Review of: "Development of a Curriculum for Emergency Physicians to Teach Transesophageal Echocardiography for Cardiac Arrests: A Kern Six-Step Model"

Leander De Mol[1]

1 Ghent University

I must commend the author for their thorough work; an understanding of the work that goes into developing a training program or curriculum is crucial to achieve a satisfactory result. Specifically, the author discusses Kern's model for curricular development with the goal of teaching Emergency Physicians (EPs) Transesophageal Echocardiography (TEE) for the management of out-of-hospital cardiac arrests (OHCA).

There are some points where I have some comments or suggestions that may help to improve the manuscript.

1. It may be interesting to note that there is a fourth edition of the book 'Curriculum Development for Medical Education': Thomas, P. A., Kern, D. E., Hughes, M. T., Tackett, S. A., & Chen, B. Y. (Eds.). (2022). *Curriculum Development for Medical Education: A Six-Step Approach* (4th ed.). Johns Hopkins University Press, ISBN 9781421444109.

2. Section 'Problem Identification and General Needs Assessment': It may be interesting to explicitly state the success rate of different OHCA strategies. In addition, it is mentioned that TEE is used 'infrequently' in the introduction, but a clear statement on the frequency of use would better communicate the need for (training in) TEE when managing OHCA.

3. Section 'Targeted Needs Assessment': I agree that the use of complex ultrasound techniques requires both technical skills to acquire images and cognitive skills to interpret them. However, I do not agree that this discussion is part of the targeted needs assessment, but rather the general needs assessment.
   A targeted needs assessment is the 'process by which curriculum developers apply the knowledge learned from the general needs assessment to their particular learners and learning environment'. Thus, it should take into account in which environment the curriculum will be implemented and the type of learners that will be enrolled; curriculum developers assess 'the differences between the ideal and actual characteristics of the targeted learning group and the differences between the ideal and actual characteristics of their learning environment'.[1]
   I completely agree that it is nearly impossible to perform a targeted needs assessment for TEE at the level of a complete college (the ACEP in this case). But each institution will be different; some may have no practitioners who have mastered the technique, others may have multiple experts who are already teaching their residents. I would propose to clarify what a targeted needs assessment is, how curriculum developers (or educational stakeholders) can perform them, and what information can and should be collected.

The mentioned study by Byars et al. is an interesting study to reference, as it does indicate that the targeted learner group can be fast learners when it comes to performing and interpreting TEE images. However, due to the definition of a targeted needs assessment, it cannot provide this required information for all institutions.

1. Section 'Goals and Objectives': Again, it is difficult to provide all readers with specific goals that they should incorporate in their curricula.

   I believe that, if a curriculum is developed specifically for TEE, the other aspects of cardiac arrest management are not part of these goals. Rather, specific goals should be set (e.g., residents are able to acquire the first image in X seconds and can identify the pathology in Y seconds), and the downstream effects of this curriculum should be that OHCA management is improved (which is a part of evaluation).

   As such, I feel that the inclusion of recognizing and rectifying CPR performances is not necessarily a part of a TEE curriculum. If this is the case, TEE training should be part of a greater OHCA-management curriculum, where multiple goals can be included and evaluated.

2. Section 'Goals and Objectives': I completely agree that EPs should be able to train in TEE, use it in clinical situations, and retain this skill. However, skill decay is an issue and should be acknowledged. This decay will be less apparent in EPs who perform TEE frequently, but it is difficult to enforce a fixed number of performances in any situation (after all, clinical education and clinical practice is dependent on the cases that are presented to the clinician). It may be prudent to inform readers that refresher courses will be necessary to maintain proficiency levels in learners.

3. Section 'Goals and Objectives': This 'train the trainer' feels somewhat out of place to me. I wonder if 'peer-assisted learning' fits your idea better, since you mention EPs teaching other EPs. I am not convinced that didactic education should be part of any clinical curriculum. After all, it is possible that EPs who participate in your curriculum graduate with perfect skill sets regarding TEE and teaching others. However, will their students graduate with perfect teaching skills? How will they train their students? And so on, and so on. Since the goal of the curriculum is to train TEE image acquisition and interpretation, I feel it is somewhat dangerous to state that all graduating EPs should be able to teach others.

   Another problem that should be noted here is that while graduating EPs may be able to teach others, the modality on which they train (the educational strategies) will differ; they may not always have access to the same simulators, and training on patients is not acceptable (especially not in OHCA scenarios).

4. Section 'Educational Strategies': While this section provides curriculum developers a wide range of possibilities, it is not always easy to discern what type of intervention is discussed for either cognitive or technical skills. It may be better to discuss both types of skills separately and discuss the combination of both at the end.

   Another point here is the mention of SDOTs. While they will provide invaluable information regarding the learner, I disagree that these are teaching modalities. Rather, they are assessment tools, used to evaluate learners either in simulated or in real environments. As such, this is one of the instances where steps influence each other. Validity refers to what educators do with the assessment scores, not that an educational method using the assessment tool is efficient or effective.[2] As a result, I believe that the paragraph discussing SDOTs may be better suited for inclusion in the 'Evaluation' section, while the use of simulation-based training is of course warranted in 'Educational Strategies'.

The same can be said of the paragraph discussing the formative and summative evaluation. Once again, the education strategy will require evaluation of participant skills (either based on written tests for cognitive skills or observational assessments for psychomotor skills), as training requires direct feedback to be effective. But the way in which assessment procedures are carried out is more linked to the evaluation of the learners and the curriculum.

5. Section 'Educational strategies': Regarding the availability of TEE simulators, I completely agree. EPs should be able to train when they have these opportunities. However, simulators may require technical personnel, and the provision of feedback is also an important aspect of training. I wonder if it would not be possible to include a paragraph discussing who will be responsible for training, observation, and feedback. Do we require trainers to be medical doctors? How much experience do they need to possess?

The inclusion of 'extracurricular' content in this paragraph is valuable, as medical experts should be able to do more than the bare minimum. Since it is discussed here, I feel that this goal should also be included in 'Goals and Objectives' as a secondary endpoint, especially since this is still training and requires resources. As such, the need for curricular support applies to this stage as well.

It may be interesting to refer to simulation-based mastery learning (SBML), where learners are required to achieve certain standards before progressing to the next training stage.[3] These additional views can be that next stage.

1. Section 'Implementation': I completely agree with the content of this section; the implementation stage is when we begin to train our learners and evaluate the feasibility of the planned curriculum. I especially appreciate that you mention the piloting of the program, as this ties forward to 'Evaluation.'

However, as I mentioned in comment #3, the identification of resources should have already been done during the 'Targeted Needs Assessment,' as this step evaluates the learning environment in which the curriculum will take place. Once again, Kern's steps influence each other.

1. Section 'Evaluation': When discussing the evaluation of educational programs, I would like to point you towards Kirkpatrick's model, in which programs are evaluated in four levels (Reaction, Learning, Behavior, and Results). The level Behavior fits perfectly with your discussion regarding the use of TEE in clinical situations. Reaction fits with the discussion on formative program evaluation, and Results fits with your discussion on summative program evaluation. This discussion will also need to include the expected outcome of improved TEE use in clinical practice: improved OHCA management and survival rates.

   Once again, the idea of 'train the trainer' is an attractive idea, but I am unsure if we should expect all graduates of TEE curricula to train others, as you may lose control over the educational process in the long term.

   I appreciate that you refer to 'Educational strategies' when discussing assessment procedures, as I explained in comment #7.

In conclusion, I agree with the author in that a dedicated training curriculum for TEE is necessary, and that its development will be difficult. This paper will undoubtedly help educators in developing curricula, thanks to the in-depth description of Kern's model, combined with relevant references with additional information. Although I interpret some of the steps differently and disagree that the inclusion of a 'train the trainer' methodology should be mandatory, this paper

does provide readers with a clear overview.

References:

1. Thomas PA, Kern DE, Hughes MT, Tackett SA, Chen BY, eds.*Curriculum Development for Medical Education: A Six-Step Approach*. 4th ed. Johns Hopkins University Press; 2022.

2. American Educational Research Association, American Psychological Association, National Council on Measurement in Education, Joint Committee on Standards for Educational and Psychological Testing (U.S.). *Standards for Educational and Psychological Testing*. American Educational Research Association; 2014.

3. McGaghie WC. Mastery learning: It is time for medical education to join the 21st century.*Academic Medicine*. 2015;90(11):1438-1441. doi:10.1097/ACM.0000000000000911