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Letter to the Editor

Reply to: Potential pros and cons of the real-time feedback mechanism embedded in smartwatches

To the Editor,

We greatly appreciate Dr. Oh for his interest and comments regarding our study. We have attempted to address his queries below.

First, we agree that a smartwatch with embedded accelerometer cannot measure the deflection of the mattress beneath the patient. The estimated chest compression depth (CCD) may be inaccurate when chest compressions are performed on patients placed on a soft bed that may absorb some force, and we have addressed this issue in the limitation section. Second, we derived the acceleration values by using the scalar projection of the collected acceleration onto gravity, and then minus the gravity, under the assumption that the direction of chest compression is the same as the direction of gravity. The depth estimation algorithm was trained and tested in a Resusci Anne QCPR manikin. We compared the CCD results given by the smartwatch and the reference using the Wilcoxon Signed Rank Test (WSRT), and used Bland-Altman (BA) analysis to assess the agreement between the two methods. WSRT showed that there was no significant difference between the two methods. By BA analysis the mean of differences was minimal and the bias between the two methods was not significant. The validation study has been published elsewhere.[1] In our study, we did not measure if there is full chest recoil or leaning after each chest compression, which has been a major drawback in most of the accelerometer-based assistive devices for chest compression during CPR.[2] Although we have addressed this deficiency in our study, yet we are happy to know that the latest model of the Resusci Anne QCPR manikin can measure the leaning depths, which deserves further investigation in future studies. Third, the smartwatch app in this study provides audiovisual feedback mechanisms to guide the rescuers in performing high-quality CPR, but we cannot tell which feedback mechanism was responsible for improving the quality based on the study design. We agree that it is hard for the rescuers to check the screen of the wrist-worn smartwatch while performing chest compressions, further research will be needed to compare the effect of the individual feedback mechanisms. Forth, we agree that CCD could be influenced by the speed of chest compression rate (CCR) without intervention. However, with the feedback of the smartwatch we developed, although not perfect, the percentage of high-quality CPR (meeting both guideline-recommended CCR and CCD) was significantly higher in the intervention group than in the control group. Again, we are unable to determine which feedback mechanism contributed to improvements in CPR quality in the intervention group. Fifth, this study was designed for healthcare providers who should perform compression to ventilation at a 30:2 ratio. We reported that the number of participants who received the investigator reminders for forgetting to perform ventilation after about 30 consecutive chest compressions was significantly higher in the control group. Although we evaluated participants' adherence to the guideline, we did not evaluate hand position on the chest or measure the ventilation quality. This limitation has been addressed in the limitation section.

Conflicts of interest

None.

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