of 0 in the first minute and required an entire course of resuscitation. The study examines the interventions that were to be put into place before further measures like intubation were implemented. It looks at what was done in the documentation of the interventions that led to an increased level of resuscitation, including but not limited to the administration of adrenaline, placement of the umbilical catheterization, and the timing of the cardiac compressions (Heathcote et al., 2018). These resuscitation events provided a framework for healthcare providers to learn and appreciate the importance of taking timely resuscitation interventions (Heathcote et al., 2018).

Since the study was conducted or analyzed in the past newborn resuscitation processes, they realized that they rarely used informed intervention approaches (Heathcote et al., 2018). The timing of the essential steps of the resuscitation events is greatly lacking in these times, making the conventional systems prevail. These findings were reinforced by the British Resuscitation Council, 2016, which indicated that healthcare professionals could realize the importance of keeping good medical records, especially those that occur during newborn resuscitation. Such records become useful in informing subsequent training of medical personnel interested in taking part in professional development processes like cardiology. They provide a baseline on which healthcare organizations can anchor their quality assessment processes. For instance, a study done by Nevrekar et al. indicated the compliance of healthcare professionals to set CPR protocols like electronic recording is based on their ability to understand the procedures (Nevrekar et al., 2017). Apart from establishing the compliance rate of the resuscitation measures, the study also ascertained that understanding the newer electronic methods of documentation makes employees willing and ready to take part in continuing educational programs. The study, conducted in an Indian Hospital, found out that the facility's ICU staff members had various specialties ranging from nurses to cardiologists (Nevrekar et al., 2017).

1.5 Aims and Objectives

1.5.1 Aims

The general aim of the study was to assess and compare the sensitivity and time discrepancy between a tablet-based application for real-time CPR documentation and the current local paper-based documentation method during simulated advanced cardiovascular life support CPR events.

1.5.2 Objectives

- To assess the sensitivity of a tablet-based application- Full Code Pro, compared to the current local paper-based documentation method during a 25-step/event simulated advanced cardiovascular life support CPR event?

- What is the time discrepancy of a tablet-based application- Full Code Pro, on the documentation quality compared to the current local paper-based documentation method during a 25-step/event simulated advanced cardiovascular life support CPR event?

1.6 Research questions

- What is the sensitivity of a tablet-based application- Full Code Pro, compared to the current local paper-based documentation method during simulated advanced cardiovascular life support CPR events?

- What is the time discrepancy of a tablet-based application- Full Code Pro, compared to the current local paper-based documentation method during simulated advanced cardiovascular life support CPR events?

1.7 Study hypothesis

- The tablet-based application - Full Code Pro has significantly higher sensitivity compared to the current local paper-based documentation method during 25-step/event simulated ACLS events.

- The tablet-based application - Full Code Pro had significantly lower time discrepancy compared to the current local paper-based documentation method during a 25-step/event simulated ACLS events.

We hypothesize that the tablet-based application for real-time CPR documentation would lead to improved resuscitation data recording and enable clinicians to address deficiencies in quality of care compared to the current local paper-based documentation method during the simulated CPR.

1.8 Importance of the study

Healthcare organizations and practitioners must ensure that cutting-edge and knowledgeable interventions direct cardiac treatment (Bashore et al., 2012). The operationalization of the aspects of care has several benefits as a result. The advantages include improved clinical proficiency and a guarantee of lower mortality rates. The NHS states that healthcare providers should make sure they implement specific actions and are focused on questioning established methods (Jacobs et al., 2004; Sedgwick et al., 2019). The improvements that would otherwise lessen the approach given vigorous patient care are impeded by the traditional ways, which stand out as such.

Comparing the two methods from the outset serves as a warning to medical practitioners to be on the lookout for novel procedures (Lustgarten, Garrison, Sinnard, & Flynn, 2020). Certain healthcare organizations frequently exhibit resistance to change, which prevents them from embracing innovative approaches like Full Code Pro that could enhance patient care. These kinds of improvements are crucial to ensuring that staff members can comprehend new ideas and develop an open mind about them. Companies should make an effort to ensure that they motivate staff members to propose ideas that defy accepted norms (Lustgarten et al., 2020).

Secondly, the study is essential in ensuring that there is a reduced level of cardiac mortalities in the community. There is an increased incidence of mortalities that results from heart-related complications and is often associated with reluctance to adopt such methods as Full Code Pro (Grundgeiger et al., 2016; Peace et al., 2014). These results are related to the inability of healthcare organizations to have competent emergency medicine technicians and intensive care specialists. There is a need for healthcare agencies to ensure that their employees are well-prepared to provide quality cardiac care that enables faster recovery. The organizations should come up with sponsorship programs that promote more rapid educative programs among their emergency staff. By

ensuring proper documentation of the resuscitation interventions, nurses and other healthcare providers become aware of their expectations.

Thirdly, comparing the two aspects of interventions sensitizes healthcare organizations on how to adhere to the set protocols that regulate resuscitation measures. The electronic applications ensure that emergency health teams are made aware of their expectations regarding the intervention approaches. According to Morgan et al., there is a need for health agencies to ensure that they offer coordinated care approaches, especially those that pertain to cardiac resuscitation (Morgan et al., 2018). The protocols serve a variety of functions. First, they make sure that a clear framework acts as a reference point for resuscitation interventions. Due to the nature of most resuscitation, there is a need for a guide. The Full Code Pro approach is an actual method that guides the team in step-by-step interventions that promote patient care when they review their performance retrospectively.

On the other hand, the majority of healthcare facilities have made sure that resuscitation protocols are pinned on walls to make sure that every employee accesses them. However, this is not the case with some facilities, as they assume that all staff members are acquainted with the protocols. The WHO asserts that hospitals should use more lively approaches, including electronic applications that are easily understandable by all employees.

Chapter Two

Methods

2 .1 Study design

The study was a prospective interventional cross-over trial.

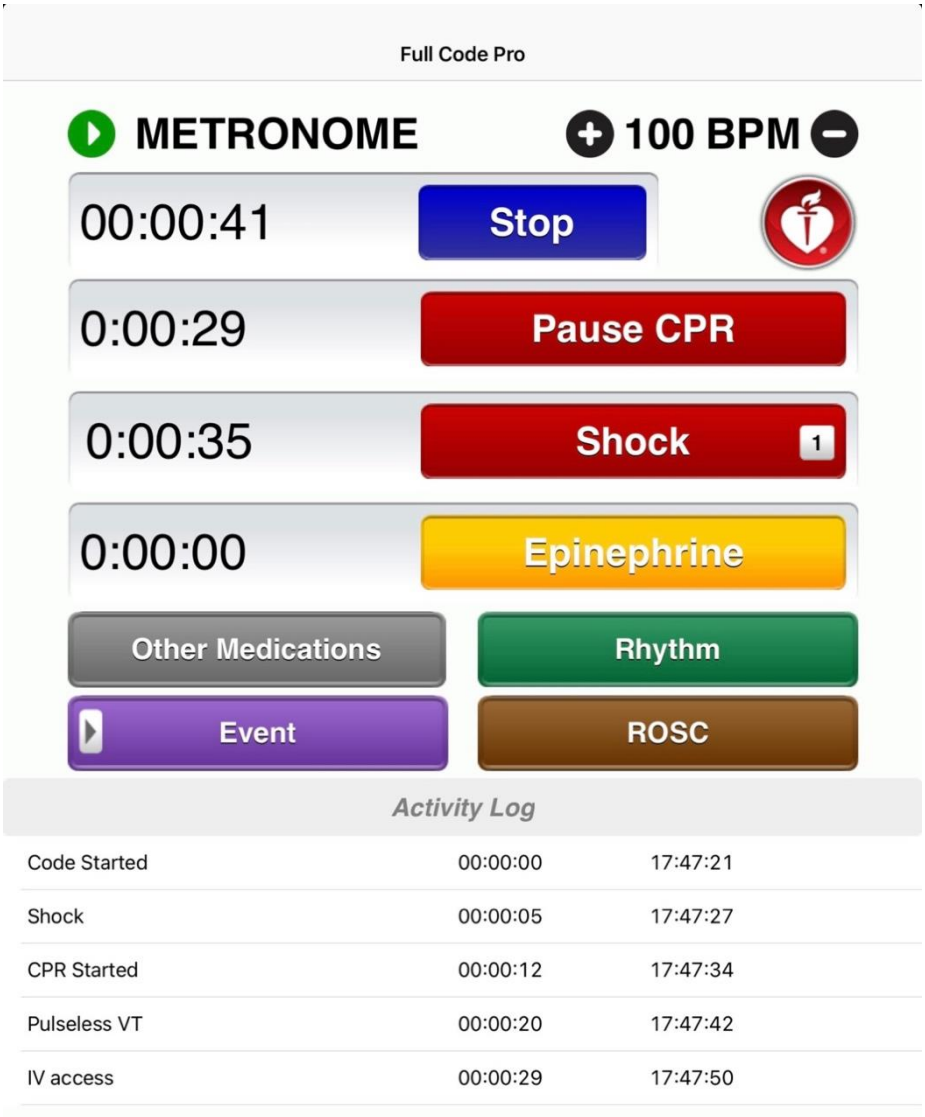
It was expected that the majority of the participants were not familiar with documenting the interventions through the use of the tablet-based application. Therefore, orientation sessions were conducted among the study participants during the advanced cardiovascular support training courses before the simulations to familiarize them with the real-time tablet-based documentation application, as both the paper-based documentation approach and the real-time tablet-based application were compared in this prospective interventional cross-over trial. The participants were allowed to use the tablet-based application to document the steps/events in the CPR during the ACLS scenarios to gain hands-on and become familiar with the application before the simulations were conducted.

The simulation scenarios involve a team of 6 participants per scenario, two of them assigned to be the recorders. All simulations were video recorded, and a defibrillator/monitor (HeartStart MRx, Philips Healthcare, Andover, MA) was used. Before each simulation, both devices were synchronized to Coordinated Universal Time (UTC) as displayed on www.time.gov.

In addition to documenting the simulation using a conventionally used paper-based documentation approach (paper code sheet) as shown in Appendix 1, the participants in this study alternately used the tablet-based application (Full Code Pro App (FCP 3.0), American Heart Association, Dallas, TX) that was installed on a tablet computer (iPad, Apple Inc., Cupertino, CA) to document each step/event in the simulated CPR. The tablet application employed a touchscreen interface for documenting interventions administered during the simulated resuscitation (Figure 1).

Figure 1

The touchscreen interface for documenting interventions administered during CPR using Full Code Pro



The sensitivity and time discrepancy in each of the 25-step/event CPR simulations, including the start of emergency (code started), start of CPR, defibrillations/shocks time, adrenaline and other medication administration time, and other key events (Grundgeiger et al., 2016; Peace et al., 2014). The true intervention time (gold standard) was extracted from the videos and reviewed several times by the researcher and was calculated as the absolute difference between the true time and the documented time for each step/event in the two documentation methods.

2.2 Study settings

The study was conducted in two centers: 1) Bethlehem University's Clinical Simulation and Life Support Center and 2) An-Najah National University's Life Support Training Center. In these centers, the participants had access to full-scale defibrillators (M-Series, Fa. Zoll Medical Deutschland GmbH, Köln, Germany), Advanced Cardiac Live Support equipment, and advanced airway management devices.

2.3 Sample size and sampling method

For sample size calculation, previous studies that were conducted to compare different documentation technologies were used to seek guidance (Grundgeiger et al., 2016; Peace et al., 2014). Expecting average differences of about 30 s between the application and the paper record system, an *a priori* power analysis with $1–\beta = 0.95$, $\alpha = 0.05$, and a large effect ($d = 1.5$) resulted in a required sample size of about 60 participants.

The sample size was calculated as informed by previous studies in which the application had a mean sensitivity of 88.0% for all interventions, compared to 67.9% for the paper code sheet (Grundgeiger et al., 2016; Peace et al., 2014). A sample size calculator was used to calculate the required sample size, as shown in Figure 2.

Figure 2

Sample size calculation

The sample size was calculated as 63 participants. Accounting for potential dropouts, we increased the sample size to 72.

The participants were selected based on their previous training in CPR as basic life support training, academic qualifications, and practical training in critical care nursing. Furthermore, all participants were enrolled in this ACLS training for the first time. The participants were recruited from Bethlehem University and An-Najah National University.

2.4 Randomization

As this study was conducted in a prospective interventional cross-over trial, the participants were randomly assigned to document each of the 25-step/event CPR simulations, once using the conventional paper-based documentation method and once using the real-time tablet-based application (Full Code Pro App, FCP 3.0). The process of creating a randomization schedule started with gathering random numbers and allocating them to each group. Random numbers generated by the computer as shown in Appendix B.

The participants were assigned to groups A and B randomly according to the following assignment:

- Group A: First use the paper-based method, then the app-based method.
- Group B: First use the app-based method, then the paper-based method.

Example Interpretation:

- Participant #1 starts with the app-based method (Group B) and then moves to the paper-based method (Group A).
- Participant #2 starts with the paper-based method (Group A) and then moves to the app-based method (Group B).

Randomization in this crossover trial helps minimize bias and allows for a more accurate comparison of the two documentation methods. Using a crossover design, the study can control for inter-participant variability, as each participant experiences both methods. To overcome the washout period, which is usually included between treatment

phases to mitigate carry-over effects and ensure that the effects of one treatment do not influence the outcomes of another, we allowed for more than two and a half hours as a time between the two experiences for each participant.

2.5 Data collection

In order to proceed with the process of data collection, permission was sought from the university's Institutional Review Board (IRB). The IRB approval was essential in making sure that the participants in the simulation centers were informed about the objectives and design of the study. Before the actual data collection, consent was also sought from the respective participants so that they could fully understand and participate in the study. It was a one-on-one approach that involved documenting in the record each of the 25 steps/events of the simulated CPR.

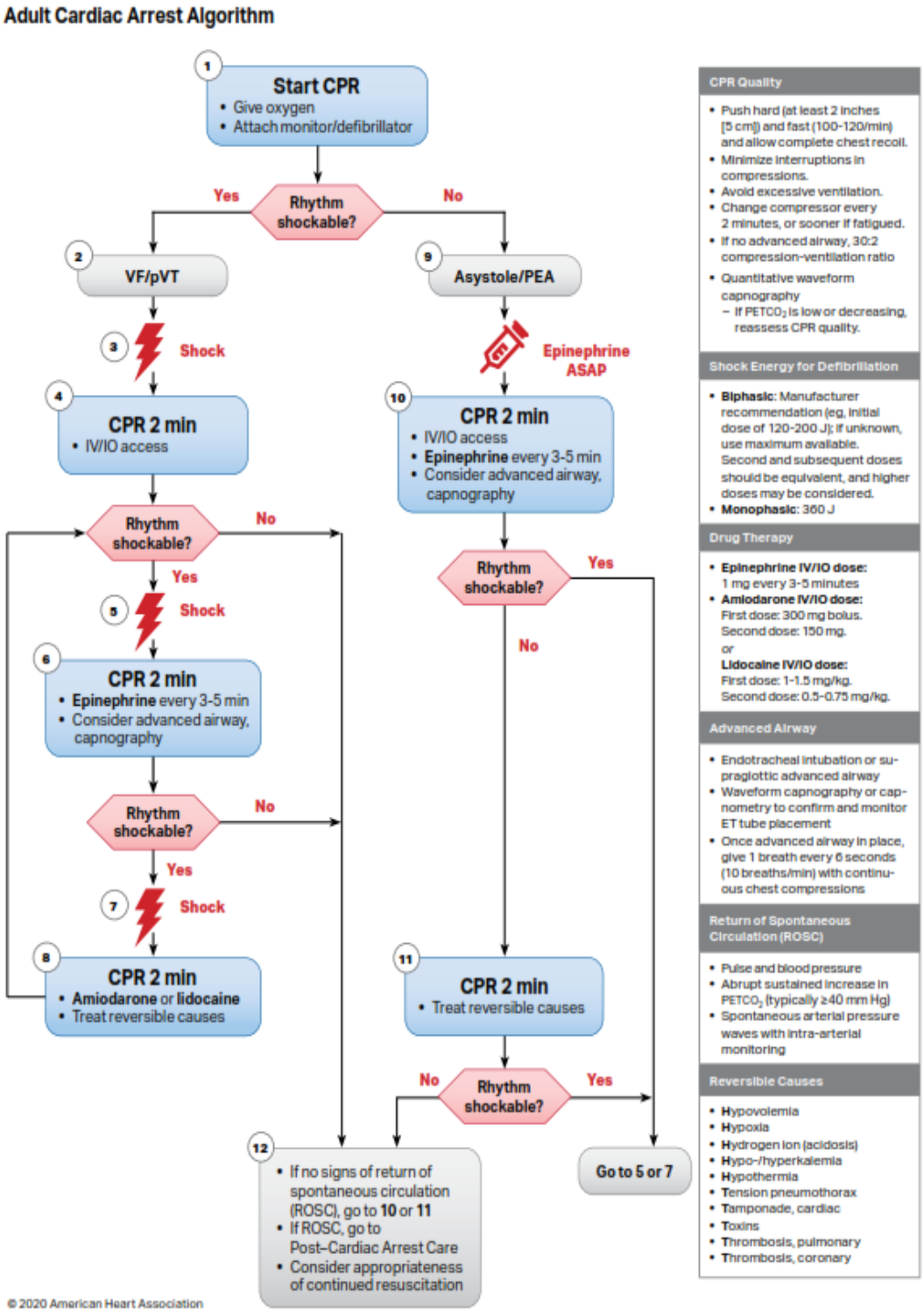
The Resus Anne QCPR Simulator was the manikin (Laerdal, Stavanger, Norway) used in this study.

The participants were instructed to document each of the 25 steps/events of the simulated CPR of the ACLS scenario once using the conventional paper-based documentation method and once using the real-time tablet-based application (Full Code Pro App, FCP 3.0). All clocks (paper-based recorder, camera, and app-based tablet) were synchronized before each session. The true intervention time (gold standard) was extracted from the videos and reviewed several times by the researcher and was calculated as the absolute difference between the true time and the documented time for each step/event in the two documentation methods.

The case scenario that was used was based on the Adult Cardiac Arrest Algorithm of the American Heart Association. It included the following steps/events in order: Code Started, CPR Started, CPR Paused, Ventricular Fibrillation rhythm, Shock, CPR Restarted, CPR Paused, Ventricular Fibrillation rhythm, Shock, CPR Restarted, Epinephrine, CPR Paused, Ventricular Fibrillation rhythm, Shock, CPR Restarted, Amiodarone 300 mg, CPR Paused, Asystole rhythm, CPR Restarted, Epinephrine, CPR Paused, Asystole rhythm, CPR Restarted, CPR Paused, and ROSC. The scenario is shown in Figure 3.

Figure 3

The Adult Cardiac Arrest Algorithm



Lead-in: You are an emergency nurse treating a man with cardiac arrest.

CPR Quality

- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Change the compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
- If Petco2 is low or decreasing, reassess CPR quality.

Shock Energy for Defibrillation

- Biphasic: Manufacturer recommendation (e.g., initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- Monophasic: 360 J.

Drug Therapy

- Epinephrine IV/IO dose: 1 mg every 3-5 minutes
- Amiodarone IV/IO dose: First dose: 300 mg bolus. Second dose: 150 mg.
- Lidocaine IV/IO dose: First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once the advanced airway is in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in Petco2 (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

To investigate the effect of using a metronome in meeting the number of recommended compressions, simulations were conducted with and without the use of metronomes, and the data were extracted from the Resus Anne QCPR manikin feedback. A metronome is a mechanical or electronic device used by musicians to maintain a consistent tempo during practice or performance. It produces a regular, metrical ticking sound at a set frequency, which can be adjusted according to the desired beats per minute (BPM). This tool is essential for developing timing accuracy, rhythm consistency, and overall musical precision (Hoffman, 2005).

2.6 Statistical analysis

The data were entered into IBM SPSS v.22.0 and GraphPad Prism V.7.0 for Windows. Sensitivity in documenting a step/event was defined as the percentage of completely documented steps/events during the 72 simulations. On the other hand, time discrepancy was defined as the time difference between the documentation time and actual time as extracted from the recorded video and synchronized with the UTC. Categorical data were presented as frequencies and percentages and continuous data were presented as means ± standard deviations (SD). Differences in the sensitivity between the real-time tablet-based application method paper-based documentation method and meeting the number of recommended compressions or not using metronomes were compared using Chi-square/Fisher's exact tests. On the other hand, differences in the time discrepancy between the real-time tablet-based application method and the paper-based

documentation method were compared using t-tests. A p-value < 0.05 was considered statistically significant.

2.7 Ethical approval

An-Najah National University's Institutional Review Board (IRB) and Bethlehem University's Ethics Committee approved the study. Approvals were obtained from the administrators of the simulation centers of Bethlehem University and An-Najah National University. Informed consent was obtained from each participant. The data collected in this study were considered confidential. The participants were ensured of their autonomy and their right to withdraw from the study at any time.

Chapter Three

Results

3.1 Demographic

Table 1 displays the demographics of the participants in the 72 simulations. The female-to-male ratio was 46/26 and the Bethlehem University/An-Najah National University ratio was 54/18 as shown in Table 1.

Table 1

Demographics of the participants in the 72 simulations

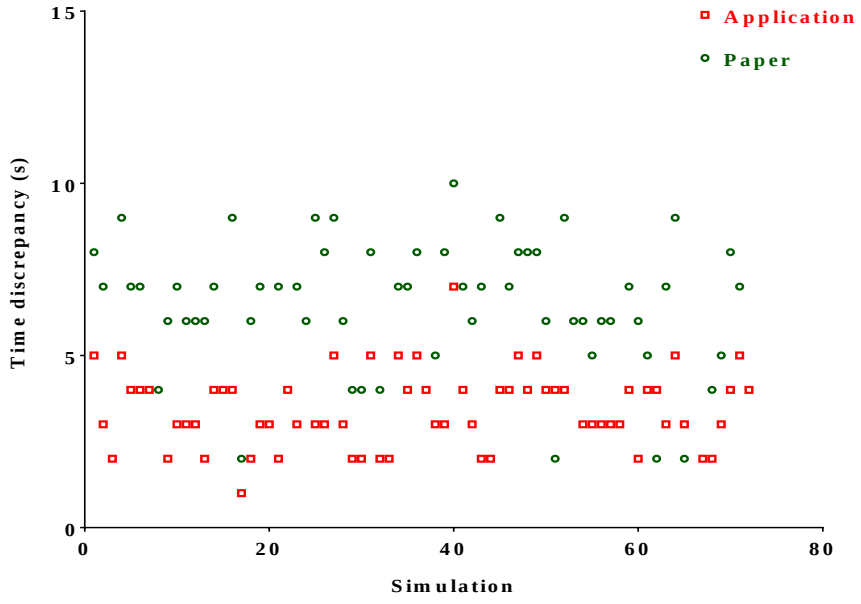
Variable	n = 72
Female/Male Gender	46/26
Bethlehem University/An-Najah National University	54/18

3.2 Time discrepancy in documenting the start of the resuscitation

As shown in Figure 4, there was a variable degree of discrepancy between the accuracy of documentation of the start of the resuscitation (code started) using the app and the traditional paper-based method.

Figure 4

Time discrepancy between application and paper-based documentation in documenting the start of the resuscitation (code started)

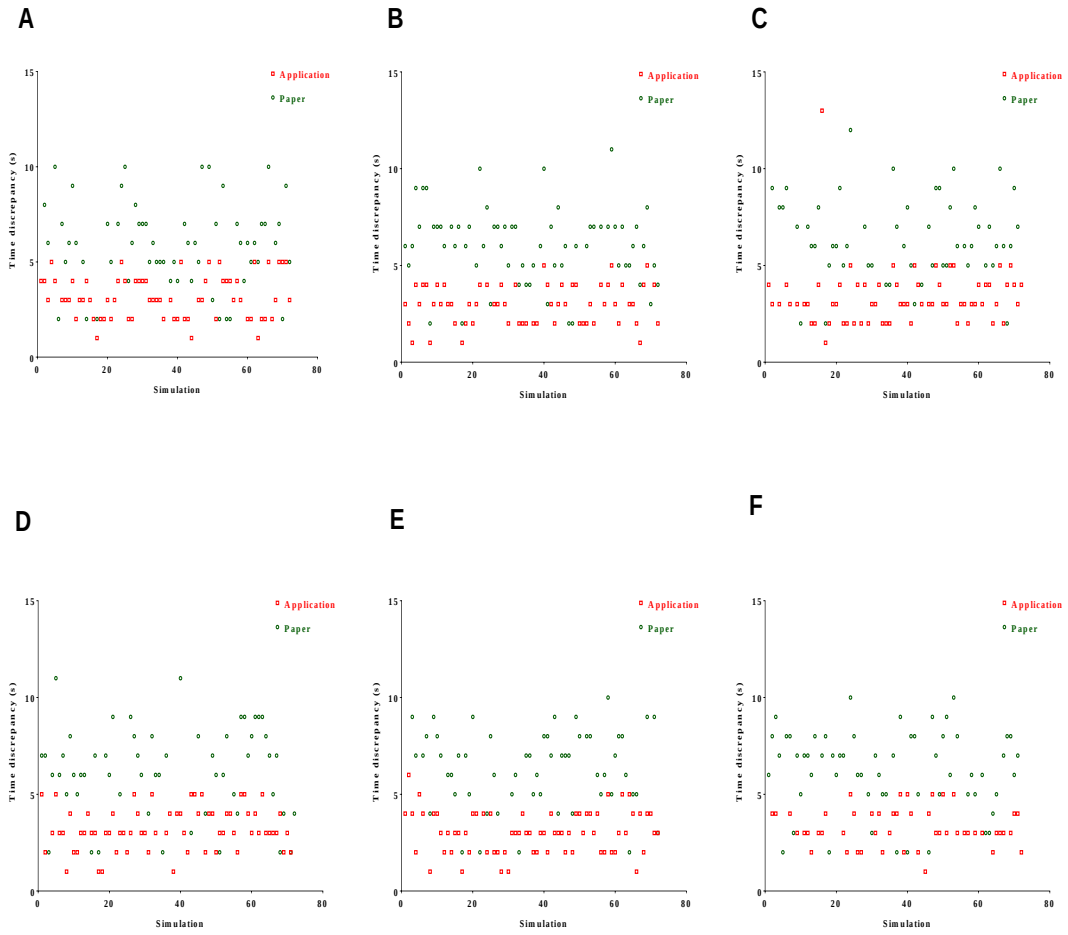


3.3 Time discrepancy in documenting CPR events

Figure 5 shows variable degrees of discrepancies between the accuracy of documentation of the CPR events using the app and the traditional paper-based method.

Figure 5

Time discrepancy between application and paper-based documentation in documenting first (A), second (B), third (C), fourth (D), fifth (E), and sixth (F) CPR events

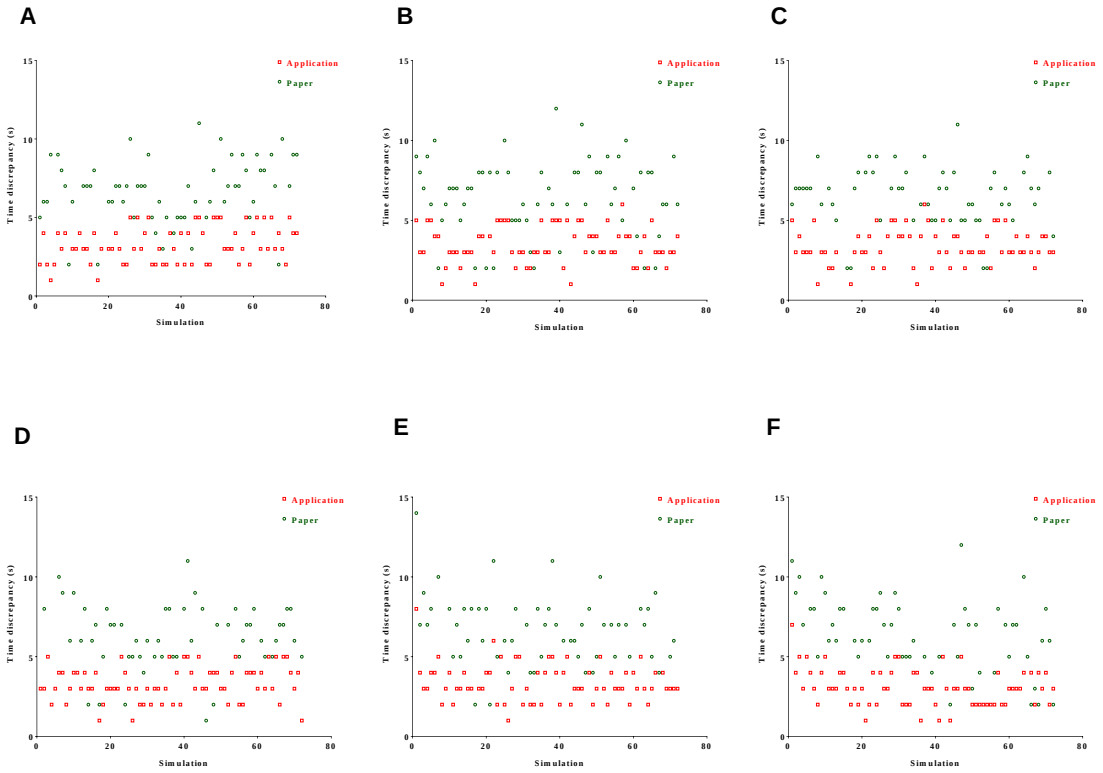


3.4 Time discrepancy in documenting CPR pause events

Similarly, Figure 6 shows variable degrees of discrepancies between the accuracy of documentation of the CPR pause events using the app and the traditional paper-based method.

Figure 6

Time discrepancy between application and paper-based documentation in documenting first (A), second (B), third (C), fourth (D), fifth (E), and sixth (F) CPR paused events

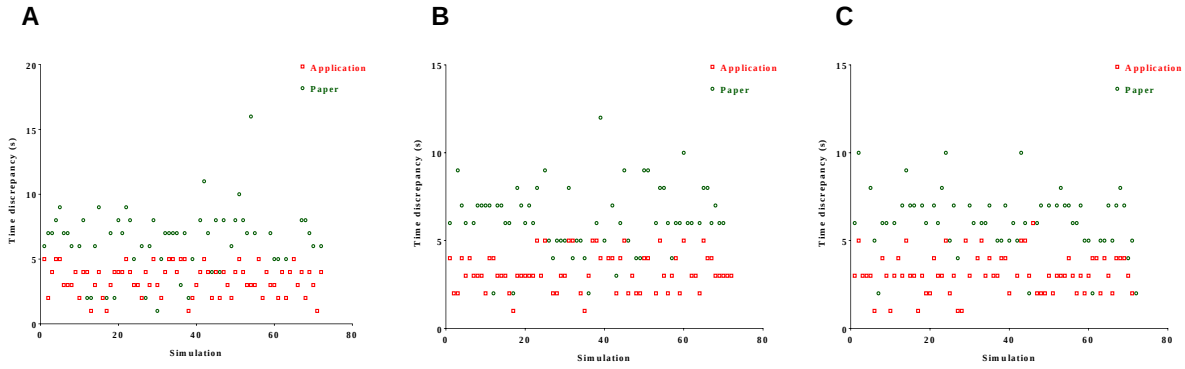


3.5 Time discrepancy in documenting VF events

Figure 7 shows variable degrees of discrepancies between the accuracy of documentation of the first, second, and third VF events using the app and the traditional paper-based method.

Figure 7

Time discrepancy between application and paper-based documentation in documenting first (A), second (B), and third (C) VF events

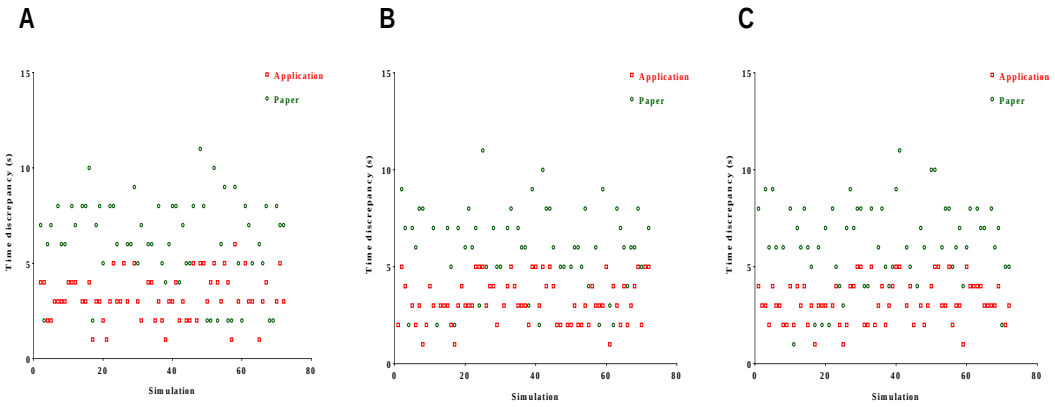


3.6 Time discrepancy in documenting shock events

Figure 8 shows variable degrees of discrepancies between the accuracy of documentation of the first, second, and third shock events using the app and the traditional paper-based method.

Figure 8

Time discrepancy between application and paper-based documentation in documenting first (A), second (B), and third (C) shock events

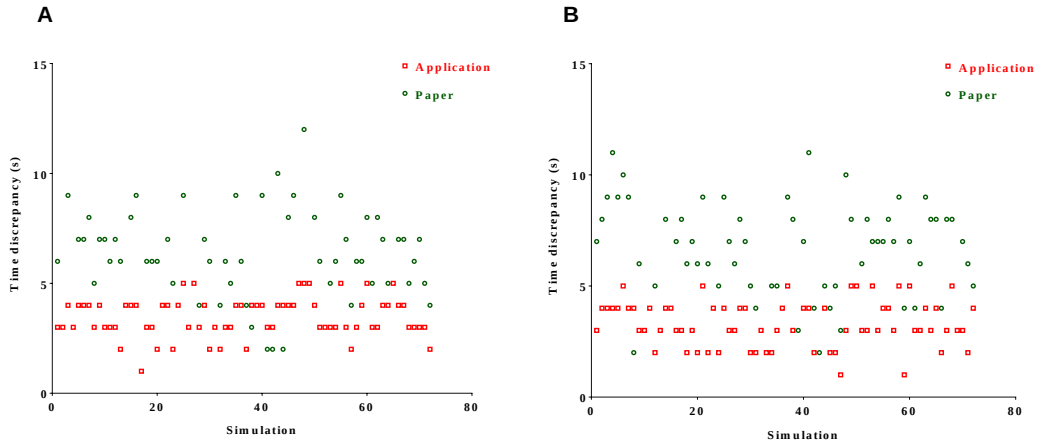


3.7 Time discrepancy in documenting shock events

Figure 9 shows variable degrees of discrepancies between the accuracy of documentation of the first and second asystole events using the app and the traditional paper-based method.

Figure 9

Time discrepancy between application and paper-based documentation in documenting first (A) and second (B) asystole events

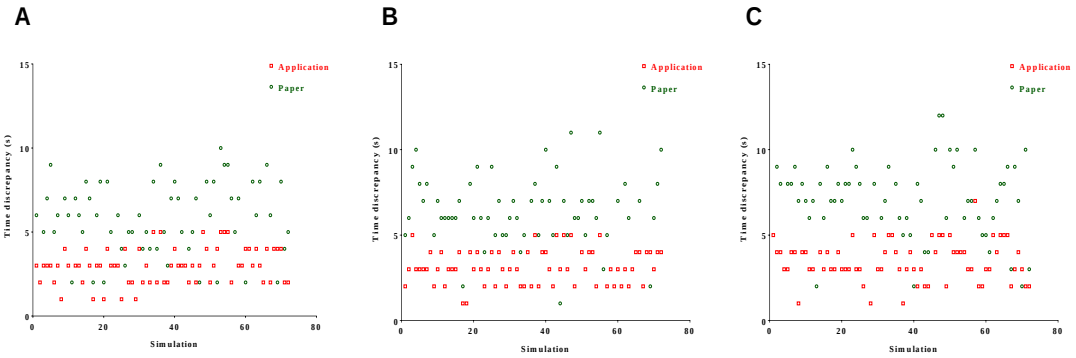


3.8 Time discrepancy in documenting shock events

Figure 10 shows variable degrees of discrepancies between the accuracy of documentation of the administration of medications using the app and the traditional paper-based method.

Figure 10

Time discrepancy between application and paper-based documentation in documenting first adrenaline (A), first amiodarone (B), and second adrenaline (C) administrations



3.9 Time discrepancy in documenting shock events

Figure C1, as shown in Appendix C, shows variable degrees of discrepancies between the accuracy of documentation of the return of spontaneous circulation (ROSC) using the app and the traditional paper-based method.

3.10 Assessment of statistical differences in the sensitivity and time discrepancy of documentation between application and paper-based documentation

3.10.1 Sensitivity of the Documentation Methods

Table 2 shows the differences in the sensitivity of the two documentation methods in recording the 25 simulated sequential events.

The table D1 shown in Appendix D shows that the application-based documentation method was significantly more sensitive compared to the traditional paper-based documentation method in recording the first CPR paused event (p-value = 0.031), first VF event (p-value < 0.001), second defibrillation (Shock) (p-value = 0.012), third CPR started event (p-value = 0.005), first epinephrine administration (p-value = 0.031), third CPR paused event (p-value = 0.021), second VF event (p-value = 0.021), fourth CPR started event (p-value = 0.007), amiodarone administration (p-value = 0.031), fourth CPR paused event (p-value < 0.001), first asystole event (p-value < 0.001), fifth CPR started event (p-value = 0.001), fifth CPR paused event (p-value = 0.004), second asystole event (p-value = 0.031), and sixth CPR paused event (p-value < 0.001).

3.10.2 Time discrepancy of documentation methods

Table D2 shown in Appendix D shows that the time discrepancies in the documentation of all 25 events (Code Started, CPR Started, CPR Paused, VF, First defibrillation (Shock), CPR Restarted, CPR Paused, VF, Second defibrillation (Shock), CPR Restarted, Epinephrine, CPR Paused, VF, Third defibrillation (Shock), CPR Restarted, Amiodarone 300 mg, CPR Paused, Asystole, CPR Restarted, Epinephrine, CPR Paused, Asystole, CPR Restarted, CPR Paused, and ROSC) were significantly shorter when the documentation was made using the application compared to using the traditional paper-based method (p-value < 0.001).

When the time discrepancy between the paper- and application-based methods were calculated, the paper-based method resulted in larger time discrepancies compared to the application-based method. Mean differences in the time discrepancy between the paper- and application-based methods are shown in Table 2.

Table 2

Mean differences in the time discrepancy between the paper- and application-based methods

	Time discrepancy (s) between paper- and application-based methods	
Event	Mean	SD
Code Started	3.3	1.2
CPR Started	3.4	1.4
CPR Paused	3.5	1.6
VF	3.5	1.7
Shock	3.3	1.4
CPR Restarted	3.3	1.3
CPR Paused	3.6	1.4
VF	3.4	1.7
Shock	3.4	1.3
CPR Restarted	3.3	1.5
Epinephrine	3.3	1.2
CPR Paused	3.3	1.6
VF	3.3	1.1
Shock	3.3	1.4
CPR Restarted	3.8	2.1
Amiodarone 300 mg	3.5	1.2
CPR Paused	3.4	1.3
Asystole	3.3	1.2
CPR Restarted	3.6	1.4
Epinephrine	3.9	1.5
CPR Paused	3.5	1.2
Asystole	3.7	1.3
CPR Restarted	3.3	1.5
CPR Paused	3.6	1.4
ROSC	4.4	6.6

CPR: cardiopulmonary resuscitation, VF: ventricular fibrillation, ROSC: return of spontaneous circulation

3.11 The effect of using a metronome on meeting the recommended number of compressions

The chi-square test showed that using a metronome was significantly associated with meeting the recommended number of compressions (p-value < 0.001). This association is shown in Table 3.

Table 3

Association between using a metronome and meeting the recommended number of compressions

	Metronome					
	No		Yes			
Number of compressions	n	%	n	%	Chi^2	p-value
100 < Compressions >120	32	88.9	6	16.7	37.7	< 0.001
Compressions = 100-120	4	11.1	30	83.3		

Chapter Four

Discussions and Conclusions

The discussion chapter of this thesis reflects on the main findings of the study, evaluates the implications of the results, and compares them with existing literature. The study's primary objective was to assess the effectiveness of a tablet-based application for real-time cardiac arrest resuscitation documentation compared to the traditional paper-based method. The study found significant differences in accuracy and time efficiency, with the digital tool outperforming the paper-based approach in documenting several critical events during CPR. These results underline the potential of digital documentation tools to enhance clinical practice, especially in time-sensitive procedures like cardiac resuscitation.

The novelty of this research lies in its context, as it represents one of the first studies conducted in Palestine focusing on the application of digital technologies for medical documentation during resuscitation. The findings offer insights into how technological advancements can improve CPR outcomes by ensuring more precise and timely documentation. This chapter delves into the interpretation of these findings, evaluates their practical implications, and highlights the study's contributions to both local and international healthcare systems. Furthermore, it discusses the potential for future research and the integration of such digital tools in clinical practice to improve patient outcomes, particularly in resource-limited settings.

4.1 Summary of the objectives, main results, novelty, and importance of the study

Providing timely CPR and adherence to international guidelines are key to success in saving the lives of patients who sustain cardiac arrests (Shoaib & Becker, 2022; Su et al., 2015). Improving the accuracy of documentation of CPR steps/events can inform healthcare providers and decision-makers who need to make appropriate decisions to improve the care of patients. This study assessed the impact of using a tablet-based application for real-time documentation of the steps/events in a simulated CPR compared to the conventionally used local paper-based documentation method. The results of this study showed much lower sensitivity and higher time differences in the paper-based documentation method as compared to the tablet application. These findings were observed in several critical steps/events of CPR, detection of VF events,

delivery of defibrillations/shocks, detection of asystole events, administration of medications, and ROSC. The outcomes of this study indicated that the tablet-based application was more accurate and efficient in recording key sequential CPR steps/events compared to the paper documentation method. It is worth mentioning that the current research represents a new addition to knowledge on which no other study has previously been conducted to our best knowledge related to Palestine. In summary, this investigation emphasizes the necessity of using up-to-date digital technology like tablets for accuracy and efficiency improvement when documenting main sequences. Moreover, these outcomes are vital in evaluating and enhancing clinical performance as well as patient outcomes among those who suffer from cardiac arrest and receive CPR within Palestine's settings.

4.2 Discussion and interpretation of the main findings

4.2.1 Discrepancies between the accuracy of documentation of the start of the resuscitation

In this study, it was established that there were significant differences in documenting when the emergency began and when resuscitation began (code started). The paper-based documentation approach in this research was less accurate than the application-based documentation approach. The results of the study were similar to those reported by other studies investigating digital versus paper approaches in documenting cardiac resuscitation (Grundgeiger et al., 2016; Heathcote et al., 2018; Montagna et al., 2020; Peace et al., 2014; Sedgwick et al., 2019; Stewart, 2014; Su et al., 2015; Susanto, 2018). For that reason, these findings prove that using digital tools to record information can enhance records' accuracy and cut down on the time needed for logging and retrieval, especially during critical incidences such as heart attack (Morris et al., 2023). With regard to emergencies within Palestinian health system, accurate documentation of time of emergency and time care was initiated helps policy makers determine delays in initiating care towards patients experienced by health professionals under crises. Moreover, these findings can inform efforts to optimize adherence to the international guidelines on the start of delivering care services to patients who sustain cardiac arrest events. In addition, the use of tablet-based applications to document CPR steps/events in real-time can ensure relying on accurate data that can be used for post-event analysis.

Rapid and timely initiation of a CPR for a patient sustaining a cardiac arrest is a cornerstone for maintaining circulation, respiration, and ensuring survival of the patient (Bircher, Chan, Xu, & Association, 2019; Hardeland et al., 2016). It is well-established that oxygen deprivation can result in rapid injury to the brain as a result of cessation of the cardiovascular functions. Therefore, delaying CPR by even seconds can lead to irreparable damages to the brain and other vulnerable organs. This can ultimately increase the risks of morbidity and mortality of the patients. CPR can help circulating the oxygenated blood to vital organs including the brain. Therefore, CPR can be efficient if started immediately after the heart ceased to function following a cardiac arrest (Herlitz, Bång, Alsén, & Aune, 2002). A delayed commencement of CPR can reduce the chances of patient survival and neurological recovery. Therefore, CPR is a time-sensitive medical intervention in saving the lives of patients who sustain cardiac arrest.

It has been argued that using digital tools to record keeping can decrease human errors that can be associated with relying on paper-based record keeping (Jacobs et al., 2004; Morris et al., 2023). This can improve the overall patient experiences and care services delivery to the patients, notably in emergency situations. The findings of this study suggest that decision-makers and healthcare professionals in Palestine might need to adopt using digital technology to document the sequential steps/events while delivering CPR to patients who sustain cardiac arrest.

Implementing such technology in the Palestinian practice might provide opportunities for training, standardizing the quality of CPR delivery, and improve the overall quality of the care services and patient experiences in the healthcare system. Because this was the first study in the Palestinian context, the study might set the pace for more future studies on the nature and duration of the training needed, costs and resources to be allocated, and challenges to be addressed before adopting such digital technologies.

4.2.2 Discrepancies between the accuracy of documentation of the different CPR steps/events

Another major finding of this study was the observed significant time discrepancies in documenting the different CPR steps/events between the tablet application and the paper-based documentation method. The tablet application was more accurate and faster

in documenting various CPR events compared to using paper-based documentation, like the beginning of resuscitation. These findings were consistent with those reported in previous studies which compared differences in timing accuracy and sensitivity between digital tools and paper-based documentation Grundgeiger et al., 2016; Harrington, Price, & Edmonds, 2020; Heathcote et al., 2018; Jacobs et al., 2004; Montagna et al., 2020; Morris et al., 2023; Peace et al., 2014; Sedgwick et al., 2019; Stewart, 2014; Su et al., 2015; Susanto, 2018). Digital tools are relatively better than their traditional counterparts when it comes to documenting different steps/events of CPR and several other earlier studies showed comparable findings Grundgeiger et al., 2016; Harrington, Price, & Edmonds, 2020; Heathcote et al., 2018; Jacobs et al., 2004; Montagna et al., 2020; Morris et al., 2023; Peace et al., 2014; Sedgwick et al., 2019; Stewart, 2014; Su et al., 2015; Susanto, 2018). These results suggest that more precise documentation of CPR steps/events and reliance on more accurate data that can be used for evaluating compliance with international protocols, quality of care provided, performance monitoring for healthcare provider teams, and improving the standard of care or services delivered while also improving patient outcomes; can be achieved through using digital tools. In addition, use of these computing devices will reduce human errors leading to better medical record-keeping during emergency conditions such as heart resuscitation (Harrington, Price, & Edmonds, 2020; Morris et al., 2023). It is necessary to emphasize that proficient healthcare providers may easily adhere to accurate, exacting and powerful electronic devices for real-time recording of occurrences during a CPR. Furthermore, policymakers in hospitals can purchase various existing digital technologies available now so as to enhance delivery efficiency in patients who experience episodes of cardiac arrest situations (Harrington et al., 2020).

The efficiency of a CPR procedure can be affected by several factors. Of those, timeliness is one of the most critical factor (Shinozaki, Nonogi, Nagao, & Becker, 2016). The sooner the initiation of the CPR the higher the chances of patient survival and neurological recovery. In addition, the adequate number and quality of chest compressions are essential to ensure proper rate and depth. Although less vital compared to chest compressions, adequate ventilation can also be essential for the success of a CPR. Additionally, the coordination and organization of teamwork among health care providers, as well as any bystanders who may be involved in performing CPR, is also important for a successful procedure with increased chances of patient

survival (Becker, Aufderheide, & Graham, 2015; Bjørshol & Søreide, 2017; Morrison et al., 2013).

Additionally, it ought to be recognized that the use of digital technology in Palestine could mitigate the variability that is inherent in current paper documentation practices and sheets used. This would ensure quality services across different healthcare facilities dealing with cardiac resuscitation for patients experiencing cardiac arrest.

4.2.3 Discrepancies between the accuracy of documentation of VF and asystole events

Additionally, it was one of the most important conclusions reached by this study, where there was a significant variation in the time difference between VF and asystole events as reported by tablet application and paper documentation method used. The accuracy, precision, and speed in documenting VF and asystole events using tablet app were better than those using paper-based approach. This finding is consistent with previous studies which also showed that digital programs like Full Code Pro App work much better when compared to traditional methods associated with paper documentation (Grundgeiger et al., 2016; Peace et al., 2014). It is noting worthy to mention that precise, accurate, and efficient documentation of VF and asystole events during a cardiac resuscitation can be essential for the timing and efficiency of defibrillation/shock administration or medication administration (Chan, Krumholz, Nichol, Nallamothu, & Investigators, 2008). This can be a critical intervention during a cardiac arrest management.

VF could be life-threatening events that affect the functionality of the heart and its ability to circulate oxygenated blood to the vital organs including the brain (Bunch, Hammill, & White, 2005). VF is the known to be the most frequent rhythm among patients who sustain cardiac arrest events (Holmberg, Holmberg, & Herlitz, 2000). VF results in unconsciousness and prevents the heart from pumping oxygenated blood to the body. Therefore, VF can only be managed through early defibrillation/shock. It is noteworthy to mention that even a short delay in the delivery of defibrillation/shock can significantly reduce the survival changes of the patients (Bunch et al., 2005; Chan et al., 2008; Holmberg et al., 2000).

Although delivery of defibrillation/shock is essential, however, an early initiation of high-quality CPR should continue until the patient regains a pulse (Bunch et al., 2005). Thus, prompt recognition of events leading to VF, immediate onset of CPR procedures, quick administration of defibrillation/shock, advanced medical support and post-cardiac arrest care are indispensable in the management of cardiac arrest and enhancing survival among individuals who have experienced heart attack (Nolan et al., 2018; Vaillancourt & Stiell, 2004). This calls for immediate action in a coordinated manner when VF is diagnosed. Such essential steps normally begin with an early identification of the VF episode and a subsequent activation of emergency medical services (Bunch et al., 2005; Keller & Halperin, 2015). Consequently, it becomes necessary for the bystanders to call for assistance from a health team. The provision of high-quality chest compressions is crucial to maintaining oxygenated blood flow within the body especially to some organs like brain. Also see that these compressions are held continuously until there are defibrillations/shocks administered to patients. Timely delivery of defibrillations/shocks is effective for the management of VF. Advanced life support that can be delivered by trained emergency team including medications and other efforts to stabilize the patient are also essential for the survival of the patients. Care efforts continue to maintain the delivery of oxygen, reducing the risks of morbidity, and ensuring neurological recovery (Bunch et al., 2005).

On the other hand, asystole can be a significant event in a cardiac arrest in which the heart completely ceases generating electrical activity (Attin, Tucker, & Carey, 2016; Høybye et al., 2021). When patients with cardiac arrest develop asystole, they often die because of it which makes it a very dangerous condition. This happens due to collapsed circulation and oxygen being deprived from crucial body organs such as the brain (Attin et al., 2016). In this case, rapid initiation of chest compressions is required to sustain blood supply to vital body organs including the heart. Another factor that is important during CPR, is maintaining the patency of patients' airways and giving medications. Medications like epinephrine are examples of these drugs that stimulate the heart while increasing blood pressure (Callaway, 2013).

According to the findings of this study, the presence of ventricular fibrillation and asystole can be documented more accurately via digital means. Also, their management can be better done by using digital tools too. Additionally; health care professionals and

policy makers use the documented data for emergency team's performance evaluation; monitoring patients or post-cardiac arrest care need purposes. This could promote better healthcare delivery aimed at survival of victims of cardiac arrests.

4.2.4 Discrepancies between the accuracy of documentation of defibrillation/shock and administration of medications

Also, another important finding of this study is the significant time difference as documented by using tablet-based application and paper documentation in delivering defibrillation/shock and administering medication. In other words, like in others studies before, the result also revealed that the accuracy of delivery such as defibrillation and administration of drugs for shock was significantly higher with use of applications on tablets compared to the traditional paper-based documentation methods (Grundgeiger et al., 2016; Morris et al., 2023; Peace et al., 2014; Sedgwick et al., 2019; Stewart, 2014). It is essential that healthcare providers have accurate timing data about when defibrillation/shock delivery and drug administration took place since both are important components of cardiac resuscitation strategies. Additionally, patients who experienced heart attacks will be affected by whether they get a shock or not as well as being given any medications to keep their hearts functioning correctly (Boyd & Brady, 2012; Callaway, 2013; Chan et al., 2008; Chan et al., 2009; Singh, Heeney, & Montgomery, 2024). Together, these findings indicate that using digital technologies can improve the documentation of defibrillation/shock delivery and administration of medications to the patients who sustained cardiac arrest events.

Timely and speedy supply of defibrillations/shocks is important for the chain of survival among patients experiencing cardiac arrest (Bunch et al., 2005). For an individual with VF, the heart becomes inefficient in circulating oxygenated blood to vital organs including the brain (Bunch et al., 2005; Keller & Halperin, 2015; Nolan et al., 2018; Vaillancourt & Stiell, 2004). Consequently, these patients become prone to organ damage and death. The VF can be successfully managed through a very effective and timely approach of defibrillations/shocks in cardiac arrest patients. This is because any delays in the provision of defibrillations/shocks may cause deaths to the victims (Bunch et al., 2005).

Also, among patients with SCA, timely administration of medications such as epinephrine and amiodarone has been shown to significantly boost survival rates (Attin et al., 2016; Høybye et al., 2021). It is common knowledge that epinephrine serves as a powerful vasoconstrictor besides being bronchodilator (Attin et al., 2016; Høybye et al., 2021). Cardiac resuscitation guidelines suggest using it to stimulate myocardium during CPR and improve BP. On the other hand, amiodarone is an ant-arrhythmic drug commonly used for arrhythmias occurring during cardiac arrest situations (Laina et al., 2016). Amiodarone can help stabilizing the electrical activities of the heart and reducing the chances of developing VF (Laina et al., 2016). Medications like epinephrine and amiodarone are listed as essential components of the advanced life support. Timely and rapid administration of these medications as well as delivery of defibrillations/shocks and CPR are essential in the management of patients sustaining cardiac arrest situations (Callaway, 2013).

Digital technology has improved the accuracy of medication administration records thus, emphasizing its potential in reducing errors and promoting trustworthiness in healthcare data. In such a case, precise and real-time recording in healthcare could support better monitoring of drug interventions, patient outcomes, adherence to treatment procedures among clinicians. Policymakers can strengthen the use of digital documentation systems by incorporating this information resulting into improved clinical practices and increased patient safety.

For instance, introducing this technology in Palestine would provide a standardized approach to recording drug distribution across different health facilities even with limited resources and training. The challenges experienced by Palestinians doctors who have no reliable access to advanced training or resources point at using dependable digital technologies. Improving the accuracy of drug delivery documentation may enhance effectiveness of resuscitation efforts for instance; bettering patient outcomes as well as supporting successful quality improvement initiatives for practitioners in medicine. Because this was the first study in Palestine, the results reported in this study stress on the importance of using digital health solutions to address particular healthcare needs and improve processes in emergency care in Palestine.

4.2.5 Association of metronome use with meeting the recommended number of compressions

The research study provided a significant increase in the probability of achieving the recommended number of chest compressions during CPR by using a metronome. The findings were consistent with those reported in numerous studies on the role of metronomes to improve the number of compressions and ventilation rates during manikins ((Bae, Chung, & Je, 2016; Chung et al., 2012; Kern, Stickney, Gallison, & Smith, 2010; Zimmerman et al., 2015). These results suggest that using metronomes may assist in giving efficient chest compressions during CPR. Additionally, these findings demonstrate that healthcare providers should introduce metronomes when performing CPRs on patients who have experienced cardiac arrests. These are some of the metronomes which will guide health care providers to provide as many as possible numbers of chest compressions needed by AHA (Bae et al., 2016).

Use of a metronome has been found to be significantly related to achieving the target compression rate indicating that this simple device can enhance effectiveness in CPR. Resuscitation treatments accompanied by a metronome inserted there may produce better results if healthcare workers ensure their efficacy towards pressure strokes delivered to patients' hearts when they are brought back from heart arrest condition. These results may be used by decision-makers to endorse the incorporation of metronome usage in CPR training and emergency treatment protocols, perhaps resulting in more uniform and efficient resuscitation efforts.

4.3 Strengths of the study

This study has a number of strengths including:

- **The use of innovative digital technology:** in this study, an innovative tablet-based application that was developed by the American Heart Association was used and compared to the traditionally used paper-based documentation approach. This provides new perspectives on the efficiency of digital tools in emergency treatment.
- **A comprehensive evaluation:** The study comprehensively assessed the documentation of 25 sequential steps/events in a CPR. These steps/events included initiation of CPR, VF events, delivery of defibrillations/shocks, asystole events,

administration of medications, and ROSC. This comprehensive evaluation ensured a thorough and comparative analysis of the two documentation approaches.

- **Improving documentation sensitivity:** This study has found that a tablet-based application is more effective, precise and accurate at documenting the different steps/events in CPR than others. By using this tool, the completeness and accuracy of medical record-keeping in emergency situations can be enhanced.
- **Documentation timeliness:** The use of the tablet application led to fewer time disparities in recording the various steps/ events in CPR during this research. Therefore, by reducing administrative tasks' delays related to emergency services due to conventional manual techniques it will improve documentations' time.
- **Improved quality of CPR:** This study found that there was a significant relationship between using a metronome and achieving proper compression rates in CPR. Accordingly, this shows how simple technologies can improve the quality of CPR which is consistent with evidence-based practice principles.
- **The first study to be conducted in Palestine:** Because it addresses a research gap and provides important insight into the viability of digital documentation tools within local settings, this work is groundbreaking for Palestine. It thus created a benchmark for further research as well as utilization of digital health solutions within the region.
- **Having practical implications:** The findings provided practical and useful information for healthcare professionals and decision-makers. This included the possibility of enhancing resuscitation techniques and achieving better patient results by using digital documentation tools and metronomes.
- **Efficacy of allocating resources:** The study presented data supporting the cost-effective use of digital instruments, such as metronomes, which may be especially advantageous in settings with limited resources, such as Palestine.

4.4 Limitations of the study

The study also had a number of limitations including:

- **Why simulations are used:** Instead of emergency situations in real life, the research was carried out in simulated resuscitation settings. Nevertheless, while they can be an excellent venue for assessing documentation approaches, simulations might not capture all ins and outs of actual clinical conditions.

- **Tiny sample sizes:** It only consisted of people from Bethlehem University and An-Najah National University. These outcomes may not apply elsewhere or within Palestine due to this fact. The technology's effectiveness could be better understood by increasing the sample size and its heterogeneity.
- **User experience variations:** There could be differences in the precision as well as timeliness of documentations between tablet-based application and conventional paper approaches. The findings might be affected by individuals' level of experience with technology at various levels.
- **No long-term effects:** The research checked out accuracy and timeliness of documentation but never considered such things as patient survival rates or total impact on the quality of care delivered. This could be looked at more deeply in order to have a comprehensive understanding of how digital documentation technologies are helpful.
- **Probable bias:** Nevertheless, both the methodology employed by the study and how it was evaluated could be sullied with observer and participant biases that might have hindered its findings. To alleviate this, blindness or other additional controls can be introduced.
- **Limitation in technical method adopted:** The performance of the tablet-based application may be affected by some technical problems such as software glitches, device malfunctions, or user mistakes. These factors could impact on how reliable the app would perform in real world settings.
- **Constraints in resources:** Deploying digital documentations tools such as tablets and metronomes require resources that may not be available in every health care facility especially those located in low resource areas. This limitation can affect how practically it can be implemented more widely.

4.5 Recommendations

The following recommendations can be based on the findings of this study:

- **Use digital documentation tools:** Healthcare organizations can opt to use tablet-based platforms that enable them to document resuscitation in real time. This study showed how better accuracy, precision, and time efficiency of digital tools compared to the traditional paper approach.

- **Training:** There should be training programs designed to equip the health care providers with skills on using digital documentation systems effectively. It is important for this training to cover issues such as the application of tablet software and metronomes in improving resuscitation methods and document quality.
- **Standardizing documenting practices:** Introduce uniformity into recording processes; set rules for all medical facilities regarding how a patient who has been resuscitated should be documented. In addition, the implementation of standard data entry protocols could improve resuscitation quality overall and facilitate analysis of collected information.
- **Integrate metronomes into CPR instruction:** Include metronome usage as part of CPR training sessions and practical activities. The importance of a metronome in attaining the correct rate compression required by CPR is supported by findings from this research study.
- **Future research motivation:** More studies on the long-lasting effects of digital documentation tools on patients' outcomes, and among them survival rates and recovery, would be needed. There could also be future research to test if these tools work in real emergency situations and across different healthcare settings.
- **Solving resource constraints:** This will involve the creation of effective solution mechanisms that can help bypass resource inadequacies which might limit the exploitation of an electronic nursing documentation system, especially in resource-scarce places. This may involve identification of alternative cost-effective approaches or phasing in technology as a process into emergency care.
- **Improving program quality:** The results obtained from this study can be applied to teaching hospitals and their ongoing quality improvement initiatives. The use of digital documentation technologies as well as improvement in precision in documentation such as having measurable feedback data such as chest compression fraction (CCF) is a way through which institutions can improve on their resuscitation undertakings.
- **Personalizing technological solutions:** Enforcing appropriate digital documentation solutions that are able to meet challenges faced by medical professionals practicing under Palestinian conditions. Such considerations should include local language, protocols used in treating affected populations, as well as

locally available resources to ensure efficient service delivery through the use of such technology.

4.6 Implications of the study's findings

4.6.1 Implications for practice

Based on the findings of this study, there are the following implications for practice:

- **Quality documentation improvement:** the use of tablet-based document tools can enhance capturing crucial events during resuscitation with more precision and promptness, thus resulting in an impetus to enhance documentation quality. Improving the quality of documentation may lead to better monitoring, evaluation, and control of resuscitation efforts.
- **Improving resuscitation practices:** Health care practitioners' decision-making abilities during resuscitation procedures can be improved by using more accurate and updated records. This could result in enhanced interventions, compliance with recommendations, and ultimately better outcomes in terms of resuscitations.
- **Procedures standardization:** The utilization of digital document technologies may help to set down all processes used for documenting health in uniform manner across different healthcare institutions. Introducing standardized document processes might facilitate gathering, analyzing and improving data's quality.
- **Education/training:** In light of the findings it is clear that healthcare workers should be thoroughly trained on how to effectively apply electronic tools or metronomes. Teaching CPR skills could also make these devices popular and improve its overall practice performance.
- **Resources allocation:** Decision makers require to allocate resources toward integrating digital documentation tools and metronomes into emergency care. This includes resource allocation towards technology acquisition, comprehensive training and continuing support for effective implementation and use of these resources.
- **Quality improvement initiatives:** The study's outcome might help in quality improvement initiatives by providing evidence regarding the efficacy of digital documentation tools in enhancing CPR practices. This information may be used by institutions to create targeted interventions that will enhance resuscitation techniques as well as patient outcomes.

- **Local adaptation:** Technological solutions developed specifically to satisfy the unique needs of medical facilities in Palestine are known as local adaptations. Adjusting digital technologies to local concerns and embedding them into existing practice can make them more efficient and acceptable.
- **Policy development:** The findings may assist the formulation of policies and recommendations that encourage usage of digital documentation tools and metronomes during revival processes. Universal acceptance, enhanced care standards could come about through adoption of evidence-based policies.

4.6.2 Implications for education

Based on the findings of this study, there are the following implications for education:

- **Curriculum Integration:** Healthcare worker educational programming should involve training on using computerized documenting implements and metronomes. By incorporating these technologies into the syllabus, students are exposed to contemporary tools for enhancing resuscitation documentation and quality.
- **Training based on simulations:** Introduce simulation-based training that incorporates the use of tablet-based programs and metronomes. Simulations provide a controlled environment where learners may get practical experience with these technologies, enabling them to comprehend their real-life uses and advantages.
- **Emphasize documentation skills:** Educators should prioritize the significance of precise and prompt documentation during resuscitation. The training should include the need of recording different occurrences, comprehending timing differences, and using digital technologies to improve the quality of documentation.
- **Evidence-based practices:** Integrate the most recent research and evidence into educational programs to guarantee that students and professionals are knowledgeable about the most effective methods. The study's results should be used to enhance and revise instructional material, including progress in technology and documenting procedures.
- **Assessment and evaluation:** Create assessment tools for students' proficiency in using digital documentation tools and metronomes. In this way, practical exams and simulations may guarantee that learners have been well trained and they can apply these technologies when it comes to clinical practice.

- **Interdisciplinary training:** Encourage inter-professional education where many healthcare professionals are engaged. Knowledge about how different members of the team use digital documentation technology could improve CPR efficacy as well as boost the collaborations between various team members.
- **Continuing Education:** Existing healthcare practitioners should be given chances for continuous professional development to know emerging technology and updated documentation methods. Ongoing education or training may help keep professionals current with advances in their fields resulting in improved clinical skills.
- **Local context and adaptation:** Provide information on what health care providers' immediate environments demand from them plus the challenges faced by the same. The adjustment of training programs to focus on local issues such as resource scarcity, technology adoption can make instruction more effective, appropriate or practical.

4.6.3 Implications for future research

Based on the findings of this study, there are the following implications for education:

- **Long-term impact assessment:** Other studies should evaluate the long-term effects of digital documenting technologies on patient outcomes specifically regarding survival rates and quality of recovery. Understanding how these techniques influence overall clinical outcomes may provide a more comprehensive evaluation of their benefits.
- **Real-world applications:** Research should be done in real emergency situations rather than artificial settings. The purpose of this study is to assess the performance of digital documentation tools and metronomes in actual clinical settings and their impact on real resuscitation procedures.
- **Comparative effectiveness:** Comparative analysis can be used to compare the relative efficiency/effectiveness between different digital documentation techniques and technologies. This could take form of a comparative study that seeks to find out what programs or platforms differ most in terms of enhancing documentation quality as well as resuscitation outcome.
- **User experience & usability:** Study the user experiences and usability of electronic medical records across different healthcare practitioners. Understanding

how varying degrees of familiarity and comfort with technology affect the efficacy of these tools might help improve their design and implementation.

- **Resource-limited settings:** Examining how digital documenting technologies are used and their impacts in resource-limited settings. This can involve research on how to adapt or optimize the use of these technologies in situations where technology and resources are limited.
- **Impact on team performance:** Considering impact of digital documentation tools on team performance and coordination during resuscitation. In this context, researchers may explore to what extent these technologies help healthcare practitioners communicate and work together more effectively.
- **Other technologies for integration:** Determine potential incorporation of digital documentation instruments in other technologies such as electronic health records (EHRs) and advanced monitoring systems. Such research would also focus on the benefit of a smooth data flow between systems and its impact on the overall quality of patient care.
- **Cost-benefit analysis:** Cost-benefit evaluations should be performed to assess the financial implications of using digital documentation techniques. The findings may assist in evaluating the financial viability and profit-making capacity of healthcare organizations that opt for these methods.
- **Efficiency of training and education:** Evaluate different training methods used in teaching digital documentation technologies. A study might also determine which training method is most effective in helping health practitioners use these tools as well as increase their usefulness.
- **Cultural and regional adaptations:** Investigate potential modifications to digital documentation tools to cater for specific cultural or geographical needs. Customization remains crucial if these tools are going to effectively address unique challenges and requirements within different healthcare settings.

4.7 Conclusion

Summing up, this research has pointed out that using tablet-based documentation tools enhances the accuracy, efficiency and timely resuscitation documentation compared to conventional paper based. This improvement in performance of these digital gadgets together with metronome utilizing them correlating positively with the attainment of recommended compression rates suggests that they could be used to enhance quality emergency care provision. Most essentially it is a novel scientific investigation carried out in Palestine aimed at proving how efficient modern technologies are in resuscitation and paving way for the future studies into their durability as well as practical applicability. As far as implementation of these findings is concerned, health workers and policy makers will not only gain better results from resuscitation but also improve documentation processes while dealing with local issues facing emergency care. It would be wise if more attention was paid on the real implications of usage on the ground thus ensuring sound practices for various medical setups.

List of Abbreviations

Abbreviation	Meaning
ACLS	Advanced Cardiovascular Life Support
CPR	Cardiopulmonary resuscitation
IRB	Institutional Review Board
NHS	National Health Service
ROSC	Return of spontaneous circulation
SD	Standard deviation
UTC	Coordinated Universal Time

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Appendices

Appendix A

CPR Documentation Sheet

ACLS Code Timer/Recorder Sheet

American Heart Association.

Time team initiated action: _____

Time chest compressions started: _____

Time defibrillator applied: _____

First documented pulseless rhythm: _____

Time compressor rotated: _____

Time	Quality CPR	Rhythm	Defibrillation (Joules)	Drug (name/dose)	Comments (ie, peripheral line placement, IO, vital signs, response to interventions)

Compression pause notes: _____

Chest compression fraction: _____%

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Appendix B

Randomization Table

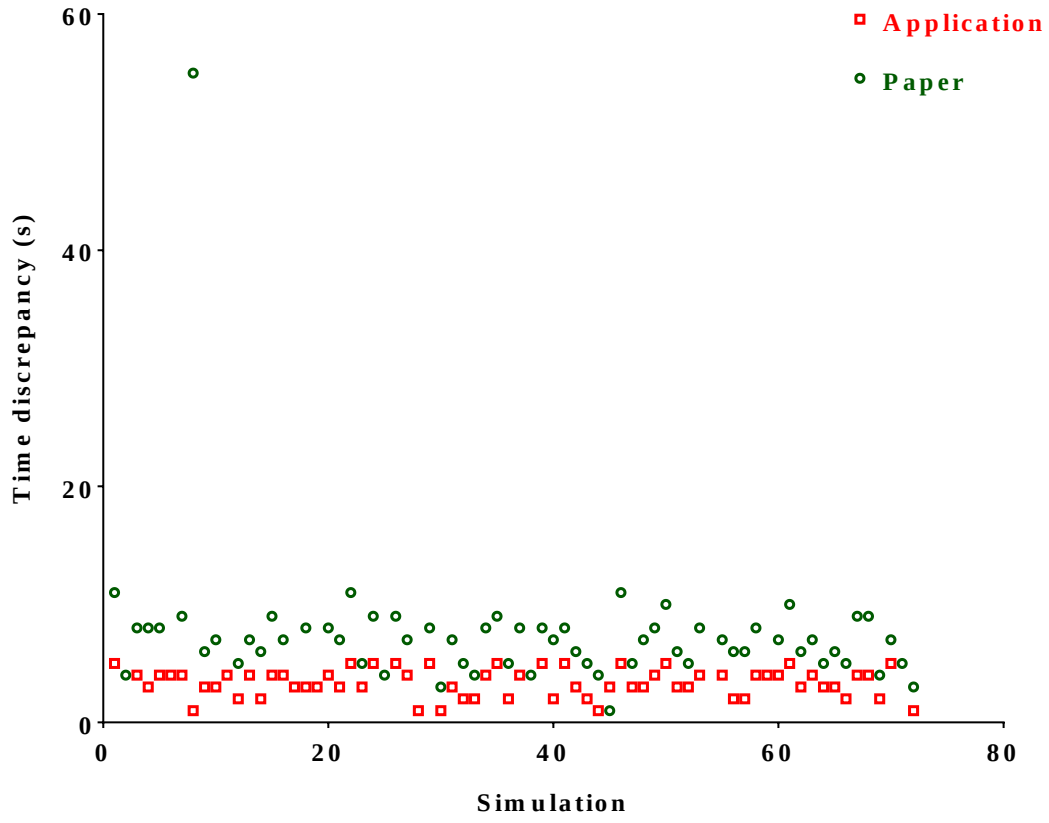
Participant #	First Group Assigned	Second Group Assigned	Participant #	First Group Assigned	Second Group Assigned
1	B	A	37	B	A
2	A	B	38	B	A
3	B	A	39	B	A
4	B	A	40	A	B
5	A	B	41	B	A
6	B	A	42	B	A
7	B	A	43	B	A
8	A	B	44	A	B
9	B	A	45	B	A
10	A	B	46	A	B
11	B	A	47	B	A
12	A	B	48	A	B
13	B	A	49	B	A
14	A	B	50	A	B
15	A	B	51	A	B
16	A	B	52	B	A
17	A	B	53	A	B
18	B	A	54	A	B
19	B	A	55	A	B
20	A	B	56	A	B
21	A	B	57	B	A
22	A	B	58	A	B
23	B	A	59	A	B
24	A	B	60	A	B
25	A	B	61	B	A
26	A	B	62	A	B
27	B	A	63	A	B
28	B	A	64	B	A
29	B	A	65	B	A
30	A	B	66	B	A
31	B	A	67	B	A
32	B	A	68	B	A
33	A	B	69	A	B
34	A	B	70	A	B
35	B	A	71	B	A
36	B	A	72	A	B

Appendix C

Figures of Study

Figure C1

Time discrepancy between application and paper-based documentation in documenting ROSC



Appendix D

Tables of Study

Table D1

Sensitivity of the documentation methods in recording the 25 sequential events

		Sensitivity		
Event	Documentation method	n	%	p-value
Code Started	Application	68	94.4	0.061
	Paper	60	83.3	
CPR Started	Application	67	93.1	0.076
	Paper	59	81.9	
CPR Paused	Application	70	97.2	0.031
	Paper	62	86.1	
VF	Application	72	100.0	< 0.001
	Paper	59	81.9	
First defibrillation (Shock)	Application	64	88.9	0.623
	Paper	61	84.7	
CPR Restarted	Application	62	86.1	0.607
	Paper	65	90.3	
CPR Paused	Application	71	98.6	0.063
	Paper	65	90.3	
VF	Application	67	93.1	0.275
	Paper	62	86.1	
Second defibrillation (Shock)	Application	68	94.4	0.012
	Paper	57	79.2	
CPR Restarted	Application	67	93.1	0.005
	Paper	54	75.0	
Epinephrine	Application	70	97.2	0.031
	Paper	62	86.1	
CPR Paused	Application	68	94.4	0.021
	Paper	58	80.6	
VF	Application	68	94.4	0.021
	Paper	58	80.6	
Third defibrillation (Shock)	Application	68	94.4	0.158
	Paper	62	86.1	
CPR Restarted	Application	68	94.4	0.007
	Paper	56	77.8	
Amiodarone 300 mg	Application	70	97.2	0.031
	Paper	62	86.1	
CPR Paused	Application	72	100.0	< 0.001
	Paper	55	76.4	
Asystole	Application	72	100.0	< 0.001
	Paper	58	80.6	
CPR Restarted	Application	70	97.2	0.001
	Paper	57	79.2	

Epinephrine	Application	70	97.2	0.166
	Paper	65	90.3	
CPR Paused	Application	69	95.8	0.004
	Paper	57	79.2	
Asystole	Application	70	97.2	0.031
	Paper	62	86.1	
CPR Restarted	Application	49	68.1	0.051
	Paper	60	83.3	
CPR Paused	Application	71	98.6	< 0.001
	Paper	57	79.2	
ROSC	Application	67	93.1	0.764
	Paper	65	90.3	

CPR: cardiopulmonary resuscitation, VF: ventricular fibrillation, ROSC: return of spontaneous circulation

Table D2

Differences in the time discrepancy between the application and paper-based documentation methods

		Time discrepancy (s) from actual time		
Event	Documentation method	Mean	SD	p-value
Code Started	Application	3.4	1.1	< 0.001
	Paper	6.5	1.9	
CPR Started	Application	3.2	1.1	< 0.001
	Paper	5.9	2.2	
CPR Paused	Application	3.3	1.1	< 0.001
	Paper	6.7	2.0	
VF	Application	3.4	1.1	< 0.001
	Paper	6.4	2.5	
First defibrillation (Shock)	Application	3.3	1.2	< 0.001
	Paper	6.1	2.3	
CPR Restarted	Application	3.0	1.0	< 0.001
	Paper	6.0	1.9	
CPR Paused	Application	3.5	1.2	< 0.001
	Paper	6.5	2.4	
VF	Application	3.2	1.1	< 0.001
	Paper	6.2	1.9	
Second defibrillation (Shock)	Application	3.3	1.2	< 0.001
	Paper	6.0	2.1	
CPR Restarted	Application	3.4	1.6	< 0.001
	Paper	6.4	2.1	
Epinephrine	Application	3.0	1.1	< 0.001
	Paper	5.8	2.1	
CPR Paused	Application	3.4	1.1	< 0.001
	Paper	6.5	1.9	
VF	Application	3.1	1.1	< 0.001
	Paper	6.2	1.7	
Third defibrillation (Shock)	Application	3.2	1.1	< 0.001
	Paper	6.3	2.1	
CPR Restarted	Application	3.2	1.1	< 0.001
	Paper	6.2	2.3	
Amiodarone 300 mg	Application	3.1	1.0	< 0.001
	Paper	6.5	2.0	
CPR Paused	Application	3.3	1.1	< 0.001
	Paper	6.3	2.0	
Asystole	Application	3.5	0.9	< 0.001
	Paper	6.4	2.0	
CPR Restarted	Application	3.0	1.1	< 0.001
	Paper	6.3	2.0	
Epinephrine	Application	3.5	1.2	< 0.001
	Paper	7.1	2.2	

CPR Paused	Application	3.4	1.2	< 0.001
	Paper	6.7	2.2	
Asystole	Application	3.3	1.0	< 0.001
	Paper	6.7	2.1	
CPR Restarted	Application	3.3	1.0	< 0.001
	Paper	6.2	2.1	
CPR Paused	Application	3.1	1.2	< 0.001
	Paper	6.5	2.3	
ROSC	Application	3.4	1.2	< 0.001
	Paper	7.5	6.3	

CPR: cardiopulmonary resuscitation, VF: ventricular fibrillation, ROSC: return of spontaneous circulation

جـامعـــة النجاح الوطنية

كليـــة الدراســـات العليـــا

تقييم جودة التوثيق والأداء السريري من خلال توثيق إجراء إنعاش القلب في الوقت الحقيقي المستند إلى الجهاز الالكتروني اللوحي

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إشراف

د عائدة أبو السعود القيسي

قدمت هذه الرسالة استكمالا لمتطلبات الحصول على درجة الماجستير في تمريض العناية المكثفة، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس- فلسطين.

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الملخص

خلفية الدراسة: وثائق الإنعاش الورقية التقليدية معروفة جيدا بافتقارها إلى الدقة، وغالبا ما تفشل في التقاط المستوى المطلوب من التفاصيل اللازمة للتوثيق المناسب للإنعاش القلبي الرئوي السريع (CPR). كان الهدف من هذه الدراسة هو تقييم الحساسية والتناقض الزمني لتطبيق توثيق إنعاش توقف القلب المستند إلى الجهاز اللوحي في الوقت الفعلي مقارنة بوثائق الإنعاش الورقية التقليدية. بالإضافة إلى ذلك، قيمت الدراسة أيضا تأثير استخدام بندول الايقاع على تلبية العدد الموصي به من الضغطات أثناء إجراء الإنعاش القلبي الرئوي.

منهجية الدراسة: أجريت الدراسة في مركز المحاكاة السريرية ودعم الحياة في جامعة بيت لحم ومركز تدريب دعم الحياة في جامعة النجاح الوطنية. تمت محاكاة حالات السكتة القلبية التي بدأ فيها فريق الدراسة (ن = 72 مشارك) الإنعاش القلبي الرئوي السريع الذي يتكون من 25 خطوة/ حدثا متتاليا خلال تدريبات انعاش القلب والرئتين المتقدم للبالغين واستند إلى خوارزمية السكتة القلبية للبالغين لجمعية القلب الأمريكية. تم توثيق كل خطوة/ حدث باستخدام طريقة توثيق الإنعاش الورقية التقليدية وتطبيق توثيق إنعاش السكتة القلبية المستند إلى الجهاز اللوحي في الوقت الفعلي. تمت مقارنة الحساسية والتناقض

الزمني للطريقتين في توثيق خطوات/ أحداث الإنعاش القلبي الرئوي، والرجفان البطيني (VF)، وإزالة الرجفان/ الصدمات، وإدارة الأدوية، وعودة الدورة الدموية التلقائية (ROSC).

نتائج الدراسة: أجريت الدراسة في مركز المحاكاة السريرية ودعم الحياة في جامعة بيت لحم ومركز تدريب دعم الحياة في جامعة النجاح الوطنية. تمت محاكاة حالات السكتة القلبية التي بدأ فيها فريق الدراسة (ن = 72 ممرضة) الإنعاش القلبي الرئوي السريع الذي يتكون من 25 خطوة/ حدثا متتاليا استند إلى خوارزمية السكتة القلبية للبالغين لجمعية القلب الأمريكية. تم توثيق كل خطوة/ حدث باستخدام طريقة توثيق الإنعاش الورقية التقليدية وتطبيق توثيق إنعاش السكتة القلبية المستند إلى الجهاز اللوحي في الوقت الفعلي. تمت مقارنة الحساسية والتناقض الزمني للطريقتين في توثيق خطوات/ أحداث الإنعاش القلبي الرئوي، والرجفان البطيني (VF)، وإزالة الرجفان/ الصدمات، وإدارة الأدوية، وعودة الدورة الدموية التلقائية (ROSC).

النتائج: أظهرت الدراسة أن تطبيق توثيق الإنعاش القلبي الرئوي باستخدام الجهاز اللوحي في الوقت الفعلي كان أكثر حساسية مقارنةً بالطريقة التقليدية الورقية في تسجيل الأحداث الرئيسية أثناء الإنعاش القلبي الرئوي. شملت هذه الأحداث أول توقف للإنعاش القلبي، الإنعاش الأول، إزالة الرجفان الثانية، إعطاء الأدوية، وإعادة الدورة الدموية المنتظمة. كانت الفروقات الزمنية في توثيق 25 حدثًا رئيسيًا أقصر بكثير عند استخدام التطبيق مقارنة بالطريقة الورقية التقليدية (القيمة الاحتمالية 0.001 >) كما أظهر الاختبار أن استخدام بندول الإيقاع كان مرتبطًا بشكل كبير بتحقيق العدد الموصى به من الضغطات أثناء الإنعاش (القيمة الاحتمالية 0.001 >).

استنتاجات الدراسة: أظهرت نتائج هذه الدراسة أن استخدام تطبيق توثيق إنعاش السكتة القلبية المستند إلى الجهاز اللوحي في الوقت الفعلي قد حسن دقة وحساسية وتوقيت توثيق الإنعاش مقارنة بالطريقة الورقية التقليدية. وبالمثل، أدى استخدام بندول الايقاع إلى تحسين تلبية معدلات الضغط الموصى بها أثناء إجراء

الإنعاش القلبي الرئوي. أشارت هذه النتائج إلى أن استخدام الأدوات الرقمية يمكن أن يحسن جودة الرعاية في حالات الطوارئ. تسلط النتائج الضوء على أهمية دمج التقنيات الحديثة والمبتكرة في ممارسات الإنعاش القلبي الرئوي. يمكن أن يسمح تحسين ممارسات التوثيق لمقدمي الرعاية الصحية وصناع القرار بتحديد ومعالجة التحديات المحلية في ممارسة رعاية الطوارئ وتحسين نتائج المرضى.

الكلمات المفتاحية: الإنعاش القلبي الرئوي، توثيق السكتة القلبية، ورقة التعليمات البرمجية، تطبيقات الكمبيوتر اللوحي.