Efficacy of metronome app and mental metronome "La Macarena" to improve the quality of chest compressions

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Background Goal of the study: The quality of chest compressions during cardiopulmonary resuscitation increases chance of survival and improves outcomes¹. The goal of the study was to compare the efficacy of a smartphone metronome application and the musical mental metronome "La Macarena" to improve the quality of chest compressions.

Material and methods: A controlled, cluster sampling study of 2 minutes of continuous chest compressions on manikin was conducted with medical students, University of Barcelona (Fig. 1). Subjects received no guidance (control), metronome app programmed at 103 bpm (App) or the order to perform compressions to the mental cadence of the song "La Macarena" (Maca). Demographic data, quality of chest compressions (Resusci Anne Wireless SkillReporter® Software), and a satisfaction survey were registered. Intention-to-treat (ITT) and per-protocol (PP) analyses were performed.

Table 1. Demographic characteristics of the students

		ITT analysis					PP analysis				
		Total	Control	App	Maca	p	Control	App	Maca	p	
Age		21[20,22]	20 [20,22]	21 [20,22]	21[20,23]	0.108	21[20,23]	21[20,22]	21[20,23]	0.515	
Sex	Female	106 (64,6)	38 (53,5)	31 (68,9)	37(77,1)	0.024	18 (51,4)	31 (68,9)	37 (77,1)	0.048	
BMI		21,46 [19,77,22,98]	21,72 [20,31,23,24]	20,2 [18,86,22,3]	21,66 [19,9,23,4]	0.053	22,09 [20,24,23,72]	20,2 [18,86,22,31]	21,66 [19,9,23,04]	0.038	
Glove sizing	S	48 (29,3)	14 (19,7)	17 (37,8)	17 (35,4)	0.054	9 (25,7)	17 (37,8)	17 (35,4)	0.462	
	M	81 (49,4)	38 (53,5)	21 (46,7)	22 (45,8)		18 (51,4)	21 (46,7)	22 (45,8)		
	L	35 (21,3)	19 (26,8)	7 (15,6)	9 (18,8)		8 (22,9)	7 (15,6)	9 (18,8)		
Year of medical school	1st	20 (12,2)	13 (18,3)	5 (11,1)	2 (4,2)	0.107	6 (17,1)	5 (11,1)	2 (4,2)	0.428	
	2nd	7 (4,3)	3 (4,2)	4 (8,9)	0 (0)		2 (5,7)	4 (8,9)	0 (0)		
	3th	84 (51,2)	37 (52,1)	17 (37,8)	30 (62,5)		17 (48,6)	17 (37,8)	30 (62,5)		
	4th	26 (15,9)	9 (12,7)	8 (17,8)	9 (18,8)		4 (11,4)	8 (17,8)	9 (18,8)		
	5th	11 (6,7)	3 (4,2)	6 (13,3)	2 (4,2)		2 (5,7)	6 (13,3)	2 (4,2)		
	6th	16 (9,8)	6 (8,5)	5 (11,1)	5 (10,4)		4 (11,4)	5 (11,1)	5 (10,4)		
Extra profession		6 (3,7)	1 (1,4)	1 (2,2)	4 (8,3)	0.149	1 (2,9)	1 (2,2)	4 (8,3)	0.385	
Previous training		161 (98,2)	69 (97,2)	45 (100)	47 (97,9)	0.788	34 (97,1)	45 (100)	47 (97,9)	0.734	
Official certificate		21 (13)	10 (14,5)	6 (13,3)	5 (10,6)	0.836	6 (17,6)	6 (13,3)	5 (10,6)	0.645	
Last training	Immediate	86 (52,4)	41 (57,7)	20 (44,4)	25 (52,1)	0.371	20 (57,1)	20 (44,4)	25 (52,1)	0.538	
Feedback		39 (23,8)	18 (25,4)	9 (20)	12 (25)	0.799	8 (22,9)	9 (20)	12 (25)	0.834	
Experience with patients		2 (1,2%)	1 (1,4)	0 (0)	1 (2,1)	1.000	1 (2,9)	0 (0)	1 (2,1)	0.734	

Table 2. Primary variables of the study

	ITT analysis				PP analysis			
	Control	App	Maca	p	Control	App	Maca	p
Rate 100-120cpm (%)	24 [1,92]	91 [87,94]	74 [8,98]	<0.001	7 [0,64]	91 [87,94]	74 [8,98]	<0.001
Mean rate (cpm)	110 [98,126]	103 [102,103]	111 [105,119]	<0.001	109 [93,128]	103 [102,103]	111 [105,119]	<0.001
Depth 5-6cm (%)	2 [0,44]	0 [0,9]	0 [0,14]	0.092	6 [0,44]	0 [0,9]	0 [0,14]	0.204
Mean depth (mm)	42 [35,49]	40 [36,45]	41 [36,46]	0.575	43 [36,49]	40 [36,45]	41 [36,46]	0.401
OK hand position (%)	100 [100,100]	100 [100,100]	100 [100,100]	0.622	100 [100,100]	100 [100,100]	100 [100,100]	0.608
Correct release (%)	95 [53,100]	97 [36,100]	94 [25,100]	0.629	98 [59,100]	97 [36,100]	94 [25,100]	0.593
Onset delay (s)	1,2 [1,1,7]	4,3 [3,5,5]	1,5 [1,2,1,9]	<0.001	1,2 [1,1,7]	4,3 [3,5,5]	1,5 [1,2,1,9]	<0.001

Fig 2. Overall Q CPR score

Results: 164 students were included (control ITT=71, PP=35; App=45; Maca=48). Groups were homogeneous except for sex and BMI (Table 1). The percentage of compressions between 100 and 120 per minute was significantly higher in the App and Maca than in the control group (Table 2). Any group reached the depth of 5 cm. The App group had the better overall quality compression scores (Figure 2) but the longer onset delay of the first compression (Table 2). Students rated the app as the most useful help method (Table 3).

Conclusions: Metronome app and mental metronome "La Macarena" improved the quality of chest compressions by increasing the proportion of adequate rate but not the depth of compressions. The metronome app was more effective but with a significant onset delay.

Table 3. Satisfaction survey

	ITT analysis				PP analysis			
	Control	App	Maca	p	Control	App	Maca	p
Feel relevant your contribution	8 [8,10]	8 [7,9]	9 [8,9]	0.292	8 [8,10]	8 [7,9]	9 [8,9]	0.354
Comfortable and well treated	10 [10,10]	10 [10,10]	10 [10,10]	0.076	10 [9,10]	10 [10,10]	10 [10,10]	0.049
Future participation in educational research	10 [9,10]	10 [10,10]	10 [10,10]	0.663	10 [9,10]	10 [10,10]	10 [10,10]	0.560
The guidance method seemed useful to you		9 [8,10]	8 [8,9]	0.023		9 [8,10]	8 [8,9]	0.023
You would apply the guidance method in a real case		9 [8,10]	9 [8,10]	0.785		9 [8,10]	9 [8,10]	0.785