Implementation of the Evidence-Based Medicine to Korean Medical Schools

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한국의과대학에서의 근거-중심의학 도입방안 연구

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임기영

의학의 패러다임을 전환시킬 수 있는 새로운 교육방식으로 관심을 모으고 있는 근거-중심 의학 (Evidence-based Medicine)을 소개하고 이를 한국 의학 교육에 적용하기 위한 방법은 무엇인지 살펴보았다. 근거-중심 의학의 핵심 내용은 기존 의학에서 중요한 임상 결정이 주로 병태-생리학적 원리나 개인의 체계화되지 못한 임상 경험, 상급 의사나 전문가의 지시 혹은 자문, 때로는 직감이나 직관에 근거하여 이루어지는 것을 비판하고, 체계적으로 축적된 개인의 임상 경험 위에 입수 가능한 임상 연구 결과들을 탐색하고 평가하여 얻어진 최선의 근거들을 추가하여 이를 바탕으로 임상 결정을 내려야 한다는 것이다. 근거-중심 의학에 대한 부분적 비판이 없는 것은 아니지만, 그 근본 취지와 방법에 대해서는 대부분의 의학교육자가 찬성하고 있으며, 실제로 근거-중심 의학의 동조자가 급속히 확산되고 있는 것이 최근의 추세이다.

미래의 의사들인 의과대학생들의 기본 학습 자체로 근거-중심 의학을 정착시키기 위해서는 의과대학 교육이 시작되는 초반부터 이를 적극적으로 교육해야한다. 이를 위해 임상-전 전반적인 교육과정에서 기본적인 의학통계(biostatistics), 정보 탐색 및 평가(medical informatics & critical appraisal), 그리고 임상 결정 방범론 (clinical decision making) 등 근거-중심 의학을 실행하기 위한 예비과정이 개설되어야 한다. 이러한 예비과정은 정규 학과목으로 개설하는 것이 바람직하며 가능하다면 학교 내에 근거-중심 의학을 교육할 주관 부서나 위원회를 설치하는 것이 좋을 것이다. 또한 근거-중심 의학은 임상 과정 및 졸업 후 전문의 과정 및 보수 교육에 이르기까지 단계별로 교육되고 실시되어야 한다. 임상 과정 이후의 과정에서의 근거-중심 의학은 각 임상 과정별로 실시하는 것이 효과적이며 임상 전 근거-중심 의학을 교육하는 학교 차원의 기구와 임상 각 과 간의 긴밀한 협력이 매우 중요하다.

Key Words: Evidence-based medicine, Implementation, Medical education, Curriculum

1. Description of the problems

Evidence-based medicine (EBM) was officially introduced in 1992 by the Evidence Based Medicine Working Group1 and is rapidly gaining supporters worldwide.2 The Cochrane Collaboration, a multi-center, international project that attempts to synthesize all randomized controlled trials of health care interventions, now consists of an international consortium of workers who conduct an ever-enlarging database by contributing their own randomized trials (includ-
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ding non-English-language trials and negative reports), discoveries of unpublished trials, and meta-analyses. The collected information extends through all branches of medicine, and the resulting comprehensive reviews, called the Cochrane Library, are distributed on CD-ROM and through the Internet (http://www.cochrane.co.uk). The journal Evidence-Based Medicine began to be published from 1995 by the American College of Physicians and the British Medical Journal Publishing Group. Several other journals for other specialties, including Evidence-Based Health Policy and Management, Evidence-Based Cardiovascular Medicine, Evidence-Based Nursing and Evidence-Based Mental Health, are being published or will be published.¹

Many medical schools and hospitals are teaching EBM skills to undergraduate medical students or residents, and the numbers are increasing so rapidly that Sackett, who is one of founders of EBM, claims that teaching the practice of EBM is now the issue of how, rather than whether.³ However, EBM is novel to Korean medical society yet. There is no report of Korean medical schools or hospitals teaching or practicing EBM. To the present author’s knowledge, no Korean medical school has the course of bio-statistics, literature searching skills or critical appraisal skills in their undergraduate curriculum. If EBM is really a paradigm shift in medical practice and an essential requirement to prepare future physician as the advocate of EBM claims¹, Korean medical schools should no longer ignore it, and should seriously consider the need to implement the EBM to their curriculum. So it would be a meaningful approach to try to answer following questions.

1. Should we or should we not introduce EBM to the medical education in Korea?

2. If we should introduce EBM, when will be the best time? During the undergraduate curriculum or during the resident training course? Pre-clinical years or clinical years?

3. If we introduce the EBM to undergraduate curriculum, what can be the most desirable methods to do it? Who should control the EBM course? Department or central unit? How can we make the best of it?

2. Should we introduce evidence-based medicine?

1) In favor of evidence-based medicine

Sackett and his colleagues defined EBM as follows⁴:

Evidence-based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of EBM means integrating individual clinical expertise with the best available external clinical evidence from systematic research.

The advocates of EBM proclaim it as a “paradigm shift” as they believe that it will change the way of medical practice fundamentally. They criticize conventional medicine as “autocratic”, “authoritarian,”⁵ or “eminence-based” medicine, in which clinical decisions are usually made on the basis of intuition, common sense, unsystematic personal experience, anecdotal evidence, or help from authority. They claim that the seniority or rank of physician plays a major role in clinical decision making in conventional medicine. They also point out that conventional medicine usually recognized pathophysiologic rationales (untested pathophysiology reasoning) as sufficient grounds for clinical decision making, that may in fact be incorrect, leading to inaccurate predictions about the performance of diagnostic tests and the efficacy of treatments.¹

Conventional medicine is based on the bio-medical
model that reduces all diseases to structural or biochemical dysfunction. Within this framework, causes are perceived as leading inevitably rather than probabilistically to their consequences, and chance and ambiguity have a very small role in explication of pathophysiologic mechanisms and in diagnostic reasoning. However, it is now undeniable that diseases result from multiple factors rather than from single cause and there is much uncertainty in the development and progress of disease. There are false-positives and false-negatives in diagnostic tests, and most treatment methods have both risks and benefits. The changing patterns of medical practice also affect clinical decision making process heavily. For example, patient’s autonomy is emphasized more than ever, and his/her preference becomes an important factor in the clinical decision making.

The managed care system and concerns about fair and efficient distribution of medical resource also influence clinical decision-making. Clinicians must know how to balance their duty to maximize the health of populations at the lowest resource use. These changes in the context of clinical practice require physicians to refer to the most up-to-date clinical trial data in their decision making process.

However, the pattern of conventional clinical practice fails to meet this basic requirement of making decision based on the best available evidence. According to the direct observation of Covell et al., general physicians usually identified up to 16 needs for new, clinically important information in a typical half-day of practice. However, only 30 percent of these information needs were met in the clinics and offices where the clinicians worked, and most of this knowledge was obtained not by searching textbooks and journals but by asking colleagues. This study shows that many important clinical decisions are made on the basis of physician’s own intuition, reflection on past experiences or unverified opinions of senior physicians.

Proponents of EBM believe that it is the best strategy to meet the changing needs of contemporary medicine. Contrary to conventional medicine, the decision makings in EBM are dependent on the “best available” clinical evidence from systematic research. The systematic research here usually means randomized controlled trial. The advent and proliferation of randomized controlled trials over the last 30 years and the development of meta-analysis as a method of summarizing the results of a number of randomized trials made the practice of EBM possible.

2) Against evidence-based medicine

Ever since the introduction of EBM, it has raised much criticism. Some critics claim that it pays too much attention to epidemiology and not enough to clinical experience and reasoning. Others call it a “fad” with no evidence to support its use. But more serious criticism has its finger on the evidences that EBM uses.

Criticism 1. Clinical practice is as much art as science: Evidence-based medicine pays too much attention to epidemiology

In introducing EBM, its advocates strongly emphasized the use of scientific evidence supported by systematic research, and devaluated previous clinical experience. This gave an impression that only scientific evidence and clinical guidelines based on that scientific evidence should be the main, if not the only, determining factor in clinical decision making. Naturally, this brought many refutations. Kenny argued that ‘clinical practice is not a science but an endeavor that uses science. Good science is necessary but insufficient for good practice. Scientific knowledge is not the only relevant knowledge; scientific and biologic goods are not the
only goods taken into account. Clinical practice is both science and art.” Establishing a good doctor-patient relationship, understanding of the psychological and social factors that may affect the clinical course or outcome, and anticipating and solving the problems of non-compliance and other obstacles against successful practice are components of clinical practice as an art. Critics of EBM worry about possible neglect of the art component by over-emphasizing so-called scientific evidence.

As a response to this criticism, advocates of EBM contended that these views represent a misunderstanding of the philosophy and intent of EBM. They explained that systemic reviews are meant not to replace clinician decision making but rather to enhance it. 10,11

Levin quoted Haynes that “Maybe we should have called it ‘evidence-in-support-of-medicine’. . . What we are trying to say is that medical decisions should be based on the physician’s clinical experience as well as any tests ordered, on the patient’s wishes and preferences, then using the best evidence from research to guide our choices. . . I don’t think anyone in his or her right mind would argue against paying attention to evidence from research. . . Most of the criticism have to do with our hubris, style, and conviction.” 2

Criticisms 2. Limitations and flaws of the evidence

If the above criticism stemmed from misunderstanding, as the advocates of EBM claim, the criticism of Feinstein and Horwitz went directly to the problems of evidence itself. 8 They pointed out that the evidence of EBM has following problems.

1. There is not enough evidence to practice EBM. Evidences of EBM are supplied by randomized trials. However, randomized trial is not possible for the prophylactic therapy of “risk” factors and many other clinical decision making issues. In some pathophysiologic principles, randomized trial would be inappropriate or unethical. The proponents of EBM said that “if no randomized trial have been carried out, we must find the next best available evidence and work out from there.” 12 However, if we include other researches such as basic science researches, EBM may lose much of its novelty as an inductive, probabilistic approach to medical practice.

2. The data of randomized controlled trials do not include many types of treatment or patients seen in the real clinical practice. Many randomized trials enroll a restricted population confined to patients expected to be highly responsive to treatment. Both too frail and too healthy patients are often excluded from randomized trials.

3. Most randomized trials omitted “soft” data such as the types of symptoms, severity of symptoms, auxometry (rate of growth) of illness, and severity of the co-morbidity produced by concomitant associated diseases. These soft data usually plays important role in the real clinical decision making process.

4. Randomized trials often omit clinical details that may be crucial for many therapeutic decisions. Among those details are responses to previous therapeutic agents, short-term response to the remedial therapy, ease of regulation when the dose of therapy must be “titrated”, difficulty in compliance with therapy and reasons for non-compliance, psychic or non-clinical reasons for impaired functional status, the social support system available at home and elsewhere, the patient’s expectation and desires for therapeutic accomplishment, and patient’s psychological state and preferences.

5. There can be a significant lag time in diffusion and uptake of new evidence. Meta-analysis of randomized trials may take long time; yet many clinical decision-making need latest information immediately.
6. In certain areas, there can be overwhelming information (evidence), and there may be a lack of consensus among the clinicians. Moreover, inappropriate use of evidences by guideline providers (for example, the Cochrane collaborators) or consumers of information (clinicians) may result in wrongful clinical decisions.

3) Evidence-based medicine: an essential ‘add-on’ course

Regarding EBM as a “paradigm shift” may be a hubris or over-conviction by the proponents of it. Much of the criticism on EBM may be a reaction to the annoying style of the EBM proponents. Importance of clinical experience and basic pathophysiologic principle should not be ignored or devaluated. It is also true that much of the evidence in EBM has a flaw to be a gold standard and there is not enough evidence in many field of clinical medicine. Nevertheless, we cannot deny the need of EBM as a new and appropriate method of practice in rapidly changing context of clinical medicine. The core concept and basic skills of EBM such as acceptance of uncertainty, regular consultation to original literature, efficient evidence searching from the overwhelming amount of information, and critical appraisal of evidence to make a correct clinical decisions are of crucial importance for the clinical practice in the coming century. The limitation and flaw of the evidence itself can be solved by the rapid development of research and meta-analysis methodology.

It may be too radical to change the whole curriculum to EBM format, but it should be an essential “add-on” course in medical education to prepare future physicians.

3. When should we introduce the evidence-based medicine?

According to the Norman and Shannon’s review article, it is more effective to teach EBM to undergraduate medical students than to residents. Instruction in critical appraisal skill can result in sizeable gains in knowledge among undergraduate medical students (mean gain 17.0%; standard deviation [SD] 4.0%). However, the effect of such instruction is much smaller among residents (mean gain 1.3%; SD 1.7%). Furthermore, there is no indication that the instruction in critical appraisal skill results in a change of residents’ behavior with respect to the critical use of the literature. Norman and Shannon pointed out the course credit or intensive evaluation in the undergraduate critical appraisal course may explain the difference of knowledge gain between two education levels. Although, it is more effective to teach EBM during the undergraduate level, their review also indicates that there is no evidence that the gains in knowledge demonstrated in undergraduate courses can be sustained into residency and practice and eventually translated into improved patient outcome. Norman and Shannon suggested the integration of EBM as an essential and continuing component of undergraduate and postgraduate program to get larger and sustained effects.

According to Sackett and Parkes, critical appraisal is just one element of EBM process. The practice of EBM requires a much larger process that begins with the patient and involves asking answerable questions, finding the best evidence, assessing it, integrating the results of that assessment with the patient’s unique biology and expectations, and evaluating one’s performance (Table 1). To meet these multiple requirements, EBM should be taught at multiple stages in pre-clinical, clinical, and
Table 1. 5 Processes of EBM Practice

1. Convert the need for clinically-important information about diagnosis, prognosis, therapy, and other clinical and health care issues into answerable questions.
2. Track down, with maximum efficiency, the best evidence with which to answer them.
3. Critically appraise that evidence for its validity (closeness to the truth) and usefulness (clinical applicability).
4. Integrate the results of this appraisal with our clinical expertise and apply the result in our clinical practice.
5. Evaluate our performance.

postgraduate curricula, and should be incorporates into the everyday function of the clinical teams in which learners gain the knowledge, skills, and attitudes that shape their clinical performance.

Basic bio-statistics and efficient literature searching skills can be successfully taught in pre-clinical years. Skills to convert information needs to answerable clinical questions and critical appraisal skills may be best taught at the end of the pre-clinical years to minimize time gap between knowledge gain and practice. Clinical practice of EBM, including the application of the best available evidences to patient problem and performance evaluation, should be continuously exercised during the clinical and postgraduate years.

4. How to introduce evidence-based medicine?

1) Centralized vs. departmental control of EBM course

Norman and Shanon show that all the schools reviewed in their article run EBM programs less than 18 hours, and the main format of teaching is short burst of classroom instruction. In residency programs, weekly journal club or seminar is the most popular form of EBM. However, as Sackett pointed out, more intense and continuous EBM program is required to get better and sustained effect. The course credits and intense evaluation are also required to get more knowledge gain from the EBM course. It means that the EBM course should be a formal and regular part of the undergraduate curriculum, and there should be a school body planning, executing, and evaluating the EBM courses.

The EBM courses should be delivered in different formats and different phases of undergraduate curriculum. Basic skills to practice EBM, such as biostatistics, literature searching skills, and critical appraisal skills, should be taught as a regular, semester long course during the pre-clinical curriculum. And clerkship courses should provide students plenty of opportunities to exercise EBM with real patient problems. As a result, the whole EBM course requires a heterogeneous team of faculty. Basic EBM skills should be taught by the team of faculty who specialized in the medical informatics, biostatistics, decision analysis or health service research (i.e., librarians, epidemiologists) in pre-clinical years. And the real practice of EBM should be taught and guided by the clerkship directors of each discipline in clinical years. Communication and cooperation among the pre-
clinical and clinical faculty is essential to ensure smooth transition from the theory to practice of EBM. Organizing the EBM committee with all faculty engaged in EBM education (faculty of the pre-clinical EBM course and clerkship directors) can be an effective solution to promote such communication and cooperation.

2) Preparation for the successful implementation of EBM

Schneider and Eisenberg recommended a number of prerequisites or preparation to ensure a successful introduction of EBM. They are:

1. A foundation in basic computer literacy should be a requirement of entering medical students.

2. Applied medical informatics should be introduced early in the curriculum to increase future physician’s familiarity with the basic information tools of practice (including computerized medical records, retrieving computer-based knowledge resources, and understanding the basics of the Internet).

3. An evidence-based curriculum should include training in health evaluation sciences (such as cost-effectiveness analysis, decision analysis, health service research, and basic statistics knowledge) with an emphasis on practical approaches to drawing inferences from databases and using data to understand the health of populations.

4. The curriculum should introduce a quality improvement paradigm that includes system analytic, process, and outcome assessment modules and introduces methods for critical self-assessment and behavior modification.

5. Interdisciplinary team approaches to learning and studying should be incorporated into the early years of medical school to facilitate broader system-based thinking, conflict resolution, and management skills.

6. The training of medical informaticians should be a priority for medical educators.

7. Academic medical centers should take on the important role of evaluating the software that is applying the medical knowledge base to practice and ensuring that it is sound.

8. Research and teaching about methods for ensuring confidentiality and security of electronic records and communication should be incorporates into medical education.

Only an exhaustive preparation can guarantee the successful implementation of EBM. Medical school should prepare hardware and software needed in EBM well ahead of the implementation of EBM. Securing enough number of computer terminals, high speed Internet connections, electronic and traditional databases, and training of medical informaticians are part of this preparation. Especially, the training of medical informaticians is of great importance as they usually teach literature searching and information management more effectively than many clinical faculty. Making rooms for EBM course in already crowded medical curriculum may be a challenge the curriculum planner should solve. Reduction of the existing lecture hours should be seriously considered.

3) Pre-clinical EBM course

Dorsch et al. introduced a ten-week critical appraisal course for third-year medical student, taught cooperatively by library and clinical department (Department of Medicine) faculty. Although this course is provided in the clerkship course and students meet only once a week for 10 weeks, its learning objectives can be a good reference in preparing pre-clinical EBM course. This course consists of two different parts. First, students learn the information searching skills with the help of library faculty. The learning objectives in this part are as follows:
As a result of the course, students will be able to:
1. Plan strategy for identifying sources of information in the library
2. Recognize when it is/is not appropriate to use Index Medicus, Current Contents, Scientific Citation Index, Medline, the library’s card and online catalogs.
3. Use Medical Subject Headings to construct a search.
4. Find, using indexes and listings, review articles on a clinical topic.
5. Find, using indexes and listings, research studies on a clinical topics.
6. Use Grateful Med software to retrieve articles on a clinical topic from selected database.

Second part of the course, instruction in reading, evaluating research methodology, and statistical analyses in published articles, is provided by medical faculty. Through this course, students will be able to:
1. Select a small number of quality journals to read on regular basis.
   A) Screen out poor or unimportant articles by examining the title, author(s), research site, abstract, and a key methodological point.
   B) Critically appraise any articles that are of interest.
2. Evaluate the worth and usefulness of new clinical information.
   A) Understand and use the concepts of “gold standard”, sensitivity, specificity, positive and negative predictive values, pre-and posttest probabilities, and the likelihood ratios when examining an article on a new diagnostic test.
   B) Understand the importance of an inception cohort, referral pattern, patient follow-up, development of objective outcome criteria, “blinded” assessment, and adjustment for extraneous prognostic factors in an article on prognosis or the clinical course of the disease.
   C) Understand the relative importance of the nine tests for causation.
   D) Understand the importance of random assignment, measurement of clinically important outcomes, patient follow-up, clinical and statistical significance, Type I and Type II errors, power, and the feasibility and generalizability of an article on therapy.

5) Practice of EBM in clinical years

Once students have been exposed to the basic principles of EBM, it can be best learned through practice with ongoing feedback from the faculty and residents during clerkship courses. Various formats of EBM are being adopted in clerkship. Student morning report, lunch conferences, weekly student seminars, and evening sessions are among the approaches in use. In these formats, students usually practice five basic skills of EBM.
1. Building a good question.
2. Carrying out an efficient, thoughtful search for evidence.
3. Choosing the best resources from the research output.
4. Critically appraising the evidence.
5. Applying what has been learned to the patient.

In practicing EBM in real patient care, building a good question is the most important step. The search question should pertain to clinical decisions pivotal to optimal care of the patient, and the group does not know, or disagrees about, evidence-based answers to the questions. A feedback and guidance of faculty and residents are very important. To ensure intensive and continuous practice of EBM during the clerkship course, faculty in the EBM committee (especially, faculty who are engaged in pre-clinical EBM education) should closely co-work with clerkship directors who are responsible for the introduction of EBM and student evaluation in their
own discipline. And in this process, as any other implementation processes of new educational methods, the will and support from the dean and chairmen of department will be very important.

5. Conclusion

Although there are criticism on the advocating style of EBM proponents and some shortcomings in the available evidence, it is undeniable that EBM can be a very useful and effective method to practice medicine in the rapidly changing context of clinical medicine. Medical schools in Korea should actively introduce it to their curriculum to educate future physicians. There can be many possible methods to introduce EBM to undergraduate curriculum in terms of the duration of course, time of introduction, operating body, and so on. Non-regular, short-term courses are most widely adopted format of EBM education in North America and Europe. However, literature review shows that an intensive and continuous EBM course is required to ensure more knowledge gain and sustained change in the behavior of clinical practice. Course credits and formal evaluation is a useful strategy to enhance knowledge gain. In this paper, I propose following solution as the best way to implement EBM course to Korean medical schools.

1. EBM should be introduced in medical curriculum as early as possible. A foundation in computer literacy should be a requirement of entering medical students, and basic bio-statistics and literature searching skills should be taught in pre-clinical years.

2. EBM course should be extended over the entire undergraduate and post-graduate course. Students should learn the basic skills and exercise of EBM at multiple levels of medical curriculum.

3. Pre-clinical EBM course should be a part of regular courses and should be taught by faculty who are expert in medical informatics, biostatistics, clinical decision making or critical appraisal. Course credits and formal evaluation is a useful strategy to maximize the educational impact.

4. There should be a central school body planning, executing, and evaluating the pre-clinical EBM courses. Practice of EBM during clinical years can be controlled by the clerkship directors of each discipline. To promote communication and cooperation among the faculty of the pre-clinical EBM course and clerkship directors, organizing the EBM committee can be an effective solution.

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