

Satisfaction of Health Care Professionals with the Use of the Crash Cart in the Clinical Setting

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Abstract

Introduction: Cardiopulmonary arrest is considered a frequent and very important problem in health services, which is why it is necessary to perform immediate cardiopulmonary resuscitation procedures. One of the main causes of delay in initiating CPR is related to human error, which in turn is directly influenced by problems such as missing elements, empty oxygen tanks and depleted equipment batteries.

Objective: To describe the satisfaction of health care professionals with the use of the crash cart in the clinical setting.

Methodology: Descriptive cross-sectional study, study population: health professionals, chosen by non-probabilistic sampling, with a sample of 221 professionals.

Results: It was found that people under 34 years of age, having less than 10 years of work experience, not knowing the supplies, not receiving training on the handling of the crash cart, not knowing the handling protocol, having difficulties in accessing and transporting the crash cart, not complying with the asepsis and biosafety protocols and inadequate organization are associated with dissatisfaction with the crash cart. Regarding the profession, nursing professionals are the least satisfied in comparison with other professions.

Conclusion: Professionals' satisfaction with the use of the crash cart is related to both clinical and technical variables. Variation in satisfaction was found in relation to age, profession and years of experience.

Keywords: Heart Arrest; Cardiopulmonary Resuscitation; Advanced Cardiac Life Support

Introduction

Cardiorespiratory arrest (CPA) refers to the “abrupt, sudden and potentially reversible interruption of breathing and circulation” [1], therefore it must be considered a vital emergency that requires immediate attention. The procedure used for this is called cardiopulmo-

nary resuscitation (CPR), which “constitutes a set of temporary and internationally standardized maneuvers, designed to ensure oxygenation of vital organs regardless of the cause of arrest” [1].

The maneuvers carried out at the intrahospital level are part of the support advanced vital, this includes, “the replacement and restoration of the function of the cardiopulmonary system, in addition to including airway management through advanced devices for it, as well as the administration of medications, electrical therapy through a heart rhythm analysis by who executes the maneuvers” [2].

The PCR is considered a frequent problem and of great importance within the health services, for which it is necessary to carry out the CPR procedures immediately. According to statistical data, “worldwide, the frequency of CPA in hospitals is approximately 4 per 1,000 hospitalized patients and the restoration of spontaneous circulation is only achieved in less than 50% of resuscitation attempts” [3].

Taking this situation into account, the procedures carried out adequately and at the indicated time are determinant in the survival of those patients who require CPR, consequently, “for each minute of delay, the chances of survival, and after 10 minutes, resuscitation attempts are usually unsuccessful, and if they do, neurological sequelae are high” [4].

Before a PCR, the health personnel or resuscitation team requires the necessary supplies to treat the patient in the first critical minutes, which produces an environment of high stress and pressure. “For this reason, the material used in CPR is organized in a unit called “Cardiac Arrest Cart”, located in the places of the hospital where the emergency is most likely to appear. Its content, whether consumables, medication or inventoriable material, must be systematized and organized in such a way that problems and delays are avoided at the time of use” [5].

“Since the 1950s, “emergency trays” have been described for different procedures. Soon after, a cart with the necessary equipment for resuscitation was developed. However, clinical care and equipment have progressed since then and the basic design of the equipment is still continued, with a series of compartments in which all the equipment is stored” [6].

It has been recognized that one of the main causes of delay in the start of CPR is related to human error, which is directly influenced by problems such as missing elements, empty oxygen tanks and depleted equipment batteries. “The UK National Patient Safety Agency (NPSA) reported a series of incidents involving resuscitation equipment, in which defibrillators were not working due to poor care and maintenance, causing a delay at the start of CPR” [7].

It should be noted that the crash cart is part of the biomedical equipment and health technologies, to which an evaluation must be carried out, which includes measurements that allow evaluating their level of performance, this from different aspects such as technical, clinical and economic.

In addition, its adequate evaluation and management constitute a crucial issue to contribute to the achievement of efficiency in medical care and effective access to quality health services. Therefore, “for health institutions it is of great importance to know the physical and functional state of their equipment in relation to its ability to meet the clinical needs for which it was acquired” [8].

According to current regulations, and the literature, the performance and/or use of biomedical equipment can be evaluated from different points, but three aspects are of interest: economic, clinical, and technical.

Clinical aspects

“These are part of the process in which members of the clinical staff are used to evaluate the medical technology in the environment in which it is used, with the purpose of obtaining information regarding compliance with its characteristics” [9]. In this way, it is distin-

guished as one of the most important in the evaluation of health technologies (HTA), since it values the impact or clinical benefit. Within this, some elements to take into account are: “compliance with the characteristics, technological quality, clinical relevance, experience and total satisfaction. In the same way, the fulfillment of the need, the visibility of controls, the facility to understand and listen to alarm signals, the adaptability of the technology in the clinical process, the comfort to clean it for future uses, the quality of the training technology, ease of connection, recognition and management of technology accessories, and interoperability” [9].

Technical aspects

“Include the review process of the technical specifications of the biomedical system or equipment, among which its operation, functionality or performance, safety, electrical requirements and compatibility stand out” [9]. This type of evaluation seeks to ensure that health technologies meet the manufacturer’s specifications and the safety requirements of the hospital and regulatory bodies. As part of this type of evaluation, there are laboratory tests to assess functionality, physical aspects to use resources safely for the patient and the equipment operator.

Objective of the Study

The objective of this article is to describe the satisfaction of health professionals regarding the use of the crash cart in the clinical setting.

Materials and Methods

This article is a descriptive cross-sectional study, in which the study population are health professionals who work in Bogotá DC Colombia, chosen by means of a non-probabilistic snowball sampling from the database. advanced life support course at the University of Applied and Environmental Sciences (UDCA), with a sample of 221 professionals.

A review of the literature, current regulations and guidelines of the Invima (National Institute for Food and Drug Surveillance) was carried out, and later a questionnaire was designed that had closed and open response questions, this questionnaire was submitted to experts for content validation, from which a grammatical and structural review was carried out, then a pilot test was carried out. Its application was made electronically and/or by telephone, for the latter case a call protocol was prepared for adequate interaction with the participants.

As inclusion criteria, the participants had to voluntarily accept their participation in the research through informed consent, and they also had to work in the clinical setting. Exclusion criteria professionals who have not been resuscitated in the last year.

The data was analyzed using descriptive statistics to characterize the study population. For the associations of the variables, the Chi-square and Fisher statistics were used in the Stata version 19 program, the level of statistical significance was $p (0.005)$.

The investigation was carried out according to the principles established in the Declaration of Helsinki and in Resolution 008430 of October 4, 1993, for which reason it will be considered without risk and will comply with the aspects mentioned in current regulations. This study was endorsed by the Research Ethics Committee of the University of Applied and Environmental Sciences (UDCA), act No. 116.

Results

The results of the research are presented below, which are organized into two sections. It begins with the results of the descriptive analysis of the variables under study, in which the clinical and technical characteristics of the crash cart are represented, and ends with the results of the aspects that influence the general satisfaction of the professionals on the crash cart. Unemployment.

The study included 221 participants and 21 people were excluded. See figure 1.

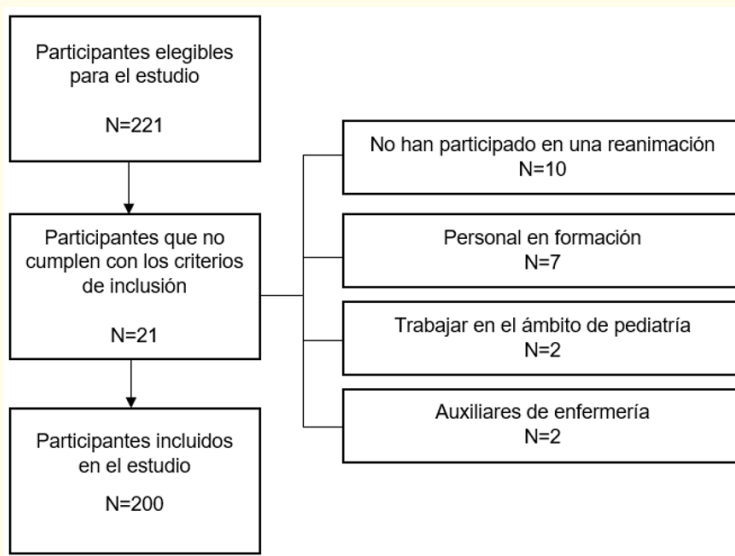


Figure 1: Study participants.

Source: Self made.

Results of univariate analysis

The average age of the participants was 35 years, with a minimum of 21 and a maximum of 62 years. Regarding sex, 77% corresponded to the female sex and 23% to the male sex.

In relation to the highest level of training, 48% were undergraduate, followed by specialists with 37.5%, master’s degree 14% and finally doctorate with 0.5%.

According to the professions, it was found that 79.5% belonged to nursing, 12.5% to medicine and 8% to other professions such as respiratory therapy.

According to the years of experience, the average was 10 years, with a minimum of 0 and a maximum of 38 years.

Regarding the last resuscitation, it is observed that this was performed in the last month by 45%, in the last six months 25.5%, in the last year 9%, between one and two years 6.5% and two years or plus 14%.

Table 1 evaluates the clinical performance of the crash cart, for this, variables such as: quantification of the workload generated by the crash cart were taken into account, evaluating it on a scale of 0 to 10, with 0 being the minimum load and 10 the maximum load., quantification of the emotional load generated by the crash car, evaluating it on a scale from 0 to 10, with 0 being the minimum load and 10 the maximum load, the participants were asked about knowledge of inputs/materials and equipment, training on inputs and/or or materials, knowledge of the crash cart handling protocol of the institution where you work, frequency of use of the service where you work, ease of access and transportation, ease of cleaning, ease of opening, asepsis and biosafety standards of the supplies, quantity of supplies/materi-

als and equipment, ease of locating supplies/materials, organization, control processes (inventory and/or verification), inventory time in minutes after a resuscitation ion and time in minutes of monthly inventory of the crash car.

In the same way, the technical performance of the crash car is evaluated, for which variables such as: adverse events have occurred when using the crash car, difficulties have arisen to connect the equipment to the electrical network, lose time in resuscitation due to the crash cart and the physical condition of the crash cart is adequate. See table 1.

Variable	Frequency %	Variable	Frequency %
Clinical performance			
Quantification of workload generated by the crash car, scale from 0 to 10	Average: 7.8	Quantification of emotional charge generated by the crash car, scale from 0 to 10	Average: 7.5
Knowledge of inputs/materials and equipment	Knows most of the supplies (43%) Know all the inputs (41.5%) Knows few inputs (15.5%)	Training on inputs and/or materials	Yes (69%) No (31%)
Knowledge of management protocol	Yes (80%) No (20%)	Frequency of use	Once a week (25.5%) Once a month (25.5%) Every day (21%) Once a semester (12%) Never (11%) Once a year (5%)
Easy access and transportation	Yes (83.5%) No (16.5%)	Easy cleaning	Yes (79%) No (21%)
Ease of opening of the security device	Yes (83.5%) No (13.5%) does not have (3%)	Supplies comply with bio-safety asepsis protocols	Yes (88.5%) No (11.5%)
The amount of inputs/materials are enough	What is necessary is found (54.5%) Supplies and/or materials are left over (23.5%) The minimum required is found (22%)	Quick and easy to locate supplies/materials	Yes (69.5%) No (30.5%)
Adequate organization	Yes (75.5%) No (24.5%)	Control processes (inventory and/or verification)	Manual checklist (65%) System checklist (22.5%) Does not (12.5%)
Inventory time after a revive	Average 77 minutes	Monthly inventory time	Average 128 minutes
Technical performance			
Adverse events in the use of the crash cart	Yes (35%) No (65%)	Difficulties connecting the equipment to the electrical network	Yes (38%) No (62%)
Lose time on resuscitation	Yes (33.5%) No (66.5%)	The physical state of the crash cart is adequate	Yes (91%) No (9%)

Table 1: Characteristic results of clinical and technical performance.

Source: Self made.

Those participants who reported having an adverse event when using the crash cart indicated that this was due to the dysfunction of equipment and/or monitors, inadequate inventory and/or verification (expired medications, lack of some supplies, their poor condition), and difficulties with the laryngoscope and its blades.

Bivariate analysis results

For this analysis it was necessary to categorize some variables as shown in table 2.

Variable	Recategorization	Variable	Recategorization
Age	Over 35 (42%) Under 34 years (58%)	Years of experience	Over 10 years (35%) Under 10 years (65%)
Last revive	Greater than 1 year (20.5%) Last year (79.5%)	Knowledge of inputs	Does not know the supplies (58.5%) Know all the supplies (51.5%)
Generates work-load	Yes (67%) No (33%)	Generates emotional charge	Yes (62.5%) No (37.5%)
Frequency of use	Greater than 6 months (28%) At least once a month (72%)	Easy opening of the security device	No (14%) Yes (86%)
Inventory time after a revive	Less than an hour (64%) Greater than an hour (36%)	Monthly inventory time	Less than two hours (70%) Greater than two hours (30%)

Table 2: Recategorization of variables.

Source: Self made.

Below are the results obtained between the dependent variable general satisfaction and the study variables in which a statistically significant association was found: age (under 34 years), nursing vs. other professions, years of experience, work and emotional load, Knowledge of inputs and/or materials, training on inputs and/or materials, knowledge of management protocol, easy access and transportation, inputs comply with aseptic and biosafety protocols, adequate organization, control and/or verification process, and loss of time in a revival. See table 3.

In relation to the findings for non-satisfaction with this device, there is an association between younger people, having less than 10 years of experience, not knowing the supplies, not receiving training on the device, not knowing the management protocol, having difficulties for access to the crash trolley and its transport, failure to comply with asepsis and biosafety protocols and inadequate organization of the device. Regarding the profession, nursing professionals are the ones who are less satisfied compared to other professions such as medicine, respiratory therapy.

The work and emotional load is related to a higher percentage of professionals who are not satisfied with the crash car. Those professionals who carry out the control and/or verification processes of the crash cart by manual list or by system are less satisfied compared to those who do not.

In relation to the variables sex, frequency of use, ease of cleaning, easy opening, adverse events, difficulty connecting to the electrical network and adequate physical condition, no statistical significance was found.

Variable		Satisfied	Not satisfied	P Value
Age	Over 35	75%	25%	< 0.006
	Under 34	56%	44%	
Nursing vs. other professions (respiratory therapy and bacteriology)	Nursing	32%	68%	< 0.005
	Other professions	42%	58%	
Years of experience	More than 10 years	75%	25%	< 0.018
	Less than 10 years	58%	42%	
Workload	Generates workload	24%	76%	< 0.001
	Does not create workload	61%	39%	
Emotional charge	Generates emotional charge	76%	24%	< 0.000
	Does not generate emotional charge	44%	56%	
Knowledge of supplies and/or materials	He doesn't know them	55%	45%	< 0.001
	Everybody	77%	23%	
Training on inputs and/or materials	No	53%	47%	< 0.033
	Yes	69%	31%	
Knowledge of management protocol	No	47%	53%	< 0.015
	Yes	68%	32%	
Easy access and transportation	No	48%	52%	< 0.042
	Yes	67%	33%	
Supplies comply with aseptic and biosafety protocols	No	35%	65%	< 0.002
	Yes	65%	32%	
adequate organization	No	41%	59%	< 0.001
	Yes	72%	28%	
Control and/or verification process	Manual list	30%	70%	< 0.001
	List by system	27%	73%	
	It doesn't	84%	16%	
Waste time on a revive	No	72%	28%	< 0.001
	Yes	46%	54%	

Table 3: Bivariate analysis results.

Source: Own elaboration.

Statistical significance Value $p < 0.05$.

Finally, the participants were asked how they would improve the crash car if, in a hypothetical situation, they had all the human, financial, and physical resources to do so. As results, recommendations of physical characteristics, content of the stop car and health personnel were found.

In relation to the physical characteristics, it was found: Reduce the size of the car, change the material for one that is transparent and lighter, reduce the number of compartments, including mobile divisions, in addition to allowing the compartments to be opened simultaneously, emit signals visual and auditory in the event of any irregularity such as missing or expiring supplies, improve the ease of opening through electronic or digital means, incorporate a height graduation system, better quality tires that facilitate their movement, implement a security device or padlock easier opening.

Regarding the content of the crash car, they recommended: Reduction in the number of materials or supplies and their reorganization, a system of colors or signs that indicate content as well as labels or lists of the supplies that are found, reorganizing medications by pharmacological groups or alphabetical order, adding prefilled medications, strategies that facilitate the inventory and verification of the characteristics of the content.

Regarding health personnel, they recommend: Periodic training on the handling and content of the crash cart and traffic lights should be carried out by a professional other than nursing.

Discussion

The results of this research led to finding different variables that are related to the satisfaction of the professionals in front of this device, the crash cart.

Younger people are less satisfied with the use of the crash cart. The study carried out by Cifuentes and Manrique in Bogotá showed that nurses who are older than or equal to 37 years of age were more dissatisfied with their professional work [10]. However, specifically, in handling the crash cart, the youngest professionals are the ones who are dissatisfied, which is associated with the fact that those over 35 years of age have already adapted to this basic device.

The profession is another factor that affects satisfaction, the nursing professional is less satisfied than other professions such as medicine, respiratory therapy and bacteriology, the study by Bowden and Smith, in which they affirm that nurses have many functions and responsibilities in relation to cardiopulmonary resuscitation (CPR), including: recognizing that a patient is deteriorating; recognize cardiac arrest and start CPR while waiting for the resuscitation team to arrive; ensure that the contents of the resuscitation cart are present, up-to-date, and fully functional [11]. In Hilderjane's research. *et al*, they affirm, that the organization and replacement of the materials in the crash cart are the responsibility of the nurse, since this professional has the powers of providing direct assistance to the patient and the administration of human and material resources [12]. With this, it is evident that the profession is a factor that contributes to the emotional and work load that nursing has regarding the use of this device. Also, taking into account that on average the inventory time after a revive is 77 minutes and in the monthly inventory it is 128 minutes

On the other hand, those professionals who have not received training on the supplies, materials and equipment of the crash car, present greater dissatisfaction compared to those who have received it. In Flores' study, he assures that the fact that a professional considers himself qualified to perform a certain task is directly related to the flow of knowledge acquired for the performance of the same, which allows him to acquire a work system and an organization, such as the equipment of the crash car, which is directly related to knowledge [5].

Specifically for nursing professionals, in the study by Susquillo., *et al*. it allowed among its findings to identify that the nursing staff does not have training in cardiorespiratory resuscitation and there are deficiencies in terms of drug management, equipment parameters, performance [13]. Likewise, the professionals stated that they were willing to participate in training programs; however, the institution does not have induction or continuous training programs for cardiac arrest care [13].

López, *et al.* assures that all medical, nursing and auxiliary personnel must carry out periodic training, not only in CPR techniques, but also in the provision of material and medication in the cart and its use during CPR [14].

Another variable that influences satisfaction is the easy access and transportation of the crash cart, given that, by presenting difficulties with this, it generates dissatisfaction among the professionals. López, *et al.* in their study confirm that it is essential that the trolley and backpack are located in an easily accessible and identifiable place. They must be marked in some way and must not be covered or obstructed by any other material [14].

The participants of this research who refer an inadequate organization of the unemployment car, they present a higher percentage of dissatisfaction. At this, Milly and Bubric, point out that when emergency cars are used in a hospital or in a health care authority are disorganized and do not standardized, this adds complexity and stress to a code blue event, making it that can cause delays in the recovery of the equipment or induce errors [15].

In the same way, Silvia, *et al.* indicates that the most relevant factors that possibly interfere with operating conditions of stop cars are directly related to the organization and management of resources materials, which can lead to a reduction in their functionality during use patient treatment [7].

Within this investigation, the result is that during the use of the crash cart, adverse events have occurred, among which were a consequence of equipment and/or monitor dysfunction, inadequate inventory and/or verification, which leads to supplies and/or or missing or expired materials and difficulties with the laryngoscope and its blades. For their part, Aljuaid and Al-Moteri confirm that the supplies of the resuscitation cart and the preparation and availability of the equipment are central components of an effective resuscitation approach [16].

In the study by Davies, *et al.* they point out that deficiencies are frequently reported in the availability and verification of resuscitation equipment. In addition, surplus equipment phenomena have been identified, which make it difficult to locate key elements in an emergency situation [17]. These deficiencies create a clinical risk by generating delays in the resuscitation process and may affect patient survival. Aljuaid and Al-Moteri reiterate that common problems observed in their study are dead batteries, equipment failure, inadequate equipment sizing, and empty oxygen tanks, and, in combination, can lead to delays in providing emergency intervention. and compromising patient safety [16]. Given this, Milloy and Bubric point out that research has shown that the design of medicine drawers using human factors principles it can reduce the time needed to locate and retrieve a medication and reduce associated errors, such as selecting the wrong item [15].

The study by da Silva, *et al.* assures that the excess equipment and lack of identification of drawers and compartments make it difficult to locate quickly and accurately of the equipment to be used. In addition, such an excess reduces the space for arranging other equipment, which is often difficult to identify inside the drawer [7]. The drawer should house in an orderly manner the minimum equipment required by the institutional protocol. Unnecessary items should be removed and only the essentials stored. Everybody drawers must have visible identification through which items are sorted. Items in each compartment for quick access [7].

Conclusion

The satisfaction of health professionals in the use of the crash cart is related to different variables that occur during its daily use; these variables are both clinical and technical. There is a variation regarding satisfaction in relation to age, profession and years of experience.

Faced with the clinical performance of the crash cart, it generates work and emotional burden specifically in the nursing staff, there is evidence of ignorance about the supplies and/or materials that make it up and the handling protocol of the crash cart, therefore, the importance of continuing education on this topic.

Regarding the technical performance of the crash car, it is found that it is directly related to inadequate conditions of the crash car, such as difficulties with the equipment to connect to the electrical network and an inadequate physical state, which has led to presenting adverse events related to the dysfunction of equipment and/or monitors and the inadequate inventory and/or verification process. This affects the optimal results expected during resuscitation and patient safety.

Conflict of Interests

The authors declare that they have no conflict of interest.

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