

# Emergency Health Care Professions' and Nursing Students' Perceptions of Mechanical Chest-Compression Devices Practice During Cardiopulmonary Resuscitation: A Phenomenological Study

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## Abstract

**Introduction:** Health professionals are inclined to use the medical devices of the developing technology as fast as possible. The aim of this study is to examine the perceptions, opinions and feelings of fourth year nursing students, the doctors and the nurses who used or observed the use of mechanical chest compression device on patients.

**Methods:** This is a phenomenological type of qualitative research. It was carried out in an emergency department of a research hospital between December 2015 and April 2016. Emergency health professionals (5 doctors and 5 nurses) and intern nursing students (5) comprise the sample group of this research. Content analysis has been conducted in order to evaluate the data.

**Results:** In accordance with the statements of the participants about the use of the mechanic chest compression devices on patients, five main themes and eight subthemes have been identified. The most important themes are the factors affecting the decision of using mechanic chest compression devices and the interest and dependence on technological innovations.

**Discussion:** The technological devices, which have made their way quickly into our lives, seem to be a normal part of it; however, from a philosophical standpoint, it is necessary to convey the feeling of human touch or the emotional intensity in order to support the patients in their times of need. Asking for the opinions of the emergency doctors and nurses regarding the efficiency of the medical devices and undertakings applied and used on the patient is extremely valuable in terms of evaluating the emergency medical services. It is advisable that a comprehensive CPR training program be conducted that incorporates both manual and MGKC's into emergency medical education.

**Keywords:** mechanical chest compression device; medical personnel; nursing; emergency department

## Introduction

Cardiopulmonary resuscitation (CPR) is made up of a series of life saving medical interventions to increase the chances of keeping the patient alive during cardiac arrest. Chest compression is one of the most significant interventions which increases the patient's chance of survival. The device consists of a silicone rubber applied to the human front body and a pneumatic cylinder mounted on two legs connected to a rigid back plate. The device compresses the patient's chest in equal amounts to the time spent in compression [1]. Mechanical Chest Compression Devices work by compressing the thorax at a certain rate (100 compressions per minute and 4-5 cm precipitation). This device; gas (oxygen or air) or an electrically operated piston device. The end of the piston attaches to the sternum and returns to its starting position when the sternum is withdrawn [2,3].

Mechanical Chest Compression Devices (MCCD) ensures a systematic and ongoing chest compression in order to eliminate the limitations of manual chest compression in difficult situations (hypothermic cardiac arrest, elongated CPR, or during angiography) and especially in the ambulance transfer of the patient to the hospital to sustain CRP until reaching the hospital. The use of manual chest compression devices in hypothermic arrest (hypothermia, chest wall hardening, ventilation and chest compression may be difficult) may be seen as a reasonable alternative [1,4-7]. Automatic CPR devices have been developed to solve some of the problems that reduce the effectiveness of manual CPR. Automatic CPR devices are mainly classified by operating method, applied force, working area and positioning time. The main categorization of CPR devices consists of a design approach. For example, the belt of the AutoPulse and the hydraulic-pneumatic should compress the chest with a wrap band in a larger area, while the jacket should do the same with a device similar to a large blood pressure cuff. The device is placed on the patient's chest, ready to compress the sternum and includes a

piston. MCCDs are placed on the chest of the patient, ready to compress the sternum and contains a piston. The interest that the ER staff show to MCCDs is still continuing [1,3,8-12]. Today, health services have become a complicated whole of services with devices used for diagnosis and treatment technological applications [13]. Health staff's desire to fully accomplish their missions and their wish to increase the quality of the care given are among the reasons why they resort to technology. Actually, the main idea beneath this wish is to take action for the patient's benefits [14]. The scientists are still continuing to discuss the relationship between the medical staff and the technological medical devices with a philosophical approach, and deal with the effects of these devices on patient care. This relationship between health care personnel and technological medicinal products is still controversial. When using medical devices, conducting research on the history of the disease, the patient's compliance with the device, and the thoughts and experiences of the health personnel contribute to improve the quality of patient care [15]. In the development and evaluation of technological medical devices, a limited number of studies have been found in which positive and negative opinions of health personnel using the product have been obtained, but the experiences and thoughts of the users of these devices are of great importance [16]. Therefore, there is a need for qualitative research which evaluates the perceptions, opinions and experiences of healthcare personnel using these devices.

In our study; We aimed to examine the emotions, thoughts and perceptions of those using or observing the MCCDs in cases of cardiac arrest in the emergency department. The results of the research will help to identify the factors that affect the decision to use the MCCDs. Emergency health personnel will contribute to the evaluation and development of the implementation of the MCCDs.

## Method

This phenomenological type qualitative research was carried out in an emergency department of a local hospital between December 2015 and April 2016. The emergency department is a tertiary service. There are three full-equipped trauma and resuscitation rooms and ten observation rooms with monitor displays in this department. The service has had the MCCD and it is being used on patients in the trauma and resuscitation rooms. Training on how to use MCCDs are given to the emergency medical staff during clinical training sessions on regular basis. Especially the emergency room(ER)doctors and nurses who make use of the device are also given training by the manufacturing firm at various times. All full-time or part-time working nurses and doctors in the ER team who have used MCCDs are invited to take part in the research. The participants are the permanent staff of the ER service and have a six-month experience on CPR in the ER service.

Participants' 6-month experience with ER is the inclusion criteria. Because participants need to have enough experience in the use of MCCDs during CPR. Moreover, senior intern nursing students who have observed the use of MCCDs in the ER service are invited to take part in the study. Five doctors, five nurses and five intern nursing students are included in the sample group of the research. The participants have experience about the use of the MCCD on the patient (at least 3 times). This device was used as a practitioner or as an observer for the patient. The individuals in the sampling group are experiencing the subject matter of our study at first hand and they are able to reflect on and express their opinions about it. There is no exclusion criterion of any kind.

In semi-structured face to face interviews, guiding questions were asked to the participants in which they can express themselves orally about their individual experiences and opinions. Participants are encouraged to share their opinions and experiences about the case. All these interviews were carried out by only one researcher. The researcher has a three-year experience as an ER nurse in-charge. She has taken part in the application part of the research as a PHD student, and she is currently working as an academician. Information regarding the method, process and the results of the study was given to the participants in a clear and detailed manner. The opinions and experiences of the participants were recorded with a voice recorder. To ensure credibility, participants were gathered together in various different times other than the interviews (during working hours in the morning and in the evening) and by using MCCDs on patients or by observing the process, they gained invaluable experience. Permit for the research was granted the institutional ethics committee.

Participants were volunteers and their names were not mentioned but their groups and numbers were coded. Participants were informed that they were free to withdraw from the study at any time they want. However, no one wanted to withdraw from the study. After having face-to-face interviews with 15 individuals, we collected enough data. Interviews were done in a room that was made available in the emergency service department. Each interview lasted about 20-30 minutes. The interviews were directed by sitting at the same height and with the help of active listening and asking questions deep in thought.

Open-ended questions asked during the interview are given in Table 1.

1	What did you think/ How did you feel when you saw/ watched an MCCD used on a patient for cardiopulmonary resuscitation? How did the fact that this device was being used on a patient make you feel as a nurse/doctor/ nursing student?
2	What do you think about using/ not using these devices on patients within the system of patient care? In other words, should such devices be used on patients, or should manpower be used instead?
	They shouldn't be used...Explain why not.

**Table 1:** Open-ended questions asked during the interview

## Data Analysis

Interviews were saved in the digital environment and after being listened repeatedly, and they were typed up on a word document in a text format by the researcher. Similar expressions were collected together in data analysis, and recurrent and non-recurrent or significant expressions were coded, expressions associated with the subject matter and appropriate themes were derived. Data analysis was carried out in accordance with the steps in Colaizzi [17], which is a qualitative research analysis process. At the end of the analysis five themes were classified. Themes have been revised by other researchers who are also academicians. All these steps were carried out together with 2 academicians who conducted the research. Later, working with a specialist in the field during regular group meetings, the codes were re-evaluated, categorized and the resulting themes were finalized. The answers of the participants were indicated in numbers and with the initial letters of their groups (e.g., nurse 2 = N2, doctor 5 = D5, nursing student 1 = NS1). Within the framework of emerging themes and patterns, findings were explained and interpreted in the discussion section. Manual chest compression method was shown in Figure 1 and mechanic chest compression device was shown in Figure 2.



Figure 1: Manuel chest compression



Figure 2: Mechanic chest compression

## Results

The demographic findings of the study group were summarized in Table 2. Five doctors, five nurses and five intern nursing students are included in the sample group of the research. There was no participant who refused to participate in the study.

## Themes

According to the accounts of the participants about the use of MCCD, five themes and eight subthemes were identified. The themes and subthemes findings have been summarized in Table 3.

The demographic findings of the study group	Participants (n=15)
<b>Gender</b>	
Male	4
Female	11
<b>Age</b>	<b>On Average</b>
Doctors (5)	39
Nurses (5)	34
4th year intern nursing students (5)	21
<b>ER service duty</b>	
Academical personal	2
Specialists	2
Assistant doctors	1
ER nurses in charge	1
ER nurses	4
4th year intern nursing students	5
<b>Terms of Office</b>	
6 weeks	5
1-5 years	10

**Table 2:** The demographic findings of the study group

<b>THEME 1</b>	There are superior features supporting the use of mechanical chest compression device
Subtheme 1	It is more standard, systematic, regular, and effective
Subtheme 2	It provides the team with support in long CPR processes
<b>THEME 2</b>	The addiction and the interest in fast technological improvements
Subtheme 1	The interest in technology and being enthusiastic about using it, when not available, feeling the absence of it
Subtheme 2	Mechanical chest compression devices are being compared to the other equipment used in the emergency department
<b>THEME 3</b>	The dominant view as to a return to expert manpower and human touch
Subtheme 1	Contacting patients at the hardest time and the necessity of expressing emotions.
Subtheme 2	The need for contact and transfer of emotional intensity in patients' time of need
<b>THEME4</b>	Factors affecting the decision of using a mechanical chest compression device.
Subtheme 1	The necessity of having enough proof supporting the use of this device.
Subtheme 2	The importance of selecting patients for the use of mechanical chest compression device.
<b>THEME 5</b>	Emergency medical personnel with medical and nursing students need to address both the heart massage using MCCDs and a heart massage using CPR as a life-saving procedure.

**Table 3:** Themes and Subthemes

### Theme 1

There are superior features supporting the use of mechanical chest compression device

**Subtheme:** It is more standard, systematic, regular, and effective Participants have given positive feedback and stated that MCCDs provide rhythmical, automatic and systematic chest compressions and that an effective CPR has been performed.

“An MCCD’s pressure with the constant automatic system, performs CPR more effectively, and works systematically and regularly” NS1, NS2, NS3, NS5.

“It is more effective and useful, it accelerates the reviving process, it makes us more successful, and you think it makes the necessary and correct chest compression while giving CPR” N1,D2, D5.

**Subtheme:** It provides support to the team in long CPR processes Participants have reported that it is not possible to apply efficient and correct manual chest compression most of the time. Some of the reasons for this are long-standing CPR interventions, tiredness of the chest compressing staff. “I think it is more efficient than manual chest compression, no matter how strong a person is, he cannot give chest compressions strong as this” NS1, NS2, NS5.

“It saves both time and manpower”, NS3, NS4.

“One gets bone-tired by long processes of CPR, it is time efficient” N2, N3,N4.

MCCD gives chest compression better than we can perform” D2.

## Theme 2

Addiction of and interest in fast technological improvements

**Subtheme:** Interest in technology and being enthusiastic about using it, when not available, feeling the absence of it Corresponding to the fast technological improvements, as it is in any field, the expectation and desire of emergency department employees to use technology in emergency medical services has increased.

“I think it should be used; after all it has been produced in order to support the patient. If we have a chance to use it, we should use it”, NS5.

“Everything is related to technology even the cell phones we have been using, I think it is a positive improvement”, N1.

“To be fair, I think technology has improved a lot, it is a more practical and effective application, people might get tired, devices do not”, D3.

“The device broke down for a while; we felt the absence of it”, D2.

**Subtheme:** Mechanical chest compression devices are compared to other equipment used in the emergency department. Some of the doctors have reported that the mechanical chest compression device is similar in appearance to other equipment in the emergency department.

“I believe it is very beneficial. I find MCCD similar to a mechanical ventilator. That is to say, just as mechanical ventilator is more efficient than our ambulance, so MCCD is more efficient at cardiopulmonary resuscitation” D2, D3.

## Theme 3

People think mechanical chest compression device is more mechanic

**Subtheme:** Contacting patients at the hardest time and the necessity of expressing emotions It has been emphasized that it is an ordinary thought that mechanical chest compression device is similar to other devices being used in emergency department.

“It might be beneficial, but I don’t think it is ethically suitable to interfere any living being that way, NS2.”

“It was a really horrible experience for me; it was so different to hear the thorax break, NS5.”

“It was like seeing a plunger on the patient, NS3.”

“I don’t think it is a good idea to leave the very last minutes of a patient to a device; it was like the life was worthless, N2.” “It sounded so mechanical, N4.” “We have lost our belief in the device because it broke down and there is not enough scientific proof, N3.”

**Subtheme:** The belief in expert manpower prevails “As a doctor, I am of the opinion that it should be the professional doctor who should support the patient with respiration and chest compression at the very last minute, not some device. It was something so mechanic didn’t make me feel right. At least at the very last and hardest minute I think one can transfer the emotional intensity and therapeutic touch with a philosophical approach, D1.”

“The device seems a little scary as if it was not beneficial for health; normally this procedure is applied by a person, D4.”

## Theme 4

Factors affecting the decision of using a mechanical chest compression device.

**Subtheme:** The necessity of having enough proof supporting the use of this device Participants have been asked whether it is a good idea to use these devices on patients, and most of the participants in this study have concluded that there are certain factors to consider such as scientific data, the necessity not to use it on the regular basis, the current situation of the team using the device, and the the application team’s knowledge level.

“I don't know if it has been researched, but does it cause a deformity on the patient? This is also crucial. Pros and cons must be evaluated, NS1, NS2.”

“We don't have any statistics or scientific data on the subject, we need a document including the number of patients we have saved and lost so far, the efficiency of the device must be tested, N2.”

“I don't say it should be used on every patient or none of the patients; one should decide well on what cases it will be used, D1.”

“I have searched the studies conducted on this field, it is said about the resuscitation of the patient that it has no superiority compared to CPR, D2.”

“It is a little costly device, D5.”

**Subtheme:** The importance of selecting patients for the use of mechanical chest compression device. It has been stated that the anatomical and physiological condition of the patient should be taken into consideration while making use of the device. These devices cannot be used on all patients. They should be developed in order to fit the needs of the patients at different ages and with different body mass index, or they should be manually adjusted for this purpose. NS2, NS4. “The device must be placed accurately considering the anatomical structures of patients with obesity; it should not be a preference for the patients with higher body mass index”, N2. “The age, weight and anatomical structure of the thorax of the patient should be taken into consideration”, N4.

## Theme 5

Emergency medical personnel with medical and nursing students need to address both the heart massage using MCCDs and a heart massage using CPR as a life-saving procedure. The continuous use of MCCDs especially at university ER services is not suitable. However, an emergency doctor stated that “in hospitals where there is no training service, especially in extremely busy emergency departments and in cases of tiredness, MCCD played a vital role in saving lives. Some emergency doctors, on the other hand, stated that even though the presence of MCCDs made them feel relieved, CPR handbooks indicated that the continuous use of this device was not appropriate.

“It should not be used in university hospitals; it might cause our skills to become blunt”, NS2, D1.

“It is not possible to give effective chest compression with few people, so you should take turns with 3 or 4 people for CPR; because the process is really tiring, it might be ineffective with fewer people. That's why it is an extremely practical and useful system”, D3, D4.

## Discussion

Chest compression is a significant endeavor that is essential for blood flow support. The rescuers' performance of manual chest compression becomes poor in time and under hard conditions during CPR, and for this reason, the mechanical devices support the rescuers [6]. Most participants in our research stated that there are superior qualities of MCCDs. It has also been stated in literature that MCCDs are desirable solutions as they provide continuous and high-quality chest compression and hence they should be used routinely. They are seen as a reasonable alternative in cases where continuous and high quality chest compressions cannot be obtained or when the rescuers' safety is in danger (during patient transfer or in prolonged CPR), when the number of rescuers is limited, while preparing for the extracorporeal CPR, in cases of hypothermic arrest, during percutaneous coronary attempts and to reduce the radiation load on the staff [7,18-20]. It is known that due to wrong manual applications, it is difficult to provide chest compression at sufficient depth and pace. It has been suggested as a reasonable alternative in cases which endanger the rescuer's safety [21]. It has also been indicated that MCCDs are used at earlier stages and more efficiently in big ER services which encounter more cases of cardiac arrest, but in order to draw any kind of conclusion as to their use, better designed and randomly controlled research results are needed [20,22]. The CPR ability which enables one to stay alive is made up of psychomotor and cognitive abilities, and it can prevent the coming death [23]. The ER nurses are a group that is greatly influenced by the changes within the health system and that closely follow and apply the new and fast technological changes [24]. For nurses, the purpose of the CPR training is not only gaining CPR knowledge and abilities but also gaining the competence to treat the cases of cardiac arrest as qualified and self-confident individuals [25]. Nurses as the key figures to save the patient's life in cases of cardiac arrest have a poor performance of CPR [26]. In order to increase the CPR abilities of the nurses, they have to attend CPR training regularly [27,28].

A participant emergency doctor's view has been considered to be noteworthy as it is related to therapeutic contact. Therapeutic contact is, in its simplest definition, a non-invasive intervention carried out manually as an energy transfer [29,30]. The curing effect of the therapeutic contact is a treatment method which aims at helping patients in their times of difficulty. On the other hand, different from this philosophical approach, nowadays the health staff is in a tendency to treat the patient quickly by means of medical devices, go on with the flow of the system as fast as possible and to use them intensely in practice [16]. The use of such devices might be recommended in ER services which lack the sufficient number of staff and receive a lot of patients [31]. The roles of MCCDs in hospitals still retain its uncertainty. In some ER services in our country in which chest compression applications are not only performed by mechanical devices, it is known that chest compression is performed by the health staff manually [32]. The use of MCCDs may be a reasonable alternative, but training programs which include both manual chest compressions and the use of MCCDs for health professionals are recommended [6].

## Conclusion

Our study revealed that the use of MCCDs should be determined by taking scientific data, the condition of the patient and the staff into consideration, and that they shouldn't be used on all patients routinely. Studies which scrutinize the patients on whom MCCDs have been used, their relatives and other variables are recommended to be carried out in the future.

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