ANALYSIS OF ANTHROPOMETRIC METADATA IN RELATION TO CARDIOPULMONARY RESUSCITATION QUALITY

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Abstract
Widespread training of the population in cardiopulmonary resuscitation (CPR) techniques is of fundamental importance for reducing deaths from cardiac arrest (CA). However, the dissemination of high-quality CPR is still underdeveloped in Brazil. The present study aims to compare the quality of CPR maneuvers by comparing them with the metadata of each participant (age, sex, height, weight, BMI) in the Medicine course through the assembly of a data collection and analysis instrument. The population in question consisted of students from Unievangélica (Universidade Evangélica Goiás), totaling 116 participants from three different semesters. To this end, a cross-sectional analytical study was conducted. Participants reported their anthropometric data and performed the maneuver on a CPR manikin, which was evaluated by a sensor attached to it. The results show that there is a significant influence of the participant's weight and gender on the quality of the maneuver's execution. Academic research found results consistent with these. Thus, it is concluded that CPR training is necessary to minimize the interference of anthropometric data so that everyone can perform the maneuver equally well.
Keywords: Cardiopulmonary resuscitation; Cardiac arrest; Academic training.

Introduction

When the heart is unable to pump blood to the body, resulting in interrupted blood flow—detected semiologically by the absence of a central pulse—the patient is said to be in cardiopulmonary arrest (GONZALEZ, et al. 2013). In this context, minimizing cardiac output and partial O_2 pressure results in metabolic decline in the body's cells, especially neurons and cardiomyocytes. This microscopic cell loss invariably results in tissue dysfunction, such that patients in cardiac arrest experience a doubling of architectural, neurological, and cardiac dysfunction with each minute that passes without intervention (NEUMAR, et al. 2008). Therefore, incidents of CPR (cardiac arrest) are classified as extremely serious medical emergencies, and it is essential to provide assistance when such cases are identified.

The Brazilian Society of Cardiology reports 200,000 cases of CPR in Brazil annually, with a survival rate of only 50%, determined by spontaneous return of circulation and the presence of a palpable central pulse. Most deaths occur within the first 24 hours after cardiac arrest, and the survival rate until hospital discharge varies from 9.5% for in-hospital cardiac arrests to 24.2% for out-of-hospital cardiac arrests (PEBERDY et al., 2003). This lower survival rate for cases outside the hospital environment, added to the indicator that 50% of CPR cases occur in these

environments (GONZALEZ et al.; 2013), highlights the urgency of providing adequate conditions for this procedure to be performed by qualified individuals.

Method

An AHA CPR manikin was obtained, and sensors were attached to it. An accelerometer (sensor responsible for measuring acceleration), an extensometer (responsible for measuring applied forces), and an ultrasonic sensor (responsible for measuring distances) were attached. They were connected to an Arduino UNO and programmed to collect data every 30 milliseconds, thus obtaining the variation in data equivalent to the sensor readings, which represent parameters of the participants' performance curve.

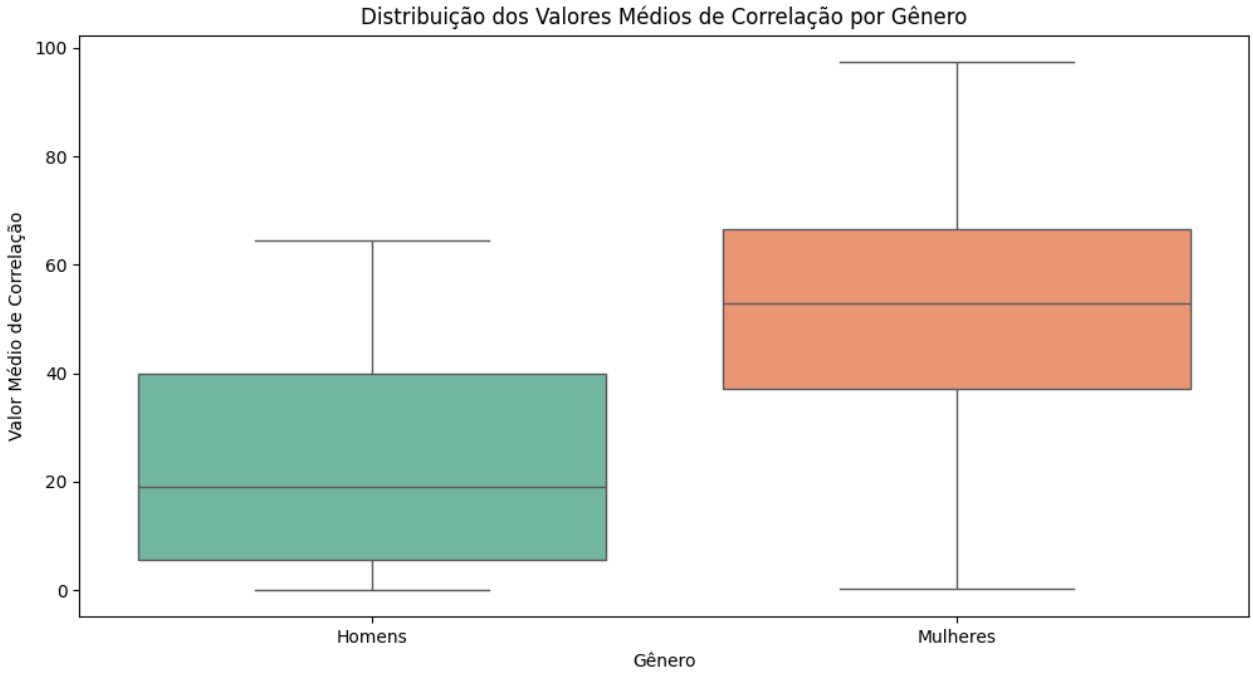
Along with the sensor data, the participants' metadata (age, gender, height, weight, BMI) was collected, all separately to avoid embarrassment. The data was stored in a .txt file along with the data in .csv in a folder named after a long, random, and unique ID. Therefore, the data collected is anonymous. Forty-two data points were collected from the first period, 37 from the fifth, and 35 from the eighth, resulting in 80% power for all classes.

The data was then read using the Python language. The code calculates the average correlation between the wrong signal (referring to the participants' performance) and the correct signal (signal collected from the supervised performance of an AHA CPR monitor) and calculates the cross-correlation between them, taking the average value of the function, subtracting it from the autocorrelation of the correct signal, dividing it by the same, subtracting it from 1, and multiplying it by 100. This provides a parameter of how much each ID was lacking from the ideal execution in percentage terms, such that the less that was lacking (i.e., lower values), the better the execution.

Results

In terms of gender, 50 men (44.64%) and 62 women (55.36%) participated. A significant difference was found in the performance of men and women, with a t-statistic of -6.83, a p-value of 5.11e-10, and the distance from the ideal performance for men was 24.01% and for women was 51.66%, representing a difference in the mean of 59.01%. Cohen's coefficient for the comparison was -1.30. The box plot for the comparison is shown in graph 1.

Graph 1. Representation of the distribution of execution quality between genders.



Source - Own elaboration.

Regarding the remaining anthropometric data to be evaluated, Pearson's correlation was used between the cross-correlation values and the data, obtaining the following results:

Table 1. Statistical relationship between performance quality and anthropometric data.

Anthropometric Data	n		Pearson coefficient	p value
Age				
18	41	3	0.07	0
21	54	48.21	0.10	0.45
25	13	11.61	-0.02	0.94
28	4	3.57	-0.02	0.97
Height				
148 - 160	23	20.53	-0.20	0
161 - 171	47	41.00	0.03	0.81
171 - 181	38	33.93	-0.17	0.33
181	15	13.39	0.01	0.96

Weight				
45	31	27.68	-0.07	0.68
60.1 – 72	37	33.04	-0.40	0.007
72.1 – 86	26	23.21	0.002	0.09
BMI				
17	28	25	0.21	0
21.1 – 24	49	43.75	-0.14	0.33
24.1 – 36	32	28.57	-0.07	0

Source - Own elaboration.

Thus, the statistically significant data obtained were that men performed better than women in 61.01% of cases and that there is a weak correlation in resuscitation quality between 60.1 and 72 kg, with higher weight within this range corresponding to better performance at a rate of -0.40.

Discussion

In the present study, a weak but positive correlation was observed between CPR performance and body weight in the range of 60.1 kg to 72 kg, indicating that as weight increases within this range, there is a slight improvement in the quality of the maneuver. This finding is consistent with the literature, which suggests that individuals with greater body mass may have more physical strength available to apply chest compressions more efficiently, reaching the depths necessary to ensure adequate blood flow (HIGHTOWER et al., 2020).

In addition, the results show that men performed better than women, with a 60.01% higher success rate. This result can be explained by physiological differences between the genders, such as greater muscle mass and strength among men, which favors the performance of effective chest compressions (CHO et al., 2019). However, it is important to note that this difference in performance should not be seen as a fixed limitation, since adequate and repeated training can substantially improve the ability of both genders to perform CPR efficiently (PANCHAL et al., 2021). Thus, an emphasis on regular training with real-time feedback can minimize the differences observed between sexes and ensure better performance, regardless of anthropometric factors.

Conclusion

It is therefore concluded that more CPR training should be provided to overcome the limitations associated with individual differences in weight and gender.

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