Evidence-based medicine in pre-clinical years: a study of early introduction and usefulness

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Introduction: Evidence Based Medicine (EBM) has established itself as a strong predictor of future medical practice by medical students. The purpose of this study was to determine the effectiveness of EBM in pre-clinical years and reflect on self-assessment skill of 4th semester medical students regarding the understanding of EBM and its various determinants.

Methods: All of the 4th semester (MD4) medical students at the Avalon University of Medical School, Curacao who had completed their EBM curriculum were asked to voluntarily participate in a cross sectional student survey containing qualitative and quantitative questionnaires in a 10-point scale. The students’ responses were analyzed statistically and the results reported.

Results: Twenty-three students participated in the survey. 91% of them reported that EBM had helped them to better understand research process and 95% believed that EBM was necessary to develop clinical skills in the future. 78% of the students agreed that they were provided with enough resources for effective implementation of EBM in the university. All participants (100%) self reported that they could appraise the research articles effectively (mean score 8.26, S.D-1.45).

Conclusions: EBM is an integrative and comprehensive way to successfully adopt concepts of acquired medical knowledge for effective medical practice. Early introduction of EBM in preclinical years proved favorable in students and better equipped them with the ability to critically apprehend and appraise new research and innovations in medicine for optimal learning experience. There is a definitive need for scientific and systematic design of the curriculum for early introduction of EBM in pre-clinical years, best suited for the students. The principles should be directed towards further research for the effective implementation of EBM to enhance clinical skills.

Keywords: Evidence-based medicine; Medical education; Medical students; Curriculum; Evaluation

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care in the modern times. EBM combines clinical competency with best available evidences. It provides a framework for clinical decisions and guides the action of the practitioner. One of the principles of EBM is to make the student competent enough to go through different available resources and enable them to interpret these resources and decide which one is best suited. In this regard, EBM definitely helps to make a suitable decision.

EBM supports the principles of integration and reflective model of learning and forms a solid foundation for incorporating these in medical curriculum. Integration, as such, is the basic principles in medicine for getting into the roots of disease causation, and thereby formulating the plan of care. Integration helps to retain the knowledge and establishes interest in medical students (1). Integration should reflect the learning aptitude. There is subsequent lack of interest in basic medical sciences as patient care is not directly reflected in learning techniques. Reflective practice, a model approach for EBM, reflects one’s awareness of their own capability of visualizing the learning perception, directing the actions. Learning should be reflected in the students’ behavior and subsequent practices (2). We can inculcate interest in the students by implementing vertical integration in the curriculum especially in the first two years by reflecting clinical principles throughout basic sciences, whereby EBM becomes a convenient tool. One of the objectives is to blend all these medical subjects, study their usefulness and create enthusiasm in students.

Most of the research articles interpret the finding in terms of statistics and whether the findings are statistically significant or not. Statistical knowledge and being literate in research methodology and interpretation are equally important in EBM (3). Statistical significance does establish the basis of selection of one group over the other, but there can be possible conflicts in future between statistical and clinical significance. This limitation of EBM can be overcome by group discussion and expert opinion to choose what is best for the patient. To enhance interest and promote student participation, focus should be on explaining application of knowledge and its significance for patient care with best available resources. This can be achieved by demonstrating proper integration of basic science knowledge into clinical application, introduction of problem-based learning, EBM, journal club and short-term clinical observation and exposure.

Effective teaching techniques represent the first goal of successful EBM delivery and incorporation into the medical curriculum. Even though EBM increases skills in pre-clinical students, there is still a clear void in terms of superior method of EBM delivery; and the best suitable policy can be made based on specific objectives and available resources (4). It is pertinent to address the specific interest to make EBM learning a more suitable experience for the target audience (5). Blended methods have been proved to be superior in comparison with face to face teaching model for EBM delivery in terms of cost effectiveness, within a framework of teaching objectives. Blended techniques are also helpful in changing the positive attitude of medical students towards EBM techniques, clearly reflected in their practice (6, 7). Group discussions, learning through case methods; and single, brief training sessions are some of the alternative approaches that enhance understanding of EBM in medical students and can be applied as effective EBM teaching tools (8-10).

EBM does have limitations for successful implementation in preclinical years. This can be broadly divided into institutional limitations and student factor. It has always been a challenge to introduce EBM in the basic science program. Basic science is a foundation of clinical medicine and integrates comprehensive study of different systems and processes necessary for normal health as well as deviation, potentially resulting in disease. Basic science has limited exposure to clinical setting and real time simulations experience. Basic science is limited within the boundary of acquiring concepts and knowledge to step up in clinical rotations. As such practical approach, patient interaction and clinical decision within standard quality of care are traditionally part of the clinical medicine, clinically oriented curriculum should be the main focus in basic science. Therefore, curriculum should incorporate comprehensive integrated teaching methods in accordance with best evidence. Staff shortage and lack of confidence in tutors is another limitation to successful implementation of EBM in medical schools. Capable and trained faculty members with conceived knowledge of basic science medicine and clinical experience are necessary to establish a casual interaction and generate motivation in the classroom.

The early introduction of EBM in medical schools has been effective in changing the thought process of the medical graduates. It also increases...
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The ability for logical and critical appraisal, better suited for the understanding of the disease process and subsequent management (11). Students are better equipped with critical appraisal skills and decision-making capacity after the introduction of EBM. In this scenario, EBM definitely has a positive impact in building competency.

The purpose of this study was to investigate the efficacy and usefulness of early introduction of EBM in medical school curriculum. This study focuses primarily on the curriculum design of EBM at Avalon University School of Medicine, paired with cross-sectional student survey study to evaluate different determinants of successful implementation of EBM with the help of standard questionnaires.

Pre-clinical years are divided into 5 semesters (MD1-MD5) in Avalon University School of Medicine. MD1-MD4 consist of the foundation of basic sciences curriculum, and MD5 is structured and designed to prepare the students for competitive board exams and equip them with brief clinical exposure before starting the clinical rotations in different clinical settings. Although EBM is introduced systematically in the 4th semester (MD4), research methodology is introduced early into the syllabus in the pre-clinical years through journal clubs. Students are encouraged to participate in journal clubs and problem-based learning from the very first semester. The class is divided into multiple small groups of maximum two members, and these groups are followed by a particular set of assignments. One of the assignments is a class presentation on a current medical topic that directly correlates to their teaching syllabus. These topics focus on current evidence in medicine. Students are required to play an active role in the class and reflect the learning in solving the problem.

University provides the students with different offline and online medical journals, and free access to research database, like EBSCO. These students are also trained to use online medical databases and portal, and encouraged to actively go through the university provided materials. They are taught and trained to follow patient, intervention, comparison, and outcome (PICO) model for EBM, which provides a systemic framework for practicing EBM. Students have to design a question based on PICO format and search for the answer using common available research tools. These tools can be PUBMED, EBSCO or journal in the library. The assessments of the tools will reflect the learning skills, provide answer to the structured questions, and guide intervention.

Students were encouraged to participate actively in e-learning to effectively and efficiently implement EBM at the personal and practice level. Teaching materials included combination of different resources (readings journals, online tutorials and videos, free-shared software for calculating epidemiological measures) to solve the problems of each session; problems and exercises in which students apply concepts and acquire the skills necessary for searching and appraising the medical literature efficiently. These problems were delivered by the instructors during the sessions. They are motivated towards reading greater number of journal articles, understand research process and appraise the results. They are also equipped with ability to understand the problems behind carrying out a search of the literature from databases such as PUBMED and EBSCO, having an understanding of the different types of literature reviews. The most important thing is to be able to ask a focused research question, carry out a literature search, write a literature review and reference a document appropriately.

At the end of this semester, the students are expected to understand the scope and aim of EBM, and execute steps necessary to provide basic physical therapy services with best available current evidence. This would include common clinical guidelines, making the students capable of forming the questions, searching for evidence, conducting meta-analysis for systematic reviews, evaluate the evidence, etc.

The final course evaluation and scoring is based on the active participation in the class, class presentation on the aspects of evidence for various common clinical conditions, the understanding of the students to appraise the research article, and ability to apprehend it in their practice, which is reflected through their response to various questionnaires based on real life situations.

Methods

A cross-sectional student survey was performed anonymously at the end of the 4th semester (MD4). All students currently in the 4th semester of Avalon University School of Medicine and attending EBM mandatory course as a part of their curriculum were voluntarily enrolled in the study to self-assess their understanding of EBM in different aspects and satisfaction towards the course technique. The students who were not willing to participate in the studies and those with less than 80% of attendance at EBM classes were excluded from the study.

The students were briefed about the study and were ensured of anonymity. A set of questionnaires were prepared to address the objectives of the
study. All the participating students were provided with this set of questionnaires. There questions were divided into qualitative and quantitative questions. The quantitative questionnaires were graded on a 10-point scale. The questionnaires were collected after the response, recorded and the data were analyzed with SPSS.

As a part of the survey, the students were asked to evaluate the faculty members assigned for delivery of EBM and suggest different recommendations for successful implementation of EBM in pre-clinical years to enhance their skills. Finally, the students’ performance at the end of the semester was evaluated. This final evaluation was performed, using an online test containing multiple choice questions structured to evaluate the students’ understanding of EBM. Their responses were graded and documented.

Ethical considerations
A proposal of the study was presented and passed through the ethical review board. The objectives and aim of the study was thoroughly explained to all the voluntary participants and consent was obtained. Priority was given to maintain the anonymity of the respondents.

Results
Of 27 students, 23 (85%) participated in the survey. The students showed an encouraging response to the introduction of EBM in the curriculum, although most of the students did not seem to participate directly in research process during their pre-clinical years (Table 1).

Self-evaluation of the EBM skills
Students were asked to self-evaluate their understanding of EBM and its determinants. Most of the students reported they understood and appraised research articles and could effectively use Pubmed and EBSCO to search for the useful medical information (Table 2).

Students’ evaluation of faculty members
The students were obliged to participate in class presentation, discussion and online assignments. The faculty members were evaluated by the students for their role in effectively organizing EBM curriculum. The mean score for faculty satisfaction and performance was 9.04 (10-point scale) and 95% of the students responded that they enjoyed the course.

Students’ responses for successful implementation of EBM
The students recommended that early introduction of EBM would be a useful way to teach and train EBM with integration of statistics and active participation in research.

Faculty members’ evaluation of medical students
The final evaluation of the class after the EBM course through online multiple choice questions to evaluate the students’ knowledge and understanding of EBM yielded an average of 64.44% with scores ranging from 50% to 80%.

Discussion
There should be an effective way to educate students about the importance of EBM and its usefulness in future clinical practice. Effective classroom teaching incorporated with hospital demonstration and real time simulation will help students to better understand EBM (12). Online

| Table 1: Students’ responses on research process and Evidence Based Medicine (EBM) |
|---------------------------------------------------------------|
| Agree | Do not agree |
|---------------------------------------------------------------|
| Possess adequate knowledge about research process | 21 (91.30%) | 2 (8.7%) |
| Involved in research activities at university | 5 (21.73%) | 22 (78.27%) |
| Believe EBM is necessary for effective clinical practice | 22 (95.65%) | 1 (4.35%) |
| Believe adequate resources are available for EBM | 18 (78.26%) | 5 (21.74%) |

| Table 2: Self-evaluation score of medical students on their understanding of EBM and its related factors: Evidence Based Medicine (EBM), Patient, Intervention, Comparison, and Outcome (PICO) |
|---------------------------------------------------------------|
| Mean±SD | Med | Mode | Min | Max |
|---------------------------------------------------------------|
| Understand EBM | 8.26±1.45 | 8 | 8 | 6 | 10 |
| Understand PICO | 6.88±1.95 | 7 | 6 | 3 | 10 |
| Effectively use Pubmed | 8.2±1.32 | 8 | 8 | 6 | 10 |
| Effectively use EBSCO | 8.3±1.53 | 8 | 10 | 5 | 10 |
| Can appraise research article with therapy | 7.42±1.74 | 7 | 7 | 4 | 10 |
| Can correlate findings with disease process | 7.56±1.88 | 8 | 8 | 4 | 10 |
| Understand statistics | 7.66±1.82 | 8 | 8 | 4 | 10 |
| Understand abstract | 9.25±0.85 | 9.5 | 10 | 8 | 10 |
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Evidence-based medicine (EBM) is an important aspect in medical education because it provides the opportunity to research deeply in the medical literature about a particular area of interest. It also gives an opportunity to the student to integrate basic and clinical sciences for developing skills as a future health professional. In order to practice quality health care, clinical decisions should be based on clinically relevant scientific evidence. Introduction of EBM from early pre-clinical years enables students to appraise the current work in medicine and use it for skill enhancement. Future research is warranted to establish these findings and establish an integrative multidisciplinary approach to introduce EBM as an integral part of curriculum, best suited for the medical students.

Conflicts of Interest: None declared.

References

1. Malau-Aduli BS, Lee AY, Cooling N, Catchpole M, Jose M, Turner R. Retention of knowledge and perceived relevance of basic sciences in an integrated case-based learning (CBL) curriculum. BMC Med Educ. 2013;13:139. doi: 10.1186/1472-6920-13-139.

2. Lewin LO, Robert NJ, Raczek J, Carraccio C, Hicks PJ. An online evidence based medicine exercise prompts reflection in third year medical students. BMC Med Educa.
1. Ilic D, Bin Nordin R, Glasziou P, Tilson JK, Villanueva E. Implementation of a blended learning approach to teaching evidence based practice: a protocol for a mixed methods study. BMC Med Educ. 2013;13:170. doi: 10.1186/1472-6920-13-170.

2. Ahmadi SF, Baradaran HR, Ahmadi E. Effectiveness of teaching evidence-based medicine to undergraduate medical students: a BEME systematic review. Med Teach. 2015;37(1):21-30. doi: 10.3109/0142159X.2014.971724.

3. Hadley JA, Davis J, Khan KS. Teaching and learning evidence-based medicine in complementary, allied, and alternative health care: an integrated tailor-made course. J Altern Complement Med. 2007;13(10):1151-5. doi: 10.1089/acm.2007.0512.

4. Maloney S, Nicklen P, Rivers G, Foo J, Ooi YY, Reeves S, et al. A Cost-Effectiveness Analysis of Blended Versus Face-to-Face Delivery of Evidence-Based Medicine to Medical Students. J Med Internet Res. 2015;17(7):e182. doi: 10.2196/jmir.4346.

5. Ilic D, Nordin RB, Glasziou P, Tilson JK, Villanueva E. A randomised controlled trial of a blended learning education intervention for teaching evidence-based medicine. BMC Med Educ. 2015;15:39. doi: 10.1186/s12909-015-0321-6.

6. Hatmi ZN, Tahvildari S, Dabiran S, Soheili S, Sabouri Kashani A, Raznahan M. Teaching evidence-based medicine more effectively. Acta Med Iran. 2010;48(5):332-6.

7. Hugenholtz NI, Schaafsma FG, Nieuwenhuijsen K, Van Dijk FJ. Effect of an EBM course in combination with case method learning sessions: an RCT on professional performance, job satisfaction, and self-efficacy of occupational physicians. Int Arch Occup Environ Health. 2008;82(1):107-15. doi: 10.1007/s00420-008-0315-3.

8. Gruppen LD, Rana GK, Arndt TS. A controlled comparison study of the efficacy of training medical students in evidence-based medicine literature searching skills. Acad Med. 2005;80(10):940-4.

9. Sánchez-Mendiola M, Kiefer-Escobar LF, Marin-Beltrán S, Downing SM, Schwartz A. Teaching of evidence-based medicine to medical students in Mexico: a randomized controlled trial. BMC Med Educ. 2012;12:107. doi: 10.1186/1472-6920-12-107.

10. Vidyardthi AR, Kamei R, Chan K, Goh SH, Lek N. Factors associated with medical student clinical reasoning and evidence based medicine practice. Int J Med Educ. 2015;6:142-8. doi: 10.5116/ijme.563a.5dd0.

11. Puljak L. Using social media for knowledge translation, promotion of evidence-based medicine and high-quality information on health. J Evid Based Med. 2016;9(1):4-7. doi: 10.1111/jebm.12175.

12. Ilic D, Tepper K, Misso M. Teaching evidence-based medicine literature searching skills to medical students during the clinical years: a randomized controlled trial. J Med Libr Assoc. 2012;100(3):190-6. doi: 10.3163/1536-5050.100.3.009.

13. Rohwer A, Schoonees A, Young T. Methods used and lessons learnt in conducting document reviews of medical and allied health curricula - a key step in curriculum evaluation. BMC Med Educ. 2014;14:236. doi: 10.1186/1472-6920-14-236.

14. Ma X, Xu B, Liu Q, Zhang Y, Xiong H, Li Y. Effectiveness of evidence-based medicine training for undergraduate students at a Chinese Military Medical University: a self-controlled trial. BMC Med Educ. 2014;14:133. doi: 10.1186/1472-6920-14-133.

15. Ilic D, Diug B. The impact of clinical maturity on competency in evidence-based medicine: a mixed-methods study. BMJ. 2016; 1: 1–4.

16. Snashall J, Fair M, Scott J. A novel approach to incorporating evidence-based medicine into an emergency medicine clerkship. Acad Emerg Med. 2013;20(3):295–9. doi: 10.1111/acem.12089.

17. Lai NM, Teng CL, Nalliah S. Assessing undergraduate competence in evidence based medicine: a preliminary study on the correlation between two objective instruments. Educ Health (Abingdon). 2012;25(1):33-9.

18. Gagliardi JP, Stinnett SS, Schardt C. Innovation in evidence-based medicine education and assessment: an interactive class for third- and fourth-year medical students. J Med Libr Assoc. 2012;100(4):306-9. doi: 10.3163/1536-5050.100.4.014.