Evidence Based Library and Information Practice

Information Services in Evidence Based Medical Education: A Review of Implementation Trends

Sedigheh Khani, Sirous Panahi, Ali Pirsalehi et Ata Pourabbasi

Volume 16, numéro 3, 2021

URI : https://id.erudit.org/iderudit/1082675ar
DOI : https://doi.org/10.18438/eblip29860

Résumé de l'article

Objective – Evidence based medical education requires supportive information services to facilitate access to the needed educational evidence. Information services designed specifically for evidence based medical education are limited or locally developed for educational units. For librarians to have an opportunity to cooperate efficiently with medical educators in evidence based medical education, they require an empirical prototype for transmission of clinical evidence at the right place and the right time. Therefore, there is a need to recognize types of information services which support evidence based medical education. The purpose of this review is to identify implementation trends of evidence based educational information services.

Methods – We found related studies by implementing search strategies in PubMed, EMBASE, Web of Science, Scopus, LISTA, and Google Scholar with keywords like: evidence based medical education, information services, and library services. We used reference-checking and citation-checking of related articles for completing the process of locating relevant articles. After employing inclusion and exclusion criteria, we selected 11 articles for inclusion in the review and analyzed them using a narrative review technique.

Results – After analyzing the results of the included studies, we identified two elements categorized as program development and five elements categorized as implementation trend. Prerequisites of program and the process of designing were essential parts of program development of information services. Schedule and type of access, how to receive educational-clinical questions, information services types, responding time, and providing evidence based outputs were the elements of the implementation process of educational supported information services.

Conclusion – Designing an evidence based educational information service strongly depends on the information needs of learners at each educational level. Schedule and type of access to information service, time of responding to the received query, and preparation of evidence based output are essential factors in designing practical educational-developed information services.
Information Services in Evidence Based Medical Education: A Review of Implementation Trends

Sedigheh Khani  
Ph.D. Candidate in Medical Librarianship and Information Sciences  
School of Health Management and Information Sciences  
Iran University of Medical Sciences  
Tehran, Iran  
Email: khani.se@iums.ac.ir; khani.sedigheh@gmail.com

Sirous Panahi  
Associate Professor  
Department of Medical Library and Information Science  
School of Health Management and Information Sciences  
Iran University of Medical Sciences  
Tehran, Iran  
Email: panahi.s@iums.ac.ir

Ali Pirsalehi  
Assistant Professor of Internal Medicine  
Clinical Development Research Center of Taleghani Hospital  
Medical School  
Shahid Beheshti Medical University  
Tehran, Iran  
Email: pirsalehi@sbmu.ac.ir

Ata Pourabbasi  
Assistant Professor  
Endocrinology and Metabolism Clinical Sciences Institute  
Tehran University of Medical Sciences  
Tehran, Iran  
Email: Atapoura@tums.ac.ir

Received: 7 Oct. 2021  
Accepted: 26 Apr. 2021
Abstract

Objective – Evidence based medical education requires supportive information services to facilitate access to the needed educational evidence. Information services designed specifically for evidence based medical education are limited or locally developed for educational units. For librarians to have an opportunity to cooperate efficiently with medical educators in evidence based medical education, they require an empirical prototype for transmission of clinical evidence at the right place and the right time. Therefore, there is a need to recognize types of information services which support evidence based medical education. The purpose of this review is to identify implementation trends of evidence based educational information services.

Methods – We found related studies by implementing search strategies in PubMed, EMBASE, Web of Science, Scopus, LISTA, and Google Scholar with keywords like: evidence based medical education, information services, and library services. We used reference-checking and citation-checking of related articles for completing the process of locating relevant articles. After employing inclusion and exclusion criteria, we selected 11 articles for inclusion in the review and analyzed them using a narrative review technique.

Results – After analyzing the results of the included studies, we identified two elements categorized as program development and five elements categorized as implementation trend. Prerequisites of program and the process of designing were essential parts of program development of information services. Schedule and type of access, how to receive educational-clinical questions, information services types, responding time, and providing evidence based outputs were the elements of the implementation process of educational supported information services.

Conclusion – Designing an evidence based educational information service strongly depends on the information needs of learners at each educational level. Schedule and type of access to information service, time of responding to the received query, and preparation of evidence based output are essential factors in designing practical educational-developed information services.

Introduction

In the 1990s, David Sackett introduced the concept of evidence based medicine (EBM). EBM was defined as the use of up-to-date, best evidence in clinical decision making for a better understanding of causation and prognosis of disease, and selecting more appropriate diagnostic tests and treatment strategies based on patient preferences and the clinical condition of the patient (Sackett et al., 1996). In the practice of EBM, clinicians complement their clinical expertise with the best available evidence (Sackett et al., 1996), which evidence is available
Evidence Based Library and Information Practice 2021, 16.3

from systematic clinical research like systematic reviews, cohort studies, and randomized control trials (Burns et al., 2011).

EBM and its applications in different functions of medicine have empowered the medical community (Djulbegovic & Guyatt, 2017; Sur & Dahm, 2011). Medical practice, healthcare management, clinical research, and of course, medical education has been affected by EBM principles (Djulbegovic & Guyatt, 2017; Shortell et al., 2007). Evidence Based Education/Best Evidence in Medical Education (EBE/BEME) makes an effort to utilize evidence in education (Davies, 1999) and reshape the practices and approaches of learner training based on the best available evidence (Harden et al., 2000; Hart & Harden, 2000). The goal of EBM in clinical practice is to enhance patient treatment, but in medical education, educators train learners in the practice of EBM to empower them to use evidence in clinical practice (Guyatt et al., 1992).

Medical educators try to have an updated and evidence based approach to their teaching practice in processes such as curriculum revision or implementing new instructional techniques (Poirier & Behnen, 2014). In the evidence based paradigm of teaching, educators combine up-to-date, quality evidence with previous experience and current educational approaches (Chessare, 1996). Typical tasks required for evidence based practice in medical education include phrasing a question, designing a search strategy, appraising the evidence, and making the required intervention in the teaching approaches (Davies, 1999; Harden et al., 2000; Hart & Harden, 2000).

A primary challenge of the above procedure is searching the published literature (Poirier & Behnen, 2014).

Finding the best evidence is one of the main challenges of EBE/BEME for medical educators; often they need assistance to effectively find required evidence (Chessare, 1996; Harden et al., 2000; Reed et al., 2005). Difficulty in accessing the empirical educational knowledge has a multidimensional nature. Medical instructors have expressed some barriers to implementing evidentiary information in education. Lack of time for finding evidence based knowledge, the volume of research evidence, lack of educational evidence, lack of access to evidence based educational databases, and difficulty in finding educational evidence were found to be obstacles for accessing relevant evidence (Emami et al., 2019; Onyura et al., 2015; Sandars & Patel, 2015; Suttle et al., 2015; Thomas et al., 2019). Searching for evidence consists of two core challenges: how to search for evidence and where to search for evidence (Haig & Dozier, 2003a, 2003b).

Information services fulfill the need for access to evidence in medical practice. The main purpose of information services in a health system is to enhance the decision-making of clinicians in the treatment of patients. The actors of an information service are skilled librarians, and the core activity of information services is transforming requests for evidence into relevant, evidence based information which then impacts clinical decision making (Fennessy, 2001). In the process of evidence based decision making, information services with different implementation trends were developed to supply qualified and up-to-date evidence for healthcare practice.

Jordan and Porritt (2004) established an information service to provide evidence based information for clinicians and patients. The information service supported both access to evidence and education for how to utilize what they could access. MCMASTER+ was another type of evidence based information service, which organized information based on evidence hierarchy and facilitated finding required evidence to address related clinical questions (Holland & Haynes, 2005). McGowan et al. (2010) developed an information service to provide evidence for primary care practitioners and enhance clinical decision making. These information services to support clinical practice had commonalities in their implementation processes. For example, the process of developing reference services for clinicians...
consisted of two main components: first, selecting and adapting appropriate technology, and second, training the librarian to deliver the information service. Most of the information services supporting clinical decision making were developed on the web with a well-defined, user-friendly interface that enhanced physician access to the best evidence (Holland & Haynes, 2005; Jordan & Porritt, 2004; McGowan et al., 2010). The process of delivering needed evidence began from searching, appraising, and summarizing evidence to transferring it into practice (Davies et al., 2017; Holland & Haynes, 2005; Jordan & Porritt, 2004; McGowan et al., 2010), and reviewing and updating collected evidence periodically (Jordan & Porritt, 2004).

Aims

All of the above evidence based information services were established for clinical practice, but providing evidence for medical education needs its own educational-developed information services (Emami et al., 2019; Onyura et al., 2015). Onyura et al. (2015) stated that the delivery approaches for evidence based knowledge currently available were insufficient and there was a need for new approaches for delivering synthesized evidence that have a concise presentation and are accessible at the point-of-need. In this respect, identifying the implementation trends of information services designed for evidence based education can be prototypical for designing evidence based information services for medical education.

Based on the hierarchy of information services in the Library, Information Science & Technology Abstracts (LISTA) database thesaurus (EBSCO, n.d.-a), information services are developed to fulfill information needs in various fields such as business, agriculture, community, education, and more. In the LISTA thesaurus, “information services in education” was defined as the “use of data storage, organization, search, retrieval, and transmission services in education” (EBSCO, n.d.-b). In the current study, we identified search, retrieval, and transmission aspects of information services in education. Therefore, the aim of this review was to identify the types of information services that were provided for EBE/BEME and compare the trends of supplying evidence for supporting student teaching and learners training under the concept of Evidence Based Educational Information Services (EBEIS).

Table 1
Search Strategy of PubMed

| No. | Search Strategy | Results |
|-----|----------------|---------|
| 1   | (“Education, medical”[Exp.] OR teaching[NoExp.] OR education[NoExp.] OR “education, professional”[NoExp.] OR “education, graduate” [NoExp.] OR “education, continuing” [NoExp.] OR “education, medical, continuing” [MeSH]) OR (teaching OR training OR education* OR instruction*) [ti, other term] | 1,522,557 |
| 2   | (“Evidence-based medicine” [Exp.] OR “evidence-based practice” [NoExp.] OR Evidence-based emergency medicine--education[MeSH] OR Evidence-based medicine--education[MeSH: NoExp] OR evidence-based practice--education[MeSH:NoExp]) OR “evidence-based”[ti, ab, other term] | 163,230 |
| 3   | (“Information services” [NoExp.] OR “Information storage and retrieval” [NoExp.] OR librarians [MeSH] OR “libraries, medical” [NoExp.] OR “libraries, hospital” [MeSH] OR “library services” [NoExp.]OR “information dissemination” [MeSH]) OR (librar* OR information*)[ti, other term] | 161,765 |
| 4   | 1 AND 2 AND 3 | 1,421 |
| 5   | Limit to: English language | 1,344 |
| 6   | Limit to: 2010/1/1 and 2020/1/2 | 721 |
Methods

Article Selection

We accessed studies on information services that supported EBE/BEME by searching databases and performing forward and backward citation tracking of related articles. We searched PubMed, Embase, Web of Science, Scopus, LISTA, and Google Scholar using keywords such as “evidence based education,” “evidence based medical education,” “information service,” and “library service.” Table 1 depicts our search strategy for the PubMed database.

Inclusion and Exclusion Criteria

After implementing search strategies in each database, we excluded non-English articles, as well as articles focused on evidence based dentistry, nursing, and pharmacy studies. Because fields like dentistry have unique educational needs versus medicine, we omitted them from the review. We also excluded study types such as letters, chapters, book reviews, editorials, conference abstracts, and viewpoints. We included studies that described an empirical experiment on the structure and trend of implementing an EBEIS. In this review, it was
important that the information services were not applied in non-educational clinical settings, nor were proposed templates or opinions. We ended up with 11 articles published between 2010 and 2020 included in the review. We have described the process of selecting related studies in Figure 1.

We compared the bibliographic and introductory data of included studies in Table 2.

**Data Analysis**

In this study, we used a narrative review technique for bringing together findings of the different studies and accomplishing the review. Narrative analysis with tabular accompaniment is a typical analysis technique for reviews (Grant & Booth, 2009). A narrative review synthesizes the available evidence from different studies to provide a conclusion from collected literature (Green et al., 2006). For the analysis of included studies, first we read the articles carefully. Second, we compared the implementation trends of applied information services in the educational clinical setting and identified the similarities and differences between structures of implementation trends. Third, we extracted the related themes for each similar part of the identified structure through note-taking. Also, we considered the related themes for any differences between applied information services. Finally, we organized the related themes of similar parts of implementation trends within the comparison tables.

### Table 2

**Introductory Data of Included Studies**

| First author                  | Year published | Year implemented | Country   | Setting                                      | Type of education | Trend of implementation                                                                 |
|-------------------------------|----------------|------------------|-----------|----------------------------------------------|-------------------|---------------------------------------------------------------------------------------|
| (Aitken et al., 2011)         | 2011           | 2009             | Canada    | Morning report/rounds/team conference        | RE<sup>a</sup>    | Searching evidence based information and delivery of documents                        |
| (Neves & Dooley, 2011)        | 2011           | 2008-09          | Canada    | Case-oriented problem solving curriculum    | UGME<sup>b</sup>  | Curriculum architecture-based LibGuides                                                |
| (Weaver, 2011)                | 2011           | 2002-10          | USA       | Morning report                              | RE                | Learning package service                                                               |
| (Santos & Mariano, 2014)      | 2014           | 2013             | Philippines | Morning rounds                       | CPE<sup>c</sup>    | Consulting, searching and delivering of information resources                          |
| (Yaeger & Kelly, 2014)        | 2014           | 2012             | USA       | Patient rounds                               | RE                | Searching and providing evidence for clinical questions                                 |
| (Zeblisky et al., 2015)       | 2015           | 2013-15          | USA       | EBM conference                              | RE                | Consult searching service                                                              |
**Results**

Implementation of a program was defined as developing performing procedures for planned tasks and achieving determined objectives (National Minority AIDS Council, 2015). In this regard, we tried to highlight typical characteristics of implementation trends in EBEIS which were common amongst included studies. After the analysis and comparison of studies, we recognized five oft-mentioned elements of information services implementation trends. In addition, for a better understanding of the implementation process of information services, we summarized the program development process and practical effects of information services.

**Program Development of Information Services**

Program development has a multi-step process. The main elements of the program development process are required resources for program implementation, program designing, and predefined measures for determining outputs of the program (National Minority AIDS Council, 2015). We determined two elements of program development by comparing the findings of the included studies.

**Prerequisites of Programs**

One of the prerequisites of using EBEIS is understanding EBM principles. It is essential to ask an evidence based question to receive a relevant response from the information service (Aitken et al., 2011; Brian et al., 2018). It is important to have a librarian present at the point of teaching when the cases are presented. It helps the librarian more quickly and effectively respond to the learners’ queries (Aitken et al., 2011; Blake et al., 2018; Gibbons & Werner, 2019;
Evidence Based Library and Information Practice 2021, 16.3

Herrmann et al., 2017; Yaeger & Kelly, 2014). Other prerequisites for an effective information service are speed of Internet connection and access to evidence based databases. Providing appropriate evidence based information on an educational-clinical question strongly depends on the accessibility of information sources like databases (Santos & Mariano, 2014). In this regard, the availability of infrastructures like a reference-tracker or data repository which deposits data like educational-clinical questions/answers, frequency of responded/non-responded questions, and common clinical patient problems is essential. Deposits of interacted data can be used for subsequent referencing and establishing a database of evidence based educational information for high prevalence clinical disorders (Gillum et al., 2018).

Process of Designing

If an information service is intended to support the evidence based needs of a curriculum, the librarian should consider the structure and needed resources of the curriculum in the design process (Neves & Dooley, 2011). In this regard, surveying the information needs of intended users helped to design the most appropriate services (Zebisky et al., 2015). The diversity of access channels to information services is an essential factor in the design process. Access via multiple communication channels like email, web, social networks, or face-to-face communication facilitates the use of information services for busy clinicians (Brian et al., 2018).

Implementation Trends of EBEIS

Schedule and Type of Access to Information Services

The schedule of implementing information services strongly depended on the volume of assigned tasks that the librarian had to do alongside the duties of information services. In addition, information services which used telecommunications channels like phone or email (Brian et al., 2018; Gillum et al., 2018; Herrmann et al., 2017; Santos & Mariano, 2014; Weaver, 2011) could provide services during a wider span of time (Table 3).

In the included studies, information services were implemented in different levels of medical education from undergraduate to postgraduate degree programs. In undergraduate medical education, medical students receive the knowledge and skills needed to be a junior doctor. Then, the junior doctor receives more training, especially via clinical education, to gain experience, develop skills for patient care, and prepare for entrance into residency education. This period is considered the internship. Residency education is a period of training to educate competent clinicians in a specific medical specialty such as internal medicine. Internship and residency programs are the two stages of postgraduate medical education. Clinical education provides an opportunity for the trainees to acquire practical skills by rotating between clinical departments of a hospital. Clinical education is an essential part of postgraduate training (Weggemans et al., 2017; Wijnen-Meijer et al., 2013). In addition, the final stage of medical education is continuing professional education (CPE), which promotes lifelong learning for clinicians within their clinical settings. CPE supports clinical skill development of medical doctors and enhances the outcomes of patient treatment (Bennett et al., 2000). CPE programs are delivered via different methods such as rounds, workshops, seminars, conferences, online learning, telemedicine, and other methods.

Medical trainees at the undergraduate and graduate levels receive clinical education in the teaching setting of morning reports and rounds. Morning report is a case-based meeting where medical students and their educators discuss a clinical case related to a patient recently admitted to the teaching hospital (Amin et al., 2000). Rounds or ward rounds are held beside the patient’s bed and consist of medical educators and students that listen to the patient
Table 3
Schedule/Access to Information Services

| Setting                                      | Type of education | Schedule of implementation | Type of access          |
|----------------------------------------------|-------------------|-----------------------------|-------------------------|
| Morning report/ rounds/ team conference      | RE<sup>a</sup>    | 10-12 hours per week        | Face-to-face            |
| (Aitken et al., 2011)                        |                   |                             |                         |
| Patient rounds                              | RE                | Once per week               | Face-to-face            |
| (Yaeger & Kelly, 2014)                       |                   |                             |                         |
| Morning rounds                              | CPE<sup>b</sup>   | Every working days          | Face-to-face/email/ phone |
| (Santos & Mariano, 2014)                     |                   |                             |                         |
| Morning rounds                              | CPE               | 24 hours/ all days of week  | Phone/email             |
| (Santos & Mariano, 2014)                     |                   |                             |                         |
| Morning report                              | RE                | 5 days a week               | Face-to-face/email      |
| (Weaver, 2011)                               |                   |                             |                         |
| EBM conference                              | RE                | Once per month              | Face-to-face            |
| (Zeblisky et al., 2015)                      |                   |                             |                         |
| Patient-family centered rounds               | CE<sup>c</sup>    | Not mentioned               | Face-to-face/email      |
| (Herrmann et al., 2017)                      |                   |                             |                         |
| Clinical rounds                             | CE                | Once a week                 | Face-to-face            |
| (Gibbons & Werner, 2019)                     |                   |                             |                         |
| Inpatient rounds                             | CE                | Between 3 to 5 days a week  | Face-to-face/email      |
| (Brian et al., 2018)                         |                   |                             |                         |
| Personal librarian program                   | UGME<sup>d</sup>   | When the users needed       | Face-to-face/email      |
| (Gillum et al., 2018)                        |                   |                             |                         |

<sup>a</sup> Residency Education, <sup>b</sup> Continuing Professional Education, <sup>c</sup> Clinical Education, <sup>d</sup> Under-Graduated Medical Education

and discuss the case of disease presented (O’Hare, 2008).

Methods of Receiving Educational-Clinical Questions

In most of the implementation trends for EBEIS, there is a preference for the presence of a librarian in educational-clinical meetings such as rounds, morning reports, and EBM conferences (Aitken et al., 2011; Brian et al., 2018; Gibbons & Werner, 2019; Herrmann et al., 2017; Santos & Mariano, 2014; Weaver, 2011; Yaeger & Kelly, 2014; Zeblisky et al., 2015). However, some of the information services were provided only virtual, with online chatting as a predefined connection channel between librarians and users. Also, users were able to submit their feedback on the quality of information services via a text box on the web (Neves & Dooley, 2011). Another channel that was provided for receiving educational-clinical queries was an online submission form. Receiving queries online made access to information services easier (Brian et al., 2018).

Types of Delivery of Information Services

The most prevalent type of EBEIS was mediated searching and document delivery based on educational-clinical queries (Aitken et al., 2011; Brian et al., 2018; Gibbons & Werner, 2019; Herrmann et al., 2017; Santos & Mariano, 2014; Weaver, 2011; Yaeger & Kelly, 2014), consulting services for how to formulate a question, and assistance searching the evidence (Blake et al., 2018; Gillum et al., 2018; Herrmann et al., 2017; Santos & Mariano, 2014; Zeblisky et al., 2015).
Table 4
Evidence Based Outputs of Information Services

| Reference number       | Case presentation | Controlled vocabulary | Keywords | Applied search strategy | Search results | Full-text of search results | Abstract of search results | Type of education          |
|------------------------|-------------------|-----------------------|----------|-------------------------|----------------|-----------------------------|-----------------------------|-----------------------------|
| (Yaeger & Kelly, 2014) | - a               | + b                   | +        | +                       | +              | -                           | -                           | Residency education        |
| (Santos & Mariano, 2014) | -                 | -                     | -        | -                       | -              | +                           | +                           | Continuing professional education |
| (Weaver, 2011)         | +                 | -                     | -        | -                       | -              | +                           | -                           | Residency education        |
| (Herrmann et al., 2017) | -                 | -                     | -        | -                       | -              | -                           | +                           | Clinical education         |
| (Brian et al., 2018)   | -                 | -                     | -        | -                       | -              | +                           | -                           | Clinical education         |
| (Blake et al., 2018)   | +                 | -                     | -        | -                       | -              | -                           | -                           | Undergraduate medical education |

a not-provided, b provided

With mediated searching, the librarian received queries, searched appropriate databases, and delivered relevant evidence to the student.

Time of Responding to Queries

The time that it took a librarian to respond to the educational-clinical questions influenced the intended learning of trainees. Some of the information services were designed to provide the needed evidence based information at the educational session itself or on the same day (Aitken et al., 2011; Brian et al., 2018; Gibbons & Werner, 2019; Yaeger & Kelly, 2014). In other studies, the authors did not mention time expectations for receiving answers (Herrmann et al., 2017; Santos & Mariano, 2014; Weaver, 2011). With information services that provided online access to questions and answers, librarians responded to queries in one to three days (Brian et al., 2018).

Providing Evidence Based Outputs

The preparation of evidence based outputs for evidence requests is an essential part of an educational information service. Evidence based output is a document of what a librarian has done to fulfill an evidence request. The evidence based output consists of three distinct parts: a) the clinical case presentation of the patient, b) a record of what keywords and search strategies were used for retrieving evidence, and c) the retrieved search results, which may include the abstracts and full text. Each information service examined presented at least one aspect of the outputs, but a service with all these outputs better supports the educational needs. The purpose of preparing outputs is to provide a documented record for what librarians do, thereby helping trainees and educators learn to better perform their own search for retrieving needed evidence. Preparing an evidence based output for each request of clinical evidence is
time-consuming for the librarian, but educators and learners then have the information documented for further learning and later referrals, as well as evidence based data to deposit in local evidence based databases for future educational purposes (see Table 4).

**Effects on Trainee Learning**

In the field of medical education, EBEIS enhanced learners’ understanding of evidence based practice in medicine (Blake et al., 2018; Brian et al., 2018; Yaeger & Kelly, 2014). After learning about EBM resources (Blake et al., 2018; Brian et al., 2018; Gibbons & Werner, 2019), the evidence retrieval behaviour of medical students shifted to more reliable databases for finding answers to clinical questions (Aitken et al., 2011). The evidence based searching skills of learners were strengthened and learners were able to formulate more meaningful evidence based searches (Brian et al., 2018; Herrmann et al., 2017; Zeblisky et al., 2015). In addition, providing such information services meant learners were supplied up-to-date, high-quality information more quickly (Brian et al., 2018; Gibbons & Werner, 2019), and enhanced the learning process (Gibbons & Werner, 2019).

Another practical effect of EBEIS was saving time for learners in finding needed evidence (Herrmann et al., 2017).

**Discussion**

According to an analysis of the included studies, EBEIS have been implemented in different types of teaching-related units (e.g., teaching hospitals), and in varied target settings (e.g., clinical rounds). In all educational settings, there is a need for learners to access evidence. EBEIS were flexible in servicing different needs within their predetermined teaching programs. In this regard, information services can be implemented in different educational settings with diverse types of access and schedules of service delivery. Consequently, changes in curricula and teaching programs that produce new information needs can be met with reciprocal revisions in the implementation plan of the information services.

It is noteworthy that some of the studied information services had unique procedures in their implementation, which were not executed in the other information services, and therefore were not categorized into identified characteristics as a part of this study. Yaeger and Kelly (2014) stated in their study that a pre-prepared summary of the patient’s clinical situation and current clinical management was provided for the librarian ahead of clinical meetings. This procedure helped the librarian to present in the meetings with more confidence, especially for librarians who are new to delivering EBEIS.

In some circumstances, the librarian taught the trainees EBM principles and skills, including understanding and creating PICO questions and designing a search strategy according to the PICO structure, to help accomplish one of the prerequisites of using EBEIS (Aitken et al., 2011; Zeblisky et al., 2015). In this regard, librarians in some of the information services collaborated with teaching teams to prepare educational materials for trainees. In such situations, librarians working in the clinical environment could provide more applicable materials than those excluded from clinical situations (Blake et al., 2018). In this regard, Safdari et al. (2018) found the types of educational roles and activities of health care librarians in teaching information literacy skills and evidence based practice principles to medical students, educators, and clinicians, especially in the location of clinics or via online training. Such educational activities included developing interactive online tutorials, developing video instructions, and co-teaching in medical faculties. Safadari et al. identified librarian participation methods in educational programs that can be considered in the development of EBEIS.

Another unique procedure which supported student learning was assigning a group of
trainees with a set number to each librarian. The librarian monitored the students’ skill learning according to pre-determined learning objectives, and reciprocally, each student knew which librarian to contact when they encountered a learning problem (Gillum et al., 2018).

Figure 2 presents a schematic diagram of identified characteristics of information services within the sequence of program implementation. Also, we included uncategorized characteristics of information services in the diagram, described in the previous paragraphs.

The main limitation of this study was differentiating between evidence based information services which were designed for clinical practice, medical education, or both simultaneously. In this respect, we tried to include studies which explained the implementation of an information service for supporting evidence for any type of educational procedure.

**Conclusion**

We conducted this study to identify the structure of the implementation process of information services which supported evidence based medical education. After conducting search strategies in target databases and employing inclusion/exclusion criteria, we selected and analyzed 11 articles. Information services which were studied in this review supported empirical knowledge for evidence based medical education at different levels of training and facilitated evidence based change in educational approaches. The summarized trend of implementing EBEIS consisted of:

- (1) schedule and type of access;
- (2) methods for receiving questions;
- (3) information service types;
- (4) response time; and
- (5) preparation of evidence based outputs.

On the basis of the implementation trends of information services being studied, an applicable EBEIS based on the needs of each educational level can be designed.

According to the findings of the current review, we propose the following practical recommendations. First, a needs assessment of predefined users is a necessary prerequisite
before designing a practical EBEIS. Based on the characteristics of stakeholders of information services, librarians can benefit from various needs assessment techniques. The characteristics and needs of stakeholders should determine the appropriate assessment technique that results in the most useful data. Second, each educational level needs to have a specifically-designed information service separately. Third, mediated searching can be used for undergraduate levels and consulting information services can be used for graduate or professional levels. Fourth, types of data needed in the evidence based outputs depend on the needs of intended users. Finally, more detailed evidence based outputs will fulfill more educational needs in the future.

It is also plausible to suggest future studies to compare the structure of evidence based information services which support clinical practice with information services that were developed for medical education, in order to identify additional characteristics of implementation trends of evidence based information services.

Acknowledgements

This study is part of a Ph.D. thesis supported by the Iran University of Medical Sciences under Grant No. IR.IUMS.FMD.REC_1396.9381623003.

Author Contributions

Sedigheh Khani: Conceptualization, Data curation, Methodology, Visualization, Writing – original draft Sirous Panahi: Conceptualization, Data curation, Methodology, Writing – review & editing Ali Pirsalehi: Conceptualization, Writing – review & editing Ata Pourabbasi: Conceptualization, Writing – review & editing

References

Aitken, E. M., Powelson, S. E., Reaume, R. D., & Ghali, W. A. (2011). Involving clinical librarians at the point of care: Results of a controlled intervention. *Academic Medicine, 86*(12), 1508-1512. [https://doi.org/10.1097/ACM.0b013e31823595cd](https://doi.org/10.1097/ACM.0b013e31823595cd)

Amin, Z., Guajardo, J., Wisniewski, W., Bordage, G., Tekian, A., & Niederman, L. G. (2000). Morning report: Focus and methods over the past three decades. *Academic Medicine, 75*(10), S1-5. [https://doi.org/10.1097/00001888-200010001-00002](https://doi.org/10.1097/00001888-200010001-00002)

Bennett, N. L., Davis, D. A., Easterling, W. E., Friedmann, P., Green, J. S., Koeppen, B. M., Mazmanian, P. E., & Waxman, H. S. (2000). Continuing medical education: A new vision of the professional development of physicians. *Academic Medicine, 75*(12), 1167–1172. [https://doi.org/10.1097/00001888-200012000-00007](https://doi.org/10.1097/00001888-200012000-00007)

Blake, L., Yang, F. M., Brandon, H., Wilson, B., & Page, R. (2018). A clinical librarian embedded in medical education: Patient-centered encounters for preclinical medical students. *Medical Reference Services Quarterly, 37*(1), 19-30. [https://doi.org/10.1080/02763869.2018.1404384](https://doi.org/10.1080/02763869.2018.1404384)

Brian, R., Orlov, N., Werner, D., Martin, S. K., Arora, V. M., & Alkureishi, M. (2018). Evaluating the impact of clinical librarians on clinical questions during inpatient rounds. *Journal of the Medical Library Association, 106*(2), 175-183. [https://doi.org/10.5195/jmla.2018.254](https://doi.org/10.5195/jmla.2018.254)
Burns, P. B., Rohrich, R. J., & Chung, K. C. (2011). The levels of evidence and their role in evidence-based medicine. *Plastic and Reconstructive Surgery, 128*(1), 305-310. [https://doi.org/10.1097/PRS.0b013e318219c171](https://doi.org/10.1097/PRS.0b013e318219c171)

Chessare, J. B. (1996). Evidence-based medical education: The missing variable in the quality improvement equation. *The Joint Commission Journal on Quality Improvement, 22*(4), 289-291. [https://doi.org/10.1016/s1070-3241(16)30232-2](https://doi.org/10.1016/s1070-3241(16)30232-2)

Davies, P. (1999). What is evidence-based education? *British Journal of Educational Studies, 47*(2), 108-121. [https://doi.org/10.10111/j.1467-8527.00106](https://doi.org/10.10111/j.1467-8527.00106)

Davies, S., Herbert, P., Wales, A., Ritchie, K., Wilson, S., Dobie, L., & Thain, A. (2017). Knowledge into action - Supporting the implementation of evidence into practice in Scotland. *Health Information and Libraries Journal, 34*(1), 74-85. [https://doi.org/10.1111/hir.12159](https://doi.org/10.1111/hir.12159)

Djulbegovic, B., & Guyatt, G. H. (2017). Progress in evidence-based medicine: A quarter century on. *Lancet, 390*(10092), 415-423. [https://doi.org/10.1016/s0140-6736(16)31592-6](https://doi.org/10.1016/s0140-6736(16)31592-6)

EBSCO. (n.d.-a). Information services. In *Library, Information Science & Technology Abstracts Thesaurus*. Retrieved March 15, 2021, from [http://www.libraryresearch.com/](http://www.libraryresearch.com/)

EBSCO. (n.d.-b). Information services in education. In *Library, Information Science & Technology Abstracts Thesaurus*. Retrieved March 15 2021, from [http://www.libraryresearch.com/](http://www.libraryresearch.com/)

Emami, S. A. H., Khankeh, H., Karbasi Motlagh, M., Zarghi, N., & Shirazi, M. (2019). Exploring experience of Iranian medical sciences educators about Best Evidence Medical Education: A content analysis. *Journal of Education and Health Promotion, 8*, 247-252. [https://www.jehp.net/text.asp?2019/8/1/247/274486](https://www.jehp.net/text.asp?2019/8/1/247/274486)

Fennessy, G. (2001). Knowledge management in evidence-based healthcare: Issues raised when specialist information services search for the evidence. *Health Informatics Journal, 7*(1), 4-7. [https://doi.org/10.1177/146045820100700102](https://doi.org/10.1177/146045820100700102)

Gibbons, P., & Werner, D. A. (2019). Embedded clinical librarianship: Bringing medical reference services bedside. *Public Services Quarterly, 15*(2), 169-175. [https://doi.org/10.1080/15228959.2019.1583153](https://doi.org/10.1080/15228959.2019.1583153)

Gillum, S., Williams, N., Herring, P., Walton, D., & Dexter, N. (2018). Encouraging engagement with students and integrating librarians into the curriculum through a personal librarian program. *Medical Reference Services Quarterly, 37*(3), 266-275. [https://doi.org/10.1080/02763869.2018.1477710](https://doi.org/10.1080/02763869.2018.1477710)

Grant, M. J., & Booth A. (2009). A typology of reviews: An analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal, 26*, 91-108. [https://doi.org/10.1111/j.1471-1842.2009.00848.x](https://doi.org/10.1111/j.1471-1842.2009.00848.x)

Green, B. N., Johnson, C. D., & Adams A. (2006). Writing narrative literature reviews for peer-reviewed journals: Secrets of the trade. *Journal of Chiropractic Medicine, 5*(3), 101-117. [https://doi.org/10.1016/S0899-3467(07)60142-6](https://doi.org/10.1016/S0899-3467(07)60142-6)
Guyatt, G., Cairns, J., Churchill, D., Cook, D., Haynes, B., Hirsh, J., Irvine, J., Levine, M., Levine, M., Nishikawa, J., Sackett, D., Brill-Edwards, P., Gerstein, H., Gibson, J., Jaeschke, R., Kerigan, A., Neville, A., Panju, A., Detsky, A., ... Enkin, M. (1992). Evidence-based medicine: A new approach to teaching the practice of medicine. *Journal of the American Medical Association*, 268(17), 2420-2425. https://doi.org/10.1001/jama.1992.03490170092032

Haig, A., & Dozier, M. (2003a). BEME Guide No 3: Systematic searching for evidence in medical education—Pt. 1: Sources of information. *Medical Teacher*, 25(4), 352-363. https://doi.org/10.1080/0142159031000136815

Haig, A., & Dozier, M. (2003b). BEME Guide No. 3: Systematic searching for evidence in medical education—Pt. 2: Constructing searches. *Medical Teacher*, 25(5), 463-484. https://doi.org/10.1080/01421590310001608667

Harden, R. M., Grant, J., Buckley, G., & Hart, I. R. (2000). Best evidence medical education. *Advances in Health Sciences Education: Theory and Practice*, 5(1), 71-90. https://doi.org/10.1023/a:1009896431203

Hart, I. R., & Harden, R. M. (2000). Best Evidence Medical Education (BEME): A plan for action. *Medical Teacher*, 22(2), 131-135. https://doi.org/10.1080/01421590078535

Herrmann, L. E., Winer, J. C., Kern, J., Keller, S., & Pavuluri, P. (2017). Integrating a clinical librarian to increase trainee application of evidence-based medicine on patient family-centered rounds. *Academic Pediatrics*, 17(3), 339-341. https://doi.org/10.1016/j.acap.2016.11.005

Holland, J., & Haynes, R. B. (2005). McMaster Premium Literature Service (PLUS): An evidence-based medicine information service delivered on the Web. *AMIA Annual Symposium proceedings / AMIA Symposium*, 2005, 340-344. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1560593

Jordan, Z., & Porritt, K. (2004). Evidence-based health information provision: Development of an online consumer 'request for information' service. *Worldviews on Evidence-Based Nursing*, 1(4), 237-240. https://doi.org/10.1111/j.1524-475X.2004.04065.x

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Alloannidis, J. P., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration. *British Medical Journal*, 339, b2700. https://doi.org/10.1136/bmj.b2700

McGowan, J., Hogg, W., Rader, T., Salzwedel, D., Worster, D., Cogo, E., & Rowan, M. (2010). A rapid evidence-based service by librarians provided information to answer primary care clinical questions. *Health Information and Libraries Journal*, 27(1), 11-21. https://doi.org/10.1111/j.1471-1842.2009.00861.x

National Minority AIDS Council. (2015). Program development. http://www.nmac.org/wp-content/uploads/2015/04/Program-Development.pdf
Neves, K., & Dooley, S. J. (2011). Using LibGuides to offer library service to undergraduate medical students based on the case-oriented problem solving curriculum model. *Journal of the Medical Library Association*, 99(1), 94-97. https://doi.org/10.3163/1536-5050.99.1.017

O’Hare, J. A. (2008). Anatomy of the ward round. *European Journal of Internal Medicine*, 19(5), 309-313. https://doi.org/10.1016/j.ejim.2007.09.016

Onyura, B., Légaré, F., Baker, L., Reeves, S., Rosenfield, J., Kitto, S., Hodges B., Silver I., Curran V., Armson H., & Leslie, K. (2015). Affordances of knowledge translation in medical education: A qualitative exploration of empirical knowledge use among medical educators. *Academic Medicine*, 90(4), 518-524. https://doi.org/10.1097/acm.0000000000000590

Poirier, T., & Behnen, E. (2014). Where and how to search for evidence in the education literature: The WHEEL. *American Journal of Pharmaceutical Education*, 78(4), 70-77. https://doi.org/10.5688/ajpe78470

Reed, D., Price, E. G., Windish, D. M., Wright, S. M., Gozu, A., Hsu, E. B., Beach M. C., Kern D., & Bass, E. B. (2005). Challenges in systematic reviews of educational intervention studies. *Annals of Internal Medicine*, 142(12 Pt. 2), 1080-1089. https://doi.org/10.7326/0003-4819-142-12_part_2-200506211-00008

Sackett, D. L., Rosenberg, W. M., Gray, J. A., Haynes, R. B. & Richardson, W. S. (1996). Evidence based medicine: What it is and what it isn’t. *British Medical Journal*, 312(7023), 71-72. https://doi.org/10.1136/bmj.312.7023.71

Safdari, R., Ehtesham, H., & Bahadori, L. (2018). Highlighting a valuable dimension in health care librarianship: A systematic review. *Medical Journal of the Islamic Republic of Iran*, 32, 1-7. https://doi.org/10.14196/mjiri.32.42

Sandars, J., & Patel, R. (2015). It’s OK for you but maybe not for me: The challenge of putting medical education research findings and evidence into practice. *Education for Primary Care*, 26(5), 289-292. https://doi.org/10.1080/14739879.2015.1079008

Santos, M. A. A., & Mariano, G. S. L. (2014). Information professional at the point of care: Clinical librarian service in neurocritical care. *Journal of Philippine Librarianship*, 34, 61-69. https://journals.upd.edu.ph/index.php/jpl/article/view/4585

Shortell, S. M., Rundall, T. G., & Hsu, J. (2007). Improving patient care by linking evidence-based medicine and evidence-based management. *JAMA*, 298(6), 673-676. https://doi.org/10.1001/jama.298.6.673

Sur, R. L., & Dahm, P. (2011). History of evidence-based medicine. *Indian Journal of Urology: IJU: Journal of the Urological Society of India*, 27(4), 487-489. https://doi.org/10.4103/0970-1591.91438

Suttle, C. M., Challinor, K. L., Thompson, R. E., Pesudovs, K., Togher, L., Chiavaroli, N., Lee A., Junghans B., Stapleton F., Watt K., & Jalbert, I. (2015). Attitudes and barriers to evidence-based practice in optometry educators. *Optometry and Vision Science*, 92(4), 514-523. https://doi.org/10.1097/OPX.0000000000000550
Thomas, A., Gruppen, L. D., Vleuten, C. V. D., Chilingaryan, G., Amari, F., & Steinert, Y. (2019). Use of evidence in health professions education: Attitudes, practices, barriers and supports. Medical Teacher, 41(9), 1012-1022. https://doi.org/10.1080/0142159x.2019.1605161

Weaver, D. (2011). Enhancing resident morning report with “Daily Learning Packages”. Medical Reference Services Quarterly, 30(4), 402-410. https://doi.org/10.1080/02763869.2011.609077

Weggemans, M. M., Dijk, B. V., Dooijeweert, B. V., Veenendaal, A. G., & Cate, O. T. (2017). The postgraduate medical education pathway: An international comparison. GMS Journal for Medical Education, 34(5), 1-16. https://doi.org/10.3205/zma001140

Zebalisky, K., Birr, R. A., & Guerrero, A. M. S. (2015). Effecting change in an evidence-based medicine curriculum: Librarians’ role in a pediatric residency program. Medical Reference Services Quarterly, 34(3), 370-381. https://doi.org/10.1080/02763869.2015.1052702

Wijnen-Meijer, M., Burdick, W., Alofs, L., Burgers, C., & Cate, O. T. (2013). Stages and transitions in medical education around the world: Clarifying structures and terminology. Medical Teacher, 35(4), 301-307. https://doi.org/10.3109/0142159X.2012.746449

Yaeger, L. H., & Kelly, B. (2014). Evidence-based medicine: Medical librarians providing evidence at the point of care. Missouri Medicine, 111(5), 413-415. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6172079

Yaeger, L. H., & Kelly, B. (2014). Evidence-based medicine: Medical librarians providing evidence at the point of care. Missouri Medicine, 111(5), 413-415. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6172079