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Editorial

Chest compression components — What do we really know?

The evaluation of research literature is crucial to the practice of evidence-based medicine.[1] Over the past decade, the methodology of evidence synthesis has developed considerably.[2] Scoping reviews or scoping studies are increasingly popular to synthesise knowledge in both emerging and established fields.

Key differences between systematic reviews and scoping reviews lie in their focus, aim and purpose.[3] Systematic reviews typically focus on a well-defined research question where appropriate study designs are identified in advance. Scoping reviews can examine an exploratory research question or broader topic area where a range of different study designs might be applicable. The aim of systematic reviews is to provide answers to questions from a relatively narrow range of quality-assessed studies. In comparison, a scoping review is less likely to yield answers to specific research questions and will not usually provide a quality assessment of included studies.

Scoping reviews may be conducted for a variety of purposes.[2,4] Scoping reviews are used to describe 'the lay of the land'; to map out the size, range and characteristics of the available evidence on a research topic.[5] Results from scoping reviews are sometimes used to determine whether there is any value in undertaking a systematic review. Scoping reviews are most useful in summarising a body of evidence that has not been comprehensively reviewed or when there is heterogeneous research methodology.[2] Findings from scoping reviews can also identify any research gaps that will benefit future research.

Despite these differences, the conduct of scoping review should still follow recommended methodology and reporting standards. Interested readers may want to refer to the published Preferred Reporting Items for Systematic reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR).[6] Due to complexity caused by a wider scope and an exploratory question, specific attention is required to ensure the purpose and research question of a scoping review is both clear and specific. Researchers should use a sensitive but structured approach to study selection to ensure the breadth and completeness of identified literature. Comprehensive results will also require careful presentation and interpretation.[4]

This month sees the first scoping review published in *Resuscitation*.[7] In the 2015 Consensus on Science with Treatment Recommendations (CoSTR) document, there were three separate systematic reviews investigating the effect of: chest compression depth, chest compression rate and chest wall recoil on clinical outcomes in cardiac arrest.[8] This updated scoping review was undertaken by International Liaison Committee on Resuscitation's (ILCOR) Basic Life Support Task Force, recognising both the need to search for updated evidence following the 2015 CoSTR, and the need to investigate how interactions between different chest compression components affected clinical outcomes.

The scoping review examines evidence from published *human* studies (i.e. excluding simulation or manikin-only studies) that chest compression components depth, rate, chest wall recoil and leaning were associated with improved clinical outcomes following cardiac arrest. The authors identified 22 studies, of which eight reported the effect of chest compression rate only, seven reported on chest compression depth only, and two reported on chest wall recoil only. They found no papers reporting on chest wall leaning. In addition, there were five studies reporting the effect of chest compression rate and depth together (489 adult patients and 390 children) on clinical outcomes. There were no studies reporting other chest wall component combinations.

Current international guidelines recommend a chest compression rate of 100–120/min, and a chest compression depth of approximately 5 cm but avoiding compressions deeper than 6 cm.[8] The reviewed studies did not consistently demonstrate associations between either chest compression rate or chest compression depth on either survival to discharge/one month, or survival with a favourable neurological outcome. Only four of 13 studies investigating chest compression rate showed an effect on clinical outcomes. Of note, one in children demonstrating that slower chest compression rate was associated with better survival with favourable neurological outcome, and one in adults demonstrating that chest compressions either slower or faster than the recommended 100–120/min resulted in lower survival to hospital discharge. Studies investigating chest compression depth that did show an effect (four out of 12) suggest that shallower compressions (particularly <38 mm depth) are associated with poorer outcomes. The two studies investigating chest wall recoil velocity contradicted each other regarding whether or not a fast recoil velocity (400 mm/s) improved survival to hospital discharge compared to a slow recoil velocity (300 mm/s). Three of the four studies investigating chest compression rate and depth together reported that increasing rate was associated with decreased depth of compressions. The other adult study and one study in children reported no association.

The authors of this scoping review should be congratulated on their sterling effort to summarise a deceptively complex area of chest compression components and the research gaps. Their conclusion was that there were not enough evidence to warrant conducting further systematic reviews, nor to change current guidelines. The reality of paucity of evidence and significant knowledge gaps may

Please cite this article in press as: J. Yeung, C. Smith, Chest compression components — What do we really know?, Resuscitation (2019), https://doi.org/10.1016/j.resuscitation.2019.10.008

surprise some. High-quality randomised controlled trials investigating chest compression components, either in isolation or in combination is lacking. There is no clinical outcome data about the effect of chest compression components in combinations. Seventeen of the 22 published studies concern out-of-hospital cardiac arrest and only three included paediatric cardiac arrest patients. For an action that we consider fundamental and core to cardiopulmonary resuscitation and to good patient outcome, it is astonishing that the quality of evidence we are able to draw upon remains so low.

Conflict of interest

The authors declare no financial conflict of interest. JY is a member of ILCOR Education Implementation and Teams Taskforce. CS is a member of ILCOR Basic Life Support Taskforce.

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Joyce Yeung*
Christopher Smith
Warwick Medical School, University of Warwick, United Kingdom

* Corresponding author.
E-mail address: j.yeung.4@warwick.ac.uk (J. Yeung).

Available online xxx

http://dx.doi.org/10.1016/j.resuscitation.2019.10.008