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DEATH BEFORE DISCO: THE EFFECTIVENESS OF A MUSICAL METRONOME IN LAYPERSON CARDIOPULMONARY RESUSCITATION TRAINING

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□ **Abstract—Background: A novel musical memory aid has been proposed for aiding laypersons in complying with the American Heart Association (AHA) cardiopulmonary resuscitation (CPR) guidelines of 100 compressions per minute (cpm). Objective: This study tested usefulness of such a memory aid to improve layperson long-term compliance with CPR compression rate guidelines. Methods: A prospective randomized controlled trial was conducted using CPR-untrained laypersons. Subjects received either a standard CPR educational experience (AHA Heartsaver® CPR class) or an experimental CPR educational experience (AHA Heartsaver® CPR class augmented with a musical metronome). Experimental group subjects were taught to perform compressions to the cadence of a pop music song (The Bee Gees "Stayin' Alive"; Saturday Night Fever, The Original Movie Soundtrack; Polygram International Music, 1977) with a tempo of 100 beats/min. Compression rates, depth of compressions, and correct compressions were measured initially and upon re-testing ≥6 weeks post-training. Results: Control subjects had a higher mean compression rate both immediately (121 [standard deviation {SD} = 21] vs. 109 [SD = 15] cpm; 95% confidence interval [CI] of mean difference 4–19; $p = 0.002$) and at follow-up (120 [SD = 20] vs. 111 [SD = 13] cpm; 95% CI of mean difference 2–16; $p = 0.014$). Compression rates stratified to 100–120 cpm demonstrated no difference between groups initially (39% vs. 48%; $p = 0.382$), but more experimental subjects maintained these rates at follow-up (43% vs. 74%; $p = 0.003$). Conclusions: Subjects trained to use a musical metronome more often maintained a compression rate of 100–120 cpm at ≥6-week follow-up, suggesting the memory aid may improve long-term guideline adherence.** © **2015 Elsevier Inc.**

□ **Keywords—cardiopulmonary resuscitation; CPR; chest compressions; music; feedback; education; training; metronome**

INTRODUCTION

An estimated 166,200–320,000 out-of-hospital sudden cardiac arrests occur in the United States annually, with reported median rates of survival to hospital discharge of 7.9% (1–3). Bystander cardiopulmonary resuscitation (CPR) is associated with a four-fold increase in survival of cardiac arrest victims (4). During the past decade, bystander CPR rates have remained

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low, between 20% and 30%, despite numerous public health initiatives (5). Bystanders have cited the reluctance to perform mouth-to-mouth breathing or the overall complex nature of this task as reasons to avoid bystander CPR (6).

The most important feature of CPR has been shown to be the quality and rate of chest compressions, which doubles or even triples a patient's chance of survival when properly performed (7–10). However, it has also been shown that most often manual chest compressions are often performed ineffectively (11,12). Observational studies of medical professionals and bystanders performing CPR have shown that target compression and ventilation rates are not uniformly maintained (8,9). In addition, retention of CPR knowledge and skills is often poor, with a significant decrease seen as early as 6 weeks and some trainees reverting to baseline skill levels as early as 6 months post training (13–15).

What is needed is a means to keep CPR skills fresh and achievable, especially for layperson providers. One such mechanism is the use of "real-time" feedback provided concurrently while CPR is being performed. CPR sensing monitor/defibrillators that measure chest compression rate and depth via both accelerometer and force-detection sensors have been shown to improve quality; however, the specific technology must be present at the time CPR is initiated, limiting its application to mostly medical professionals in health care settings (16,17). The use of a musical metronome that is low cost, ubiquitous, and easily utilized represents an ideal standard for laypersons performing bystander CPR.

A novel and largely untested memory aid has been anecdotally proposed for aiding practitioners in complying with American Heart Association (AHA) CPR compression rate guidelines (18,19). It has been noted that several pop music renditions have a cadence that is timed to approximately 100 beats/min (bpm), the same rate as 2005 AHA CPR guidelines (19). CPR providers can use the cadence of the music to help them time external compression rates to 100 bpm. Recent pilot experiences with medical professionals using a pop music memory aid to time CPR compression rates during simulated cardiac arrest scenarios has been favorable (19,20). However, its usefulness as a training tool and a mechanism for long-term adherence to compression rate guidelines among layperson CPR providers has not been explored. We hypothesize that use of a pop music song as a CPR metronome during layperson CPR training will improve long-term chest compression rate adherence to the AHA 2010 CPR guidelines, as compared to standard CPR training.

METHODS

Study Design and Setting

A randomized educational intervention study utilizing a control group was conducted. The primary outcome measure was a chest compression rate between 100 and 120 compressions per minute (cpm) between groups at 6-week follow-up. Secondary outcomes included a chest compression rate between 100 and 120 cpm immediately during training, adequate compression depth, the proportion of adequate compressions, and subject's attitudes performing CPR.

Standard and experimental educational experiences were offered to the students and employees of the University of Illinois at Urbana-Champaign (UIUC). UIUC is a public University located in Urbana-Champaign, east-central Illinois straddling the twin cities of Urbana and Champaign and offers undergraduate and graduate education for > 40,000 students annually. There are also > 10,000 faculty and staff employed by the University. The student body is composed of 54% men and 46% women.

Selection of Participants

Adult UIUC students without CPR certification were recruited from the Urbana-Champaign community for participation in the trial. Subjects were recruited using written flyers and direct invitations to UIUC undergraduate student groups, as many students are required to have AHA CPR certification to participate in certain school activities or work-study programs. Subject exclusion criteria included age older than 80 years (due to concerns about the ability to perform and maintain adequate CPR external compressions for five cycles), the inability to speak or comprehend the English language, a significant primary or secondary hearing impairment (as reported by the subject; defined as requiring a hearing assist device for daily activities), a self-reported physical inability to perform CPR compressions for at least five full cycles, a reported occupation as a health care professional, and prior formal CPR training < 5 years before enrollment in the study.

AHA CPR instructors were recruited via e-mail invitations to local AHA CPR instructor list servers. The invitation described the study in general terms, and interested instructors attended a general study training session detailing general study details and protocols. Instructors were required to have experience in teaching the AHA Heartsaver® CPR class in the past. The instructors were randomly assigned to either the experimental or the control group via computer randomization and utilized the usual instructor materials and coursework that