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Can lightweight rescuers adequately perform CPR according to 2010 resuscitation guideline requirements?

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ABSTRACT

Aim To evaluate associations between rescuers' anthropometric characteristics and chest compressions (CC) depth according to 2010 resuscitation guidelines.

Methods 186 medical and pharmacy students, never trained in basic life support (BLS) before, underwent video self-instruction training. The participants were asked to perform a BLS test on a manikin connected to a PC for 6 min immediately after training, and the quality of the cardiopulmonary resuscitation (CPR) skills was evaluated.

Results Women with body weights less than 56 kg were 6.29 times more likely to produce insufficient CCs than women weighing 56—62.7 kg, and 4.72 times more likely to produce insufficient CCs compared with women weighing more than 62.7 kg.

Conclusions Lightweight rescuers may have difficulty achieving the full compression depth of 5—6 cm required by new resuscitation guidelines. These rescuers require special attention during CPR training, with an emphasis on correct body positioning and use of body weight for CCs.

INTRODUCTION

Lightweight rescuers, especially women, have difficulty achieving adequate chest compressions (CC) depths and tire more quickly.[1–4] Since the 2010 guidelines were released, the aim of CCs has been to push the chest to a depth of at least 5 cm.[5] The aim of our study was to evaluate the associations between rescuers' anthropometric characteristics (weight, height, body mass index (BMI) and body fat percentage) and CC depth, as measured on a basic life support (BLS) manikin.

METHODS

The Regional Ethics Committee of the Lithuanian University of Health Sciences (LUHS) approved the study. The participants included in this study were sixth-year medical and fourth-year pharmacy students who underwent BLS training according to the LUHS curriculum in the Department of Disaster Medicine between January and March 2011. We excluded students who had already received practical training in BLS.

The video-based lecture titled *AHA Family and Friends, CPR Anytime* in Lithuanian was employed to teach practical cardiopulmonary resuscitation (CPR) skills. Each participant was given an individual Resusci Anne manikin. BLS skills were tested one-by-one immediately after the training session by American Heart Association (AHA)-certified BLS instructors using a case-based scenario. We evaluated the students' CPR skills, including their initial assessment, calling emergency responders, CCs, ventilations and using the automated external defibrillator. Data were collected automatically with the Laerdal Resusci Anne Manikin PC SkillReporter System (Laerdal Medical, Norway). The mean compression depth for each minute was retrieved from the Skillmeter software database. Criteria for inadequate depth were defined as 49 mm or less.

Data analysis was performed at a significance level of 5% (two-tailed) using SPSS V.12 (SPSS Inc, Chicago, IL, USA). To investigate associations between variables, we used Pearson's and Spearman's correlations, t tests, chi-squared tests and logistic regression. To allow a logistic regression analysis, the variable of compression depth was dichotomised: compression depth <50 mm was regarded as 'insufficient' and other depths were labelled 'sufficient'.

RESULTS

The average CC depth of male participants was sufficient (5.8 (0.8) cm). Data from 146 female students who met the selection criteria were used for further analysis. There was a significant correlation between the weight, height, BMI and compression depth of female participants. We used a cross-tabulation to determine the association between insufficient CC depth and the weight of the female study participants. There was a significant difference between the first and the other terciles in the number of cases with insufficient compression depth (table 1). The association between weight and compression depth is presented as a scatter plot in figure 1. We calculated ORs to illustrate the associations between anthropometric factors and insufficient compression depth (table 2). Our sample size (n=146) allowed us to detect OR>3.5 at the statistical power 0.80.

DISCUSSION

The lightweight women in our study were not able to perform CCs of adequate depth in accordance with the 2010 resuscitation guidelines. The percentage of inadequate compressions was 60.3% (2010 guidelines) versus 18.5% (2005 guidelines).

Women resuscitate victims more frequently, but it is known that the depth of their compressions,

Table 1 Cross-tabulation for the association between insufficient chest compression depth and weight of female study participants

	Compression depth		
	Insufficient	Sufficient	Total
First tercile, <56 kg			
Count	41	8	49
%	83.7%	16.3%	100.0%
Second tercile, 56–62.7 kg			
Count	22	27	49
%	44.9%	55.1%	100.0%
Third tercile, >62.7 kg			
Count	25	23	48
%	52.1%	47.9%	100.0%
Total			
Count	88	58	146
%	60.3%	39.7%	100.0%

Pearson's χ^2 17.39, df=2, p<0.01.

and thus the quality of their resuscitations, are often inadequate.[1–3 6 7] Our study also supports the notion that the gender effect might be explained by physical characteristics such as body weight or muscle strength.[1 2 7]

It seems that 22 min of video self-instruction training is not sufficient to teach lightweight women to produce CCs of sufficient depth. Virtual feedback devices are not always adequate, and a live instructor's feedback is necessary to ensure that an individual approach is taken. A focus on correct body positioning during CPR training will help lightweight rescuers produce efficient CCs for a longer period of time.

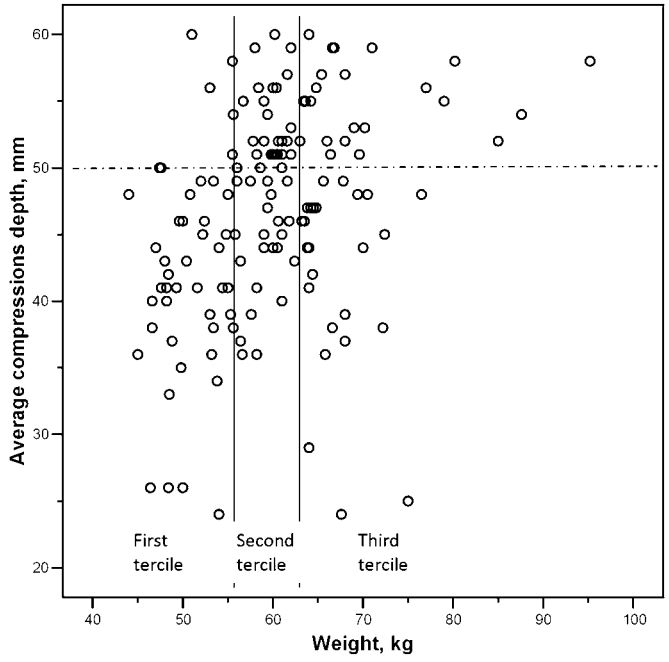

Figure 1 Association of body weight and depth of chest compressions among female rescuers. Scatter plot showing the weights of female participants and chest compression depth. The insufficient compression depth is below the dotted line. The weight terciles are 56 and 62.5 kg.

Table 2 ORs for the association between the female participants' anthropometric data and insufficient chest compression depth

Factor	Intertercile association	OR (95% CI) Women
Weight	First/second	**6.29 (2.45 to 6.16)**
	First/third	**4.72 (1.83 to 12.14)**
Height	First/second	2.22 (0.95 to 5.15)
	First/third	**3.73 (1.53 to 9.09)**
BMI	First/second	2.12 (0.95 to 5.14)
	First/third	**2.37 (1.01 to 5.75)**
Fat, %	First/second	2.09 (0.91 to 4.79)
	First/third	1.62 (0.70 to 3.73)

Significant ORs are in bold.

CONCLUSIONS

Lightweight women are likely to perform inadequate CC's; therefore, we recommend that during CPR training for lightweight adults, especially women, trainers should emphasise how the maximum use of body mass can be achieved during CCs. Instructors should focus on correct rescuer body positioning and biomechanics.

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Competing interests None.

Ethics approval The study was approved by the Regional Ethics Committee based at Lithuanian University of Health Sciences (Protocol No. BC-MF-188/2011).

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