

## Review Article

# Impact of Evidence Based Medicine on Medical Education, Practice and Research

Hossam Hamdy

College of Medicine & Medical Sciences,  
Arabian Gulf University, Manama, Bahrain

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**ABSTRACT**

This review article presents Best Evidence in Medical Education (BEME) as a concept; approach to education and research and as an organization. It refers to the lessons learnt from teaching and practicing Evidence Based Medicine (EBM) and the difficulties which could be encountered in medical education particularly

searching for the evidence and how to evaluate its quality. It also emphasized on the importance of continuing training of teachers. The review discusses the importance of conducting systematic reviews and the ongoing systematic reviews by six Topic Review Groups (TRG) registered under the BEME organization.

KEY WORDS: evidence, medical education

**Impact of Evidence Based Medicine on Medical Education, Practice and Research**

From the early 90's the paradigm of Evidence Based Medicine (EBM) has rapidly influenced medical practice and training all over the world. In medical education there is a remarkable difference in attitude between University staff as teachers, clinicians or researchers. As clinicians or researchers, we critically read the new literature, think of new approaches and theory, look for empirical verification, submit our work to the critique of others through vigorous peer review, are keen on the latest development in our profession, and we replace existing habits by new ones when appropriate. As teachers, we do the things we do because that is the way we have been trained ourselves and the way it has been done for many years, and even centuries<sup>[1]</sup>.

In medical schools few medical teachers read the literature on medical education and some are not even aware that such literature exists. In a survey at a medical school with innovative curriculum, it was found that out of 150 faculty members, only 10 read regularly a medical education journal<sup>[2]</sup>. These ten are in charge of the curriculum in the college.

Almost 10 years after, the establishment of the EBM move, a similar paradigm started to evolve in medical education. It is based on the principles of EBM, that increasing incorporation of evidence based medicine in the day-to-day clinical practice, may enhance quality and minimize error. We hold

the same anticipation for Evidence Based Education and Best Evidence Medical Education (BEME).

In 1999 a number of sessions at the Association for Medical Education in Europe Conference in Sweden were devoted to discuss the use of evidence in medical education. Rapidly, the BEME movement started to influence medical education. Its definition was refined and adopted by the BEME Steering Group in London, December 1999 which stated that it is "The implementation, by teachers in their practice, of methods and approaches to education based on the best evidence available."

BEME is an international collaboration to evaluate the effectiveness of different strategies in medical education using systematic reviews. The conduct of such reviews is time and resource intensive and methodologically challenging. A BEME Steering Committee having internationally known educationalists is active in developing this initiative.

BEME is not just a database of systematic reviews, it also aims at creating a culture of using the Best Evidence in Medical Education, improving the evidence base by preparing and maintaining high quality systematic reviews, developing methods of searching which are user friendly, disseminating best available evidence and stimulating high quality research.

In medical education, we are moving from opinion-based teaching to evidence-based teaching<sup>[3]</sup>. This is not an either/or position, but it is a continuum (Fig. 1).

Address correspondence to:

Dr. Hossam Hamdy, Professor of Surgery and Dean, College of Medicine & Medical Sciences, Arabian Gulf University, P.O. Box: 22979, Manama, Bahrain. E-mail: meddean@agu.edu.bh

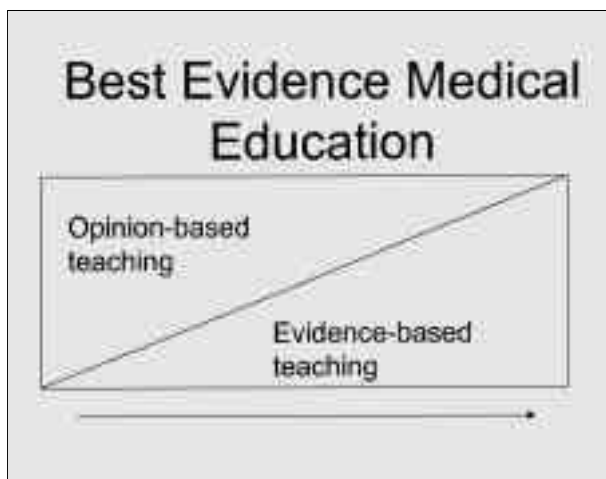


Fig. 1: Best evidence medical education can be represented as a continuum between 100% opinion-based and 100% evidence-based education.



Fig. 2: The BEME approach

BEME encourages the use of trustworthy research findings to replace personal opinions as a basis for decision-making in education for health professionals. The need for scrutiny in education is the same as in clinical practice. BEME operates at two levels: (1) to utilize existing evidence from worldwide research and literature on education and associated subjects and (2) to establish sound evidence where existing evidence is lacking or of a questionable, uncertain or weak nature.

The emphasis in BEME is on the user by translating educational research into practice and educational decisions at the level of the teacher, learner (micro decisions) and educational institutions (macro decisions)<sup>[4]</sup>.

Many lessons as listed below have been learnt over the years from teaching and practicing evidence-based medicine that may be helpful in the development of evidence-based medical education<sup>[5]</sup>:

1. Reviewing/synthesizing evidence is more complex and complicated than at first imagined and needs international collaboration and cooperation, specialized registers.

2. Reviewing/synthesizing evidence can be done in a systematic, organized fashion in which international collaboration, cooperation, and volunteerism are not only possible, but work well.
3. Resources are necessary at multiple levels for this work to be done well.
4. Specialized registers or databases of primary studies can be extremely useful.
5. There are multiple audiences (or constituencies) with differing needs.
6. Translating evidence into practice can be more difficult than generating evidence.
7. Secondary (or even tertiary) databases may be more efficient and useful than primary databases for accessing good quality evidence in "real-time".
8. Evidence alone is insufficient for making good decisions; context is critical.
9. High quality systematic reviews can help to improve the quality of future primary research.
10. How evidence is framed and communicated can influence decisions.

Concerns about BEME have been raised. Having the evidence of the effectiveness or ineffectiveness of a teaching or assessment method is not sufficient to make a positive significant change in the educational process or outcome. The reason is that important educational decision usually takes place at the level of the teacher and in the classroom and training sites (micro decisions).

In order for BEME to have a significant impact on the education and training of health professionals, teachers should be educated, trained and their teaching capabilities developed. Teacher training and self-learning should take place hand in hand with the methodological and organizational development of the BEME movement.

### How to Practice BEME

The following scenario is an example of how a BEME approach is practiced:

"A significant trend in recent years has been a move to problem-based learning (PBL) as an educational strategy. You are a member of a committee in a medical school which has to-date adopted a more traditional approach. Your committee is to decide whether the school should move to a PBL approach. What evidence would you show to help your committee make a decision?" In order to find the answer to this question BEME recommends the following steps (Fig. 2):

- a. Define the educational question. This is a key step in searching for the evidence or developing the evidence (primary research or systematic review). The question should be focused, and

should consider the characteristics of the study population, educational context, educational intervention or correlation and outcome measurements.

- b. Looking for the evidence. Databases are not well developed in medical education. In addition to what is available on Medline, or Pubmed, other databases like SPECTR and TIME are more specific to education, but not comprehensive (Appendix 1). BEME has identified 136 journals which could be searched when looking for evidence ([www.bemecollaboration.org/review\\_action.htm](http://www.bemecollaboration.org/review_action.htm)). Systematic searching in medical education is particularly challenging given that the evidences are widely dispersed and very often poorly indexed.
- c. Evaluate the evidence. "Best Evidence" implies a comparative assessment with standards agreed in advance. The process for deciding what is "best" should be as objective and reproducible as possible. "Best" is relevant to the educational situation and context. Critical appraisal of the evidence should consider issues of validity, relevance, importance, context specificity, type of research (quantitative/qualitative) and methods of outcome measurements.

For judging the evidence, the Scottish Intercollegiate Guidelines Network (SIGN) classified levels of evidence, from "1++" high quality meta-analyses systematic review of randomized controlled trials (the most powerful evidence) to "4" expert opinion which is the weakest evidence (Table 1).

- A set of criteria was proposed to assist the medical teacher to grade the evidence, such as the quality, utility, extent, strength, target and setting of the research "QUEST"<sup>[3]</sup>. Experience in the application of the "QUEST" indicated that it has many shortcomings, particularly in definition of terms like utility, extent and strengths. BEME has developed coding sheets for data extraction and quality assessment of articles. The BEME web page is under trial in the current BEME Systematic Review ([www.bemecollaboration.org](http://www.bemecollaboration.org)).
- d. Based on the quality of the available evidence the user will make a judgment whether the results of the research are applicable to his educational context or not. Finding weak evidence is usually the trigger for initiating a primary research or a systematic review. Conducting a systematic review in medical education is one of the important activities of the BEME Collaboration. Systematic reviews provide summaries of what we know and do not know, that are as free from bias as far as possible. Glass (1976) was the first to describe

**Table 1**

Levels of Evidence

The SIGN (Scottish Intercollegiate Guidelines Network) System

1++	High quality meta analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well conducted meta analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1-	Meta analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
2++	High quality systematic reviews of case-control or cohort or studies High quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is casual
2+	Well conducted case control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal
2-	Case control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not casual
3	Non-analytic studies, e.g. case reports, case series
4	Expert opinion

the technique of meta-analysis. He detailed a method of reviewing biases and random errors through extensive and systematic searching of the literature in preference to the selection of papers to augment one line of argument<sup>[6]</sup>.

The BEME systematic review is an overview of a clearly formulated question that uses explicit methods of systematically assembled, critically analyzed and appropriately synthesized evidence relevant to the topic. The BEME search approach is inclusive and open to a wide range of evidence including gray literature.

At the moment several pilot systematic reviews are launched by the BEME organization aiming at developing and improving the methodology for conducting systematic reviews in medical education and to find evidence for important questions in medical education. International, multi-centric topic review groups are collaborating to develop systematic review protocols and conduct the studies. Currently six systematic review lead centers are registered with the BEME organization and their protocols are as follows: (1) University of Miami, USA - features and usage of high-fidelity simulations that facilitate effective learning; (2) University of Westminster, UK - impact of inter-professional education; (3) Barcelona, Spain - feedback in assessment; (4) Arabian Gulf University, Bahrain - predictive values of assessment measurements obtained in medical schools and future performance in medical practice; (5) Lisbon, Portugal - skills assessment and (6) Birmingham, UK - web-based clinical teaching.

The future success of BEME as an educational philosophy, approach and organization will depend on:

1. Creating an ethos in educational institutions that evidence is better than hearsay or tradition.
2. Spreading the BEME culture through training of the teachers on how to practice evidence based education and develop critical appraisal skills.
3. Encouraging cooperation between different medical education groups, such as, accrediting bodies, educational institutions, government, and professional training organizations in developing and using evidence.
4. Identifying and directing educational researches and systematic reviews to assess where the evidence is lacking or weak, e.g., effectiveness of PBL.
5. Improving and developing databases of educational researches, user friendly searching and retrieval mechanisms.
6. Improving the methodology of systematic reviews in medical education.

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## APPENDIX 1

### Databases and Websites

- SPECTR: Social, Physiological, Educational, Criminology, Trial Register 10,000 records
- TIME: Topics in Medical Education 10,000 medicine
- Best Evidence Medical Education homepage <http://www.bemecollaboration.org/>
- Cochrane Collaboration homepage. <http://www.cochrane.org>
- Cochrane Effective Practice and Organization of Care Group homepage [http://www.abdn.ac.uk/public\\_health/hsru/epoc/index.hti](http://www.abdn.ac.uk/public_health/hsru/epoc/index.hti)
- Campbell Collaboration homepage <http://campbell.gse.upenn.edu/index.html>
- The Evidence for Policy and Practice Information Co-ordinating Centre <http://eppi.ioe.ac.uk/PEPBL/Project>
- <http://www.hebes.mdx.ac.uk/teaching/Research/PEPBL/index.htm>
- British Educational Research Association: <http://www.bera.ac.uk/index.html>
- PubMed: <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi/>
- PubMed: <http://www.pubmedcentral.nih.gov/>
- ERIC Clearinghouse: <http://searcheric.org/>
- BRS Server at the University of Leeds: <http://brs.leeds.ac.uk/>
- Centre for Medical Education Dundee: <http://www.timelit.org>
- Freely available journals: <http://www.freemedicaljournals.com/>
- Research Search: <http://www.biomedcentral.com/>