Jikeikai Med J 2002 ; 49 : 101-13

Special Article

Evidence-Based Medicine (EBM) and the Art of Medicine

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ABSTRACT

We considered present state of an effective verification of medical treatment technology. So we have much attention to Evidence-based medicine (EBM) and the art of medicine. We investigated the concept and practice of EBM thoroughly. There are 8 contents which are a definition of EBM, the reason and important factors of rapid spread of EBM, the actual steps of EBM practice, useful internet site for EBM, levels of evidence, study design, limitation of EBM and Extension of EBM. And we studied the art of medicine. Research evidence and clinical expertise (including art of medicine) were closely connected and indispensable to practice EBM.

(Jikeikai Med J 2002 ; 49 : 101-13)

Key words : evidence-based medicine (EBM), medical technology assessment, meta-analysis, critical appraisal, art of medicine

I. Present State of an Effective Verification of Medical Treatment Technology

According to a report of "consideration committee about a way of a medical treatment technology evaluation", President Takaku (Jichi Medical School, the chairman of committee) et al defined what 'An evaluation of medical treatment technology' is.

On the other hand, medical expense of our country reaches 30.9 trillion yen (1999). There is a few research that verifies whether medical expense is effectively used or not.

And the increase of medical expense goes to 75 times with 30.9 trillion yen with 0.4 trillion yen in past forty years. Against the growth national product (GNP) or the growth domestic products (GDP), medical expense increased from 3 percents to near 8.1 percents and 2.7 times in these 40 years. This tendency is more remarkable in America, Canada, Great Britain than in Japan[1].

We have many problems for medical technology evaluation. They are the needs for standard of treatment, improvement of treatment quality, specialization of treatment and so on. It is Evidence - Based Medicine (EBM) that is most relevant methodology of an evaluation of medical treatment technology and was made an appearance recently[2-3].

EBM remains a relatively young discipline whose positive impacts are just beginning to be validated and it will continue to evolve. This evolution will be enhanced as several undergraduate, post-graduate, and continuing medical education programs adopt and adapt it to their learners' needs.

II. EBM

1. A definition of EBM

EBM is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. And it is the integra-

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tion of best research evidence with clinical expertise and patient values.

EBM, whose philosophical origins extend back to mid-19th century Paris and earlier, remains a hot topic for clinicians, public health practitioners, purchasers, planners, and the public. There are now frequent workshops in how to practice and teach it

But enthusiasm has been mixed with some negative reaction[4-6]. Criticism has ranged from evidence-based medicine being old-hat to it being a dangerous innovation, perpetrated by the arrogant to serve cost-cutters and suppress clinical freedom. As evidence-based medicine continues to evolve and adapt.

A best research evidence is an outcome of a clinically relevant research, often from the basic sciences of medicine, but especially from patient centered clinical research into the accuracy and precision of diagnostic tests (including the clinical examination), the power of prognostic markers, and the efficacy and safety of therapeutic, rehabilitative, and preventive regimens.

The clinical expertise is the ability to use our clinical skills and past experience to rapidly identify each patient's unique health state and diagnosis, their individual risks and benefits of potential interventions, and their personal values and expectations.

The patient values are the unique preferences, concerns and expectations each patient brings to a clinical encounter and which must be integrated into clinical decisions if they are to serve the patient.

When these three elements are integrated, clinicians and patients form a diagnostic and therapeutic alliance which optimizes clinical outcomes and quality of life.

Table 1. Three elements of EBM.

1. Best research evidence
2. Clinical expertise
3. Patient value

Table 2. Four elements of EBM.

1. Best research evidence
2. Clinical expertise
3. Patient value
4. Medical facilities and circumstances

But by medical facilities and circumstances of the hospitals we are limited our medical treatment. So this is added to the elements of EBM.

2. The reasons and important factors of rapid spread of EBM

These ideas have been around for a long time. We identify with their expression in post-revolutionary Paris (when clinicians like Pierre Louis rejected the pronouncements of authorities and sought the truth in systematic observation of patients), and a colleague has nominated a much earlier origin in ancient Chinese medicine. In the current era, they were consolidated and named EBM in 1991 by a group led by Gordon Guyatt at McMaster University in Canada. Professor Guyatt said that I coined the term in 1990, and in that year it appeared in the information packages about our internal medicine residence program (which I was then directing)[7,8]. It took a year before it appeared in the literature. Since then, the number of articles about evidence-based practice has grown exponentially (from 1 publication in 1991 to about thousands in 2000) and international interest has led to the development of 6 evidence-based journals (published in up to 6 languages) that summarize the most relevant studies for clinical practice and have a combined world-wide circulation of over 200,000.

The subsequent rapid spread of EBM has arisen from 4 reasons and is made possible by 5 recent important factors. (Table 3, 4)

The reasons, attested to by ever-increasing numbers of clinicians, are :

1) Our daily need for valid information about diagnosis, prognosis, therapy and prevention (up to 5 times per in-patient and twice for every 3 out-patients).

2) The inadequacy of traditional sources for this information because they are out-of-date (textbooks), frequently wrong (experts), ineffective (didactic continuing medical education) or too overwhelming in their volume and too variable in their validity for practical clinical use (medical journals).

3) The disparity between our diagnostic skills and clinical judgement, which increase with experi-

Table 3. Four reasons of rapid spread of EBM.

1. Daily need for valid information
2. Inadequacy of traditional sources
3. Disparity between diagnostic skills and clinical judgement
4. Inability to afford more than a few seconds

Table 4. Five important factors of rapid spread of EBM.

1. Development of strategies
2. Creation of systematic reviews and concise summaries
3. Creation of evidence-based journals
4. Creation of information systems
5. Identification and application of effective strategies

ence, and our up-to-date knowledge and clinical performance, which decline.

4) Our inability to afford more than a few seconds per patient for finding and assimilating this evidence, or to set aside more than half an hour per week for general reading and study.

Until recently, these problems were insurmountable for full-time clinicians. However, 5 important factors have permitted us to turn this state of affairs around :

1) The development of strategies for efficiently tracking down and appraising evidence (for its validity and relevance).

2) The creation of systematic reviews and concise summaries of the effects of health care (epitomized by the Cochrane Collaboration).

3) The creation of evidence-based journals of secondary publication (that publish the 2% of clinical articles that are both valid and of immediate clinical use).

4) The creation of information systems for bringing the foregoing to us in seconds.

5) The identification and application of effective strategies for life-long learning and for improving our clinical performance.

We describe these innovations, demonstrating their application to clinical problems, and show how they can be learned and practiced by clinicians who have just 30 minutes per week to devote to their continuing professional development. And we can have many literatures of meta-analysis and randomized controlled trials (Table 5).

Table 5. Chronological trends of meta analysis, randomized controlled trials.
(from PubMed, * : estimation)

Year	meta-analysis	randomized controlled trials
1985	21	3209
1986	23	3545
1987	45	4038
1988	110	4192
1989	249	5341
1990	323	6456
1991	422	6937
1992	458	7377
1993	397	8093
1994	496	9358
1995	604	10209
1996	606	9993
1997	817	10216
1998	806	10210
1999	922	10823
2000	1000*	11000*

3. Actual steps of EBM practice

The practice of EBM comprises 5 steps (Table 6), and theses are as follows ;

Step 1 Converting the need for information (about prevention, diagnosis, prognosis, therapy, causation, etc) into an answerable question.

Step 2 Tracking down the best evidence with which to answer that question.

Step 3 Critically appraising that evidence for its validity (closeness to the truth), impact (size of the effect), and applicability (usefulness in our clinical practice). The methodologies of that were exactly and minutely explained by EBM working group in MacMaster University[9-35].

Step 4 Integrating the critical appraisal with our clinical expertise and with our patient's unique biology, values and circumstances.

Table 6. 5 steps of EBM practice.

1. Formulating Answerable Clinical Questions
2. Searching for the Best Evidence
3. Critical Appraisal of the Evidence
4. Applying Evidence to Patients
5. Evaluation

Step 5 Evaluating our effectiveness and efficiency in executing Steps 1–4 and seeking ways to improve them both for next time.

When we carry out practice of EBM, we need much time to do step 3 (critically appraising). It is important to seek the literature of meta-analysis and randomized controlled trials to obtain information. The number of papers published on meta-analyses and randomized controlled trials in medical research has increased sharply in the past 15 years (Table 5). We conserve our time by seeking out critical appraisals already performed by others who describe explicit criteria for deciding what evidence they selected and how they decided whether it was valid. That is, we leave out the time-consuming Step 3 (critically appraising) and carry out just Step 2 (searching) but restrict the latter to sources that have already undergone critical appraisal (Cochrane Reviews, Best Evidence, and the like).

When we find the best evidence we must integrate it with our clinical expertise and with our patient's unique biology, values and circumstances

4. Useful internet site for EBM

And we can take many informations from internet WWW. We show useful internet site of EBM (Table 7–9).

Table 7. Useful internet site for EBM (Search)

ADEPT : Applying Diagnosis Etiology Prognosis Therapy Filters ScHARR
http://www.shef.ac.uk/~scharr/ir/adept/intro.htm
Agency for Health Care Policy and Research(AHCPR), U.S.A
http://text.nlm.nih.gov/ftrs/pick?collect=ahcpr&cc=1&oldK=34464&t=0&t=874476543
Center for Evidence-Based Medicine, Oxford
http://cebm.jr2.ox.ac.uk/
Center for Evidence-Based Mental Health, Oxford
http://www.psychiatry.ox.ac.uk/cebmh/
Center for Evidence-Based Medicine, Swizerland
http://www.sams.ch/ebm/default.html
ClinicalTrials.gov
http://clinicaltrials.gov/
Cochrane Database of Systematic Reviews
Cochrane Library
http://www.cochrane.org/cochrane/cdsr.htm
Controlled Trials in History
http://www.rcpe.ac.uk/controlled_trials/index.html
Evidence-based Filters for Ovid CINAHL
http://www.urmc.rochester.edu/miner/educ/ebnfilt.htm
Evidence-Based Healthcare Links Pages ScHARR
http://www.shef.ac.uk/~scharr/ir/links.html
The Evidence-Based Healthcare Project
http://evidence.ahc.umn.edu/
Evidence-Based Medicine Reviews
http://www.ovid.com/products/clinical/ebmr.cfm
Evidence-Based Medicine Information
http://jeffline.tju.edu/Education/courses/informatics/activities/ebm_info.html
Evidence-Based Medicine Italian
http://www.gimbe.org/
Evidence-Based Topics
http://www.ohsu.edu/bicc-informatics/ebm/ebm_topics.htm

Evidence That Changed Medical Practice
http://www.hsc.usf.edu/~bdjulbeg/oncology/practice-change.htm
Filtering the literature ScHARR
http://www.shef.ac.uk/~scharr/ir/filter.html
Finding the literature ScHARR
http://www.shef.ac.uk/~scharr/ir/finding.html
Focusing the question ScHARR
http://www.shef.ac.uk/~scharr/ir/focusing.html
Health Information Research Unit, McMaster, Canada
http://hiru.mcmaster.ca/ebm/overview.htm
Health Reviews for Primary Care Providers
http://library.mcphu.edu/resources/reviews/revw_ind.htm
Healthy Resources for Evidence Based Medicine
http://www.ecmag.net/EC2000/sullivan12.html
How to Teach Evidence-based Clinical Practice
http://hiru.mcmaster.ca/ebm/default.htm
InfoPOEMS
http://www.infopoems.com/POEMs/POEMs_Home.htm
Literature Searching ScHARR
http://www.shef.ac.uk/~scharr/ir/litsrch.html
Medicina basada en pruebas : Evidence-Based Medicine (EBM)
http://usuarios.bitmailer.com/rafabravo/mbe.htm
Netting the Evidence, Sheffield
http://www.shef.ac.uk/~scharr/ir/netting/
The Oxford Pain Internet Site
http://www.jr2.ox.ac.uk/bandolier/booth/painpag/
PEDro - Physiotherapy Evidence Database
http://ptwww.cchs.usyd.edu.au/pedro/
Register of Reviews of Effectiveness in Health Promotion
http://eppi.ioe.ac.uk/rev_search1.htm
RehabTrials.org
http://www.rehabtrials.org
RES&WCE
http://www.shef.ac.uk/~scharr/reswce/reswce.htm
ScHARR-Lock's Guide to the Evidence ScHARR
http://www.shef.ac.uk/uni/academic/R-Z/scharr/ir/scebm.html
Seeking the Evidence : a protocol ScHARR
http://www.shef.ac.uk/~scharr/ir/proto.html
Sheffield EBM pages
http://www.shef.ac.uk/uni/academic/R-Z/scharr/ebm/
Sources of Evidence (CASPFEW)
http://wwwlib.jr2.ox.ac.uk/caspfew/sources.html
SUMSearch
http://SUMSearch.UTHSCSA.edu/cgi-bin/SUMSearch.exe
Teaching/Learning skills for Evidence-Based Practice
http://www.mdx.ac.uk/www/rctsh/ebp/main.htm
TrialsCentral
http://www.trialscentral.org/
Turning Research Into Practice (TRIP) Database
http://www.tripdatabase.com/
World Wide Web-Based EBM Hedges
http://www.mssm.edu/library/ebm/ebmhedges.htm

Table 8. Useful internet site for EBM (Cochrane Collaboration & PubMed)

Australian Cochrane Collaboration	http://www.cochrane.org.au/
Canada Cochrane Collaboration	http://hiru.mcmaster.ca/cochrane/
DeuchesCochrane Collaboration	http://www.cochrane.de/
Nordic Cochrane Collaboration	http://www.cochrane.dk/default.html
SpanishCochrane Collaboration	http://www.cochrane.es/default.html
UKCochrane Collaboration	http://www.update-software.com/ccweb/default.html
USCochrane Collaboration	http://www.cochrane.org/
PubMed	http://www.ncbi.nlm.nih.gov/PubMed/

Table 9. Useful internet site for EBM (Journals)

ACP Journal Club
http://www.acponline.org/journals/acpjc/jcmenu.htm
Bandolier
http://www.jr2.ox.ac.uk:80/Bandolier
Bandolera
http://www.infodoctor.org/bandolera/
Effective Health Care Bulletins
http://www.york.ac.uk/inst/crd/ehcb.htm
Effectiveness Matters
http://www.york.ac.uk/inst/crd/em.htm
Evidence
http://www.bangor.ac.uk/hs/evidence/
Evidence-Based Health Care
http://www.harcourt-international.com/journals/ebhc/
Evidence-Based Medicine
http://www.acponline.org/journals/ebm/pastiss.htm
Evidence-Based Medicine - Edizione Italiana
http://www.infomedica.org/ebm/
Evidence-Based Medicine Journal
http://cebm.jr2.ox.ac.uk/docs/hiru/ebmj/default.htm
Evidence-Based Mental Health
http://www.ebmentalhealth.com/
Evidence-Based Nursing
http://www.bmjpg.com/template.cfm?name=specjou_nu
Evidence-Based Purchasing
http://www.doh.gov.uk/research/swro/rd/publicat/ebpurch/
International Journal of Epidemiology
http://ije.oupjournals.org/
Journal of Clinical Epidemiology
http://www.elsevier.co.jp/inca/publications/store/5/2/5/4/7/2/?menu=gen.aimsandscope
Journal Club on the Web
http://www.journalclub.org/
Journal of Family Practice POEMs (Patient Oriented Evidence that Matters)
http://jfp.msu.edu/
JSCAN-Online
http://www.uaeu.ac.ae/jscan/
New Zealand Evidence-Based Healthcare Bulletin
http://www.nzgg.org.nz/news/bulletin.cfm

5. Levels of evidence

What are we to do when the irresistible force of the need to offer clinical advice meets with the immovable object of flawed evidence? All we can do is our best: give the advice, but alert the advisees to the flaws in the evidence on which it is based.

The ancestor of this set of pages was created by Suzanne Fletcher and Dave Sackett 20 years ago when they were working for the Canadian Task Force on the Periodic Health Examination[36]. They generated "levels of evidence" for ranking the validity of evidence about the value of preventive manoeuvres, and then tied them as "grades of recommendations" to the advice given in the report.

The levels have evolved over the ensuing years, most notably as the basis for recommendations about the use of anti-thrombotic agents[37], have grown increasingly sophisticated[38], and have even started to appear in a new generation of evidence-based textbooks that announce, in bold marginal icons, the grade of each recommendation that appears in the texts[39] in bold icons.

These levels were generated in a series of iterations among members of the NHS R & D Center for Evidence-Based Medicine (Chris Ball, Dave Sackett, et al)

Homogeneity is a systematic review that is free of worrisome variations (heterogeneity) in the directions and degrees of results between individual studies. Not all systematic reviews with statistically significant heterogeneity need be worrisome, and not all worrisome heterogeneity need be statistically significant. As noted above, studies displaying worrisome heterogeneity should be tagged with a "−" at the end of their designated level.

6. Study design

We show you a definition and a comparison of the advantages and disadvantages of the different study design.

Case-control studies are studies which involve identifying patients who have the outcome of interest (cases) and patients without the same outcome (controls), and looking back to see if they had the exposure of interest. They have 4 advantages (quick, cheap, only feasible method for very rare disorders or those with long time lag between exposure and outcome and fewer subjects needed than cross-sectional studies) and 4 disadvantages (reliance on recall or records to determine exposure status, confounders, difficulty of selection of control groups and potential bias (recall, selection)).

Cross-sectional survey is the observation of a defined population at a single point in time or time interval. Exposure and outcome are determined simultaneously. It has 3 advantages (cheap, simple and ethically safe) and 5 disadvantages (no causality of association, recall bias susceptibility, unequal distribution of confounders, Neyman bias and inequality of group sizes).

Cohort study involves identification of 2 groups (cohorts) of patients, one which received the exposure of interest, and one which did not, and following these cohorts forward for the outcome of interest. It has 7 advantages (ethically safety, match of subjects, establishment of timing and directionality of events, stan-

Table 10. Levels of Evidence (For Therapy/Prevention, Etiology/Harm)

1a: Meta-analysis (with homogeneity) of RCTs
1b: Individual RCT (with narrow Confidence Interval)
1c: All or none
2a: Meta-analysis (with homogeneity) of cohort studies
2b: Individual cohort study (including low quality RCT; e.g., <80% follow-up)
2c: "Outcomes" Research
3a: SR (with homogeneity) of case-control studies
3b: Individual Case-Control Study
4: Case-series (and poor quality cohort and case-control studies)
5: Expert opinion without explicit critical appraisal, bench research or "first principles"

dardization of eligibility criteria and outcome assessments and administrative easiness and cheapness than RCT) and 5 disadvantages (controls may be difficult to identify, exposure may be linked to a hidden confounder, blinding is difficult ; randomization not present, and for rare disease, large sample sizes or long follow-up necessary).

Randomized controlled trial means that a group of patients is randomized into an experimental group and a control group. These groups are followed up for the variables/outcomes of interest. It has 3 advantages (unbiased distribution of confounders, blinding more likely and randomization facilitates statistical analysis) and 3 disadvantages (expensive (time and money), volunteer bias and ethically problematic at times).

Crossover design is the administration of 2 or more experimental therapies one after the other in a specified or random order to the same group of patients. It has 4 advantages (all subjects serve as own controls and error variance is reduced thus reducing sample size needed, all subjects receive treatment (at least some of the time), statistical tests assuming randomization can be used and blinding can be maintained) and 3 disadvantages (all subjects receive placebo or alternative treatment at some point, washout period lengthy or unknown and cannot be used for treatments with permanent effects).

7. Limitations of EBM

There are 3 limitations that are unique to the practice of EBM. First, the need to develop new skills in searching and critical appraisal can be daunting, although evidence-based care can still be applied if only the former has been mastered and directed toward pre-appraised resources. Second, busy clinicians have limited time to master and apply these new skills, and the resources required for instant access to evidence are often woefully inadequate in clinical settings. Finally, evidence that EBM "works" has been late and slow to come.

On the other hand, the ensuing discussion and debate has clarified some "pseudo-limitations" that arise from misunderstandings of the definition of EBM. An examination of the definition and steps of EBM quickly dismisses the criticisms that it denigrates clinical expertise, is limited to clinical research, ignores patients' values and preferences, or promotes a cookbook approach to medicine. Moreover, it is not an effective cost-cutting tool, since providing evidence-based care directed toward maximizing patients' quality of life often increases the costs of their care and raises the ire of health economists.

8. Extension of EBM

EBM reinforces the need for, and mastery of, the clinical and communication skills that are required to gather and critically appraise patients' stories, symptoms, and signs and to identify and incorporate their values and expectations into therapeutic alliances.

It fosters generic skills for use in finding, appraising and implementing evidence from the basic sciences and from other applied sciences.

It provides an effective, efficient framework for post-graduate education and self-directed, life-long learning ; when coupled with "virtual libraries" and distance learning programs it supplies a model of worldwide applicability.

Although not its primary aim, by identifying the questions for which no satisfactory evidence exists it generates a supremely pragmatic agenda for applied health research

And now EBM is spread to the method of Evidence-Based Clinical Practice, Evidence-Based Nursing, Evidence-Based Mental Health, Evidence-Based Dentistry, Evidence-Based Surgery, Evidence-Based Gynecology Evidence-Based Health Care Evidence -Based Public Health, Evidence-Based Policy and Evidence-Based Education et al.

III. ART OF MEDICINE

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 evidence-based medicine means integrating individual clinical expertise with the best

available external clinical evidence from systematic research. By individual clinical expertise we mean the proficiency and judgement that individual clinicians acquire through clinical experience and clinical practice. Increased expertise is reflected in many ways. For this clinical expertise, it is very important to consider art of medicine. The concept of 'art of medicine' was mainly built by Sir William Osler (1849-1919).

Osler, Sir William was Physician and professor of medicine who practiced and taught in Canada, the United States, and Great Britain and whose book The Principles and Practice of Medicine (1892) has been a leading textbook in the field of medicine.

When Osler died in 1919, he was probably the most famous and beloved physician in the English-speaking and perhaps the whole world. He remains so more than 50 years later. His renown was not due to his contributions to science, which were small, or his contributions to medicine, though these were sizable. He adored and fascinated the young, and he transformed medical education in the United States and elsewhere. Before Osler, the relations between teacher and student, teacher and teacher, and teacher and patient had been cold and formal. After him, the relations were warm and friendly. He personified the learned, scholarly, skillful physician who was also a warm human being. Osler thought his epitaph should be that he took the teaching of medicine into the wards.

Osler was educated at Trinity College, Toronto, Toronto Medical School (entered 1868), and McGill University, where he received a medical degree in 1872. He identified platelets in the blood in 1873. In 1875 he was appointed professor at McGill Medical School and in 1878 as physician to the Montreal General Hospital. He was appointed professor of medicine at Johns Hopkins University Medical School in 1888 and as regius professor of medicine at Oxford University in 1904. (Excerpts from Encyclopaedia Britannica, 15th Edition,). Table 11. shows you his famous addresses.

Aequanimitas was Osler's famous essay and first delivered as a valedictory address at the University of Pennsylvania School of Medicine in 1889. Osler urges the graduates to develop two qualities or virtues. First is the "bodily" virtue of imperturbability or "a judicious measure of obtuseness." This means the outward expression of calmness and coolness, even under difficult circumstances. This virtue suggests that physicians should be relatively "insensible" to the slings-and-arrows of patient care, always maintaining a degree of detachment from their patients. The complementary "mental" virtue is aequanimitas, which is the personal quality of calmly accepting whatever comes in life. These virtues, however, should not lead to "hardness" in dealing with patients. Osler also urges his students and colleagues to develop the other gentlemanly virtues of courage, patience, and honor.

Table 11. Sir William Osler's famous addresses

The Student of Medicine
The Profession of Medicine
The Qualities Required of a Physician
The Clinical Years
L'Envoi
The General Practitioner
The Consultant Physician
The Alabama Student
Service in the Armed Forces
A Way of Life
The Christian Way of Life
The Foundations of a University Education
Aequanimitas

Osler seems to be promoting detachment and distance from patients. Osler believes that some distance is necessary in order for the physician to develop what we would call empathy, the ability to understand the patient's problem accurately and to convey that understanding back to the patient. The virtue of aequanimitas also suggests a general attitude of acceptance that is crucial to good medical practice. Notice, too, that Osler views certain personal qualities (virtues) as essential for the good physician.

In 'The Clinical Years' he said' How can we make the work of the student in the third to sixth years as practical as it is in his first and second? I take it for granted we all feel that it should be. The answer is, take him from the lecture-room, take him from the

amphitheatre-put him in the out-patient department -put him in the wards. It is not the systematic lecture, not the amphitheatre clinic, not even the ward class-all of which have their value- in which the reformation is needed but in the whole relationship of the senior student to the hospital.

During the first three years, he is thoroughly at home in the laboratories, domiciled, we may say, with his place in each one, to which he can go and work quietly under a tutor's direction and guidance. To parallel this condition after the third year, certain reforms are necessary. First, in the conception of how the art of medicine and surgery can be taught. My firm convictions that we should start the third year student at once on his road of life. Ask any physician of twenty years' standing how he has become proficient in his art, and he will reply, by constant contact with the disease; and he will add that the medicine he learned in the schools was totally different from the medicine he learned at the bedside. The graduate of a half of a century ago went out with little practical knowledge, which increased only as his practice increased.

In what may be called the natural method of teaching the student begins with the patient, and ends with his studies with the patient, using book s and lectures as tools, as means to an end'. He emphasized 'out-patient department, at the bedside, to hear the patient and importance of practice of reading'. So former president of Jikei university Abe's opinion is 'Listen to the patient, he is telling you diagnosis.' We thought it is art of medicine. This art of medicine is a main clinical expertise of physicians. So art of medicine and clinical evidence are closely connected and indispensable to practice EBM.

Acknowlegements: We are grateful to Prof. Emeritus Masakazu Abe (former President of the Jikei University) for giving us the sugestive letters and books about the art of medicine and Sir William Osler, professor emeritus of Johns Hopkins University.

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Appendix

Important EBM Terms

Table 12 shows important EBM terms. So we must understand these terms to do EBM.

These terms are ;

1. Absolute risk reduction : The absolute arithmetic difference in rates of adverse outcomes between experimental and control participants in a trial, calculated as |EER-CER|.

2. Confidence Interval (CI) : Quantifies the uncertainty in measurement. It is usually reported as a 95% CI which is the range of values within which we can be 95% sure that the true value for the whole population lies. For example, for an NNT of 10 with a 95% CI of 5 to 15, we would have 95% confidence

Table 12. Important EBM Terms

1. Absolute risk reduction. 2. Confidence Interval (CI) 3. Control Event Rate (CER) 4. Decision analysis (or clinical decision analysis) 5. Event rate 6. Experimental event rate (EER) 7. Heterogeneity 8. Incidence 9. Inception cohort 10. Intention to treat (ITT) analysis 11. Likelihood ratio 12. Meta-analysis 13. n-of-1 trials 14. Negative predictive value 15. Number needed to treat (NNT) 16. Odds. 17. Odds ratio (OR) 18. Positive predictive value 19. Post-test odds 20. Pre-test probability (prevalence) 21. Randomized control clinical trial (RCT) 22. Relative risk reduction (RRR) 23. Risk Ratio 24. Sensitivity 25. SnNout. 26. Specificity 27. SpPin. 28. Systematic review (Overview) :

that the true NNT value lies between 5 and 15.

3. Control Event Rate (CER) : The frequency with which the outcome of interest occurs in the study group not receiving the experimental therapy.

4. Decision analysis (or clinical decision analysis) : The application of explicit, quantitative methods that quantify prognoses, treatment effects, and patient values in order to analyze a decision under conditions of uncertainty.

5. Event rate : The proportion of patients in a group in whom the event is observed. Thus if out of 100 patients, the event is observed in 27, the event rate is 0.27. Control event rate (CER) refers to the proportion of patients in the control group who experience the event and the experimental event rate (EER) is the proportion of patients in the experimental group who experience the event of interest. The patient expected event rate (PEER) refers to the rate of events we'd expect in a patient who received conventional therapy or no treatment.

6. Experimental event rate (EER) : The proportion of patients in the experimental treatment group who are observed to experience the outcome of interest.

7. Heterogeneity : This occurs when there is more variation between the study results (in a systematic review) than would be expected to occur by chance alone.

8. Incidence : The proportion of new cases of the target disorder in the population at risk during a specified time interval.

9. Inception cohort : A group of patients who are assembled near the onset of the target disorder.

10. Intention to treat analysis : A method of analysis for randomized trials in which all patients randomly assigned to one of the treatments are analyzed together, regardless of whether or not they completed or received that treatment.

11. Likelihood ratio : The likelihood that a given test result would be expected in a patient with the target disorder compared with the likelihood that this same result would be expected in a patient without the target disorder.

12. Meta-analysis : A systematic review of the literature that uses quantitative methods to summarize the results.

13. n-of-1 trials : In such trials, the patient undergoes pairs of treatment periods organized so that one period involves the use of the experimental treatment and the other involves the use of an alternate or placebo therapy. The patient and physicians are blinded, if possible, and outcomes are monitored. Treatment periods are replicated until the clinician and patient are convinced that the treatments are definitely different or definitely not different.

14. Negative predictive value : Proportion of people with a negative test result who are free of the target disorder.

15. Number needed to treat (NNT) : The number of patients that we need to treat with a specified therapy in order to prevent one additional bad outcome. Calculated as the inverse of the absolute risk reduction (1/ARR).

16. Odds : A ratio of the number of people incurring an event to the number of people who have non-events.

17. Odds ratio (OR) : The ratio of the odds of having the target disorder in the experimental group relative to the odds in favor of having the target disorder in the control group (in cohort studies or

systematic reviews) or the odds in favour of being exposed in subjects with the target disorder divided by the odds in favour of being exposed in control subjects (without the target disorder).

18. Positive predictive value : Proportion of people with a positive test who have the target disorder.

19. Post-test odds : The odds that the patient has the target disorder after the test is carried out (calculated as the pre-test odds x likelihood ratio).

20. Pre-test probability (prevalence) : The proportion of people with the target disorder in the population at risk at a specific time (point prevalence) or time interval (period prevalence).

21. Randomized control clinical trial (RCT) : A group of patients is randomized into an experimental group and a control group. These groups are followed up for the variables/outcomes of interest.

22. Relative risk reduction (RRR) : This is a measure of treatment effect and is calculated as (CER -EER)/CER.

23. Risk Ratio The ratio of risk in the treated group (EER) to the risk in the control group (CER). This is used in randomized trials and cohort studies and is calculated as EER/CER.

24. Sensitivity : The proportion of people with the target disorder who have a positive test. It is used to assist in assessing and selecting a diagnostic test/sign/symptom.

25. SnNout : When a sign/test/symptom has a high Sensitivity, a Negative result rules out the diagnosis. For example, the sensitivity of a history of ankle swelling for diagnosing ascites is 93% ; therefore is a person does not have a history of ankle swelling, it is highly unlikely that the person has ascites.

26. Specificity : Proportion of people without the target disorder who have a negative test. It is used to assist in assessing and selecting a diagnostic test/sign/symptom.

27. SpPin : What a sign/test/symptom has a high Specificity, a Positive result rules in the diagnosis. For example, the specificity of a fluid wave for diagnosing ascites is 92% ; therefore if a person does have a fluid wave, it rules in the diagnosis of ascites.

28. Systematic review (Overview) : A summary of the medical literature that uses explicit methods to perform a thorough literature search and critical appraisal of individual studies and that uses appropriate statistical techniques to combine these valid studies.