|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Question: CPR Feedback Devices in Training | | | |  |
|  | | | |
| Population: Among students who are receiving resuscitation training |  | Background: |  |
| Intervention: does use of a CPR feedback/guidance device |  |  |
| Comparison: compared with no use of a CPR feedback/guidance device |  |  |
| Main outcomes: Patient survival, quality of performance, skill performance |  |  |
| Setting: All |  |  |
| Perspective: High quality CPR is a key predictor of survival from cardiac arrest. Excellent CPR training is important to save lives of cardiac arrest victims. |  |  |

| Assessment | | | | |
| --- | --- | --- | --- | --- |
|  | **Criteria** | **Judgements** | **Research evidence** | **Additional considerations** |
| Problem | **Is there a problem priority?** | ○ No  ○ Probably no  ○ Uncertain  X Probably yes  ○ Yes  ○ Varies | CPR Quality is a key component in outcome of both OHCA and IHCA. Optimal methods of training both health care providers and laypersons are key to improving cardiac arrest outcomes | We excluded studies that examined the use of CPR feedback devices to improve performance of CPR (either simulated or on real patients). We only considered studies that involved assessment of learning at some point after the intervention.  We considered both true feedback devices (systems that assess participant performance and provides corrective information) and guidance devices (systems that only provide prompts not based on participant performance - such as a metronome for CPR rate). |
| Benefits & harms of the options | **What is the overall certainty of this evidence?** | ○ No included studies  ○ Very low  ○ Low  x Moderate  ○ High | Evidence is based on randomized controlled trials in manikin-based simulation settings, most of which have some concerns of risk of bias.  We identified no studies examining the effect of training with CPR feedback devices on patient outcomes or performance in actual resuscitations.  Five studies showed improvement in CPR performance at training conclusion when training was augmented with CPR feedback devices {Griffin 2014 264; Wilson-Sands 2015 E1; Baldi 2017 480; McCoy 2019 15; Wagner 2019 PMID 30700565}  Six studies showed improved retention of CPR skills following training conclusion (from 7 days to 3 months) {Griffin 2014 264; Hafner 2015 43; Cortegiani 2017 e0169591; Katipoglu 2019 31565794; Smereka 2019 e15995; Zhou 2020 73}. |  |
|  | **Is there important uncertainty about how much people value the main outcomes?** | ○ Important uncertainty or variability  ○ Possibly important uncertainty or variability  ○ Probably no important uncertainty or variability  x No important uncertainty or variability  ○ No known undesirable outcomes | The task force did not consider that there was important uncertainty or variability in how much people value the main outcomes. |  |
|  | **Are the desirable anticipated effects large?** | ○ No  ○ Probably no  ○ Uncertain  x Probably yes  ○ Yes  ○ Varies | Retention of skills following CPR training is typically poor. In one randomized trial, training cohorts that did not use CPR feedback devices had a large decrease in CPR performance scores only 7 days after training compared to training cohorts that did receive feedback (67% vs. 90%) {Cortegiani 2017 e0169591}. Similar results were reported at 1-month {Katipoglu 2019 31565794, Smereka 2019 e15995} and 3-months post-training {Zhou 2020 73}. |  |
|  | **Are the undesirable anticipated effects small?** | ○ No  ○ Probably no  ○ Uncertain  x Probably yes  ○ Yes  ○ Varies | Only one study (downgraded secondary to a very high risk of bias) demonstrated any worsening of educational outcomes with the use of CPR feedback devices {Min 2016 158}. |  |
|  | **Are the desirable effects large relative to undesirable effects?** | ○ No  ○ Probably no  ○ Uncertain  ○ Probably yes  x Yes  ○ Varies | Only one study (downgraded secondary to a very high risk of bias) demonstrated any worsening of educational outcomes with the use of CPR feedback devices (Min 2016 158} |  |
| Resource use | **Are the resources required small?** | ○ No  ○ Probably no  ○ Uncertain  x Probably yes  ○ Yes  ○ Varies | CPR Feedback devices are becoming more readily available in the educational environment. There have been no studies examining the cost-benefit of these types of devices |  |
| **Is the incremental cost small relative to the net benefits?** | ○ No  ○ Probably no  x Uncertain  ○ Probably yes  ○ Yes  ○ Varies | There have been no cost-benefit analyses done around the use of these devices in CPR training, nor is there evidence on how training with these devices affects performance during real resuscitations or on patient outcomes. However, most studies indicate improved performance and retention of CPR skills when these devices are used for training. |  |
| Equity | **What would be the impact on health inequities?** | ○ Increased  ○ Probably increased  x Uncertain  ○ Probably reduced  ○ Reduced  ○ Varies | No studies examined the effect on equity of training with CPR feedback devices. | It is likely that systems with more resources will use these devices more frequently in training. |
| Acceptability | **Is the option acceptable to key stakeholders?** | ○ No  ○ Probably no  ○ Uncertain  x Probably yes  ○ Yes  ○ Varies | No evidence on acceptability of these devices was reviewed. However, the general feedback literature suggests that learners are always interested in more objective feedback on their performance. |  |
| Feasibility | **Is the option feasible to implement?** | ○ No  ○ Probably no  ○ Uncertain  x Probably yes  ○ Yes  ○ Varies | We reviewed no empirical data around feasibility of training with these devices. However, they are becoming more and more common in practice around the world. |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| RecommendationQuestion: | | | | | |
| **Balance of consequences** | Undesirable consequences clearly outweigh desirable consequences in most settings | Undesirable consequences probably outweigh desirable consequences in most settings | The balance between desirable and undesirable consequences is closely balanced or uncertain | Desirable consequences probably outweigh undesirable consequences in most settings | Desirable consequences clearly outweigh undesirable consequences in most settings |
|  | ○ | ○ | ○ | x | ○ |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of recommendation** | We recommend against offering this option | We suggest not offering this option | We suggest offering this option | We recommend offering this option |
|  | ○ | ○ | x | ○ |
| **Recommendation** | We suggest the use of feedback devices that provide directive feedback on compression rate, depth, release, and hand position during CPR training (weak recommendation, low certainty evidence). If feedback devices are not available, we suggest the use of tonal guidance (examples include music or metronome) during training to improve compression rate only (weak recommendation, low certainty evidence). | | | |
| **Justification** | * In making this recommendation, the EIT Task Force noted that there have been a number of RCTs examining this topic in simulated settings but none examining patient-related outcomes. These studies have shown positive effects on retention of CPR skills, at least in the short term with one very low quality study suggesting harm. * We recognize that effective feedback devices are only part of an efficient CPR educational strategy. | | | |
| **Subgroup considerations** |  | | | |
| **Implementation considerations** | There is no evidence on effects on health equity, feasibility, cost-effectiveness, or acceptability of these devices. More research is needed in these areas. | | | |
| **Monitoring and evaluation** | As above, more studies are needed on implementation, integration with optimal instructional design techniques and on their effect on long-term retention, actual performance and patient outcomes. | | | |
| **Research possibilities** | * Although there are a number of studies that demonstrate improved CPR performance both immediately after training with a feedback device and short-term retention of CPR skills post-training, only two studies examined the effect of feedback devices on long-term retention and none looked at patient outcomes. * The use of feedback devices is likely an important component of CPR training and how it should be integrated with other instructional design elements such as mastery learning and distributive practice needs to be better defined. * It remains unclear how best to use these devices, how they interact with instructors and how timing of feedback may impact learning and retention. | | | |

**References**

Baldi, E., Cornara, S., Contri, E., Epis, F., Fina, D., Zelaschi, B., Dossena, C., Fichtner, F., Tonani, M., Di Maggio, M., Zambaiti, E. and Somaschini, A. (2017). "Real-time visual feedback during training improves laypersons' CPR quality: a randomized controlled manikin study." CJEM **19**(6): 480.

Cortegiani, A., Russotto, V., Montalto, F., Iozzo, P., Meschis, R., Pugliesi, M., Mariano, D., Benenati, V., Raineri, S. M., Gregoretti, C. and Giarratano, A. (2017). "Use of a Real-Time Training Software (Laerdal QCPR®) Compared to Instructor-Based Feedback for High-Quality Chest Compressions Acquisition in Secondary School Students: A Randomized Trial." PloS one **12**(1): e0169591.

Griffin, P., Cooper, C., Glick, J. and Terndrup, T. E. (2014). "Immediate and 1-year chest compression quality: effect of instantaneous feedback in simulated cardiac arrest." Simulation in healthcare : journal of the Society for Simulation in Healthcare **9**(4): 264.

Hafner, J. W., Jou, A. C., Wang, H., Bleess, B. B. and Tham, S. K. (2015). "Death before disco: the effectiveness of a musical metronome in layperson cardiopulmonary resuscitation training." J Emerg Med **48**(1): 43-52.

Katipoglu, B., Madziala, M. A., Evrin, T., Gawlowski, P., Szarpak, A., Dabrowska, A., Bialka, S., Ladny, J. R., Szarpak, L., Konert, A. and Smereka, J. (2019). "How should we teach cardiopulmonary resuscitation? Randomized multi-center study." Cardiology journal. PMID: 31565794

McCoy, C. E., Rahman, A., Rendon, J. C., Anderson, C. L., Langdorf, M. I., Lotfipour, S. and Chakravarthy, B. (2019). "Randomized Controlled Trial of Simulation vs. Standard Training for Teaching Medical Students High-quality Cardiopulmonary Resuscitation." West J Emerg Med **20**(1): 15.

Min, M. K., Yeom, S. R., Ryu, J. H., Kim, Y. I., Park, M. R., Han, S. K., Lee, S. H., Park, S. W. and Park, S. C. (2016). "Comparison between an instructor-led course and training using a voice advisory manikin in initial cardiopulmonary resuscitation skill acquisition." Clin Exp Emerg Med **3**(3): 158.

Smereka, J., Szarpak, L., Czekajlo, M., Abelson, A., Zwolinski, P., Plusa, T., Dunder, D., Dabrowski, M., Wiesniewska, Z., Robak, O., Frass, M., Sivrikaya G, U. and Ruetzler, K. (2019). "The TrueCPR device in the process of teaching cardiopulmonary resuscitation: A randomized simulation trial." Medicine **98**(27): e15995.

Wagner, M., Bibl, K., Hrdliczka, E., Steinbauer, P., Stiller, M., Gröpel, P., Goeral, K., Salzer-Muhar, U., Berger, A., Schmölzer, G. M. and Olischar, M. (2019). "Effects of Feedback on Chest Compression Quality: A Randomized Simulation Study." Pediatrics **143**(2). PMID 30700565.

Wilson-Sands, C., Brahn, P. and Graves, K. (2015). "The Effect of Instructional Method on Cardiopulmonary Resuscitation Skill Performance: A Comparison Between Instructor-Led Basic Life Support and Computer-Based Basic Life Support With Voice-Activated Manikin." Journal for Nurses in Professional Development **31**(5): E1.

Zhou, X.-L., Wang, J., Jin, X.-Q., Zhao, Y., Liu, R.-L. and Jiang, C. (2020). "Quality retention of chest compression after repetitive practices with or without feedback devices: A randomized manikin study." The American journal of emergency medicine. 38(1):73-78