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"*PUSH AS HARD AS YOU CAN*" INSTRUCTION FOR TELEPHONE CARDIOPULMONARY RESUSCITATION: A RANDOMIZED SIMULATION STUDY

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☐ Abstract—Background: The medical priority dispatch system (MPDS®) assists lay rescuers in protocol-driven telephone-assisted cardiopulmonary resuscitation (CPR). Objective: Our aim was to clarify which CPR instruction leads to sufficient compression depth. Methods: This was an investigator-blinded, randomized, parallel group, simulation study to investigate 10 min of chest compressions after the instruction "push down firmly 5 cm" vs. "push as hard as you can." Primary outcome was defined as compression depth. Secondary outcomes were participants exertion measured by Borg scale, provider's systolic and diastolic blood pressure, and quality values measured by the skill-reporting program of the Resusci® Anne Simulator manikin. For the analysis of the primary outcome, we used a linear random intercept model to allow for the repeated measurements with the intervention as a covariate. Results: Thirteen participants were allocated to control and intervention. One participant (intervention) dropped out after min 7 because of exhaustion. Primary outcome showed a mean compression depth of 44.1 mm, with an inter-individual standard deviation (SD_b) of 13.0 mm and an intra-individual standard deviation (SD_w) of 6.7 mm for the control group vs. 46.1 mm and a SD_b of 9.0 mm and SD_w of 10.3 mm for the intervention group (difference: 1.9; 95% confidence interval −6.9 to 10.8; $p = 0.66$). Secondary outcomes showed no difference for exhaustion and CPR-quality values. Conclusions: There is no difference in compression depth, quality of CPR, or physical strain on lay rescuers using the initial instruction "push as hard as you can" vs. the standard MPDS® instruction "push down firmly 5 cm."

☐ Keywords—cardiopulmonary resuscitation; out-of-hospital cardiac arrest; chest compression; manikin; telephone

INTRODUCTION

There is an ongoing discussion on quality of cardiopulmonary resuscitation (CPR). Guidelines on CPR provide target values for chest compression and ventilation. Effective chest compressions are vital to establish a minimum blood flow in cardiac arrest victims and are important for good neurological outcomes. It is known that good-quality CPR keeps rhythms shockable, increases tolerance against delay of defibrillation, increases first shock success, and improves survival in out-of-hospital cardiac arrest (1,2). In telephone-assisted CPR,

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instructions provided by emergency medical dispatchers to lay rescuers might increase survival (3).

Regarding the number of investigations illustrating that quality of CPR remains suboptimal, it is important to realize that there is no difference in outcome between no CPR and poorly performed CPR (4–7). However, chest compression remains suboptimal in 60% and even emergency medical service (EMS) professionals often do not achieve the given target depth (6,8). The European Resuscitation Council guidelines were modified in 2010 to require a compression depth of "5 but not to exceed 6 cm," and the American Heart Association (AHA) guidelines require "at least 5 cm" compression depth (9,10).

Especially in unknown victims, lay rescuers are often encouraged to provide compression-only CPR (COCPR) if untrained or rescue breaths are refused to be given (11,12). There is evidence that in adults with assumed cardiac cause of arrest, good-quality chest compressions outrank ventilation, at least for the first minutes of CPR (13,14). In cases when lay rescuers are reluctant to give rescue breaths, dispatchers provide verbal instructions for COCPR. This has been proven to improve outcome vs. telephone-assisted CPR with commands for ventilation (15–17).

The globally used medical priority dispatch system (MPDS® V12.0 Priority Dispatch Inc., Salt Lake City, UT) is a standardized caller interrogation and emergency triage system combined with pre-arrival first aid and CPR instructions. Although, the MPDS® is not evidence-based, lacking prospective testing, 2855 emergency dispatch centers in 43 countries worldwide are currently using this protocol. Therefore, a more effective instruction would have a relevant and global impact on quality in telephone-assisted, lay rescuer CPR.

The current study was set to evaluate the effectiveness of a differing verbal instruction in telephone-assisted COCPR. We hypothesized that the instruction "to push as hard as you can" would result in an improved chest-compression depth compared with the current standard instruction of the MPDS® "push down firmly 5 cm."

METHODS

Trial Design

The study was planned in an investigator blinded, randomized, parallel group, simulation design (www.controlled-trials.com ISRCTN51784217). The ethical committee of the Medical University of Vienna approved the protocol.

Participants

The study was conducted at the Austrian Red Cross Blood Donation Center, on March 3, 2011. In total, 26 voluntary blood donors could be recruited in advance of their blood donation. Participants older than the age of 18 years were eligible for randomization. Pregnant women and health care professionals (e.g., paramedics, nurses, and physicians) were not allowed to take part. Further exclusion criteria were a baseline systolic blood pressure (SBP) of >160 mm Hg and any medical condition restricting physical exercise. In Austria, almost all adults have participated in a first-aid course because this is mandatory to obtain a driving license. We therefore defined lay rescuers as those with no first-aid course within the last 6 months and excluded anyone with more recent training. This is based on the knowledge that first-aid skills are diminishing 6 months after performing a course (18).

Study Setting

After agreement and informed consent, every participant was asked for demographic data containing sex, age, smoking status, and body mass index, which were recorded on datasheets.

To evaluate physical fitness, participants had to complete the physical fitness questionnaire (FFB-Mot) (19). This questionnaire evaluates the individual motor fitness status in normal populations using 28 self-report items assessing cardiorespiratory fitness, strength, flexibility, coordination, activity of daily life, and sport-specific items. Values from FFB-Mot can reach from 28 up to 140 points. In a standard population, normal values for FFB-Mot are 117 $\pm$ 11 points.

Heart rate and blood pressure were measured before and immediately after the study. After prestudy measurements, participants were guided to a separated scenario room. For the study scenario, we used a Resusci® Anne Simulator manikin with the PC skill-reporting program (Laerdal Medical AS, Norway). Telephone instructions were given following the 12th version of the MPDS® protocol provided by the International Academy of Emergency Dispatch for telephone-assisted CPR, which is used in several regions of Austria. This protocol is in accordance with the AHA guideline requirement of 5-cm chest compression. Therefore, for this study, we defined 5 cm as correct compression depth. Dispatchers were instructed to strictly read from the protocol without any deviation to avoid contamination.

Every participant had to call the emergency dispatch center using a stationary telephone with a reserved number simulating an emergency call for suspected cardiac arrest. The dispatcher was remotely located in an emergency dispatch center 60 km away from the study setting.

At the time of a new incoming simulated emergency call, the dispatcher was requested to open the next sequential numbered envelope, assigning the participant