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Evidence Based Medicine

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Abstract: Health professionals have shown a significant deal of interest in the notion of Evidence Based Medicine (EBM) over the past ten years. By definition, evidence-based medicine is the process of making decisions about a patient's care that integrates clinical competence, the patient's values, and the best available evidence. Applying EBM entails connecting unique clinical symptoms and experiences with the best available scientific data from clinical research. The definition of evidence-based medicine has been refined and is now defined as a methodical approach to clinical problem solving that enables the integration of patient values, clinical competence, and the best available research data. Additionally, there are a lot of opportunities—as well as challenges—to collect data thanks to advancements in wearables, sensor technologies, and Internet of Medical Things (IoMT) architectures. In this Perspective, discuss the key areas that require improvement in the domains of clinical trial design, clinical trial conduct, and evidence generation.

Keywords: AI, EBM, IOT, Health, Patient.

1. INTRODUCTION

Health professionals have shown a significant deal of interest in the notion of Evidence Based Medicine (EBM) over the past ten years. By definition, evidence-based medicine is the process of making decisions about a patient's care that integrates clinical competence, the patient's values, and the best available evidence. Every day scientific knowledge about medicine expands, making it appear hard to keep up with the rapid aging of previously accepted facts. It can be challenging for clinicians to stay up to date with new findings that are published in medical journals. For instance, general practitioners are expected to read 19 articles every day, and many of them only have one hour available per week to do this. A doctor should devote the majority of their working hours to reviewing all published publications and studies, but this is where the issue of academic isolation, also known as the armchair phenomenon, arises. However, even if the doctors had the time to read them all, they wouldn't have enough time to assess the study's worth, methodology, results, and transparency. Because of this, the doctor must choose wisely what to read and what not to read in order to maximize his limited reading time. Family medicine is an extremely complex field by nature, with many poorly differentiated disorders that intersect with biological, psychological, and social elements, among other characteristics. Evidence-Based Medicine (EBM), which dates back to the second half of the 1800s, refers to the thoughtful and appropriate application of the most recent, high-quality scientific research to treatment decisions for individual patients[1]–[5]. When making decisions regarding a patient's care, evidence-based medicine refers to the methodical, clear, prudent, and reasonable application of the best available research at the time. Applying EBM entails connecting unique clinical symptoms and experiences with the best available scientific data from clinical research. The definition of evidence-based medicine has been refined and is now defined as a methodical approach to clinical problem solving that enables the integration of patient values, clinical competence, and the best available research data [6]–[10]. We considered that a doctor's ability, talent, and years of clinical practice are what define an individual clinical notice, and that clinical experience is an essential component of what makes a successful doctor. A randomized controlled clinical trial

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with a sufficient number of participants is seen to provide the finest scientific evidence, as it may demonstrate the usefulness of numerous medications as well as the drawbacks and ineffectiveness of others when compared to the existing therapy. Evidence-based medicine is a self-directed, lifelong learning process where patients' needs for diagnosis, prognosis, therapy, and other clinical and health-related issues necessitate the acquisition of clinically relevant knowledge [11]–[16].

A clinical query is the first step in an EBM inquiry. The clinical question is the issue that the patient and the healthcare provider discuss. Relevant scientific information pertaining to the clinical question is sought after the clinical issue has been formulated. Examples of scientific evidence are findings from studies and opinions. Not all data sets are created equal. Expert opinions are not as trustworthy as well-conducted research, which is not as good as a group of well-conducted research findings. Therefore, in evidence-based medicine, each level of evidence or data should be graded according to its relative strength. Greater evidence should be taken into account when making clinical decisions. [6], [10], [17], and [21].

Evidence-based medicine, with philosophical roots in Paris in the mid-1800s, refers to the methodical, transparent, and prudent application of the most up-to-date research when making decisions on a patient's care. Integrating individual clinical experience with the best external clinical data from systematic research is the practice of evidence-based medicine. Individual clinical expertise refers to the skill and discernment that each of us as doctors develops by practice and clinical experience. Many indicators point to increased skill, but two stand out in particular: more accurate and timely diagnosis, as well as the careful recognition and compassionate application of each patient's unique circumstances, rights, and preferences when making decisions regarding their care. The term "best available external clinical evidence" refers to clinically relevant research, which is typically derived from the basic sciences of medicine. However, patient-centered clinical research that focuses on the precision and accuracy of diagnostic tests (such as the clinical examination), the effectiveness and safety of therapeutic, rehabilitative, and preventive regimens, and the power of prognostic markers is particularly noteworthy.

In addition to invalidating previously accepted diagnostic procedures and treatments, external clinical evidence also introduces safer, more potent, more accurate, and more effective alternatives. The greatest available external evidence is used in conjunction with a doctor's unique clinical skill; neither approach is sufficient on its own. Without clinical skill, practice runs the risk of being subjugated by outside data, since even the best data from outside sources might not apply to or be appropriate for a certain patient. Without the most recent external evidence, practices run the risk of quickly aging out of favor of patients. Evidence-based medicine is a self-directed, lifelong learning process in which taking care of our patients creates a need for clinically important information about diagnosis, prognosis, therapy, and other clinical and health care issues. We then translate these information needs into questions that can be answered; we find the best evidence to answer these questions as efficiently as possible, whether from research evidence, the diagnostic laboratory, the clinical examination, or other sources; we

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critically evaluate the evidence for its usefulness (clinical applicability) and validity (closeness to the truth); we integrate this evaluation with our clinical expertise and apply it in practice; and we assess our performance [6]–[10].

However, EBM behavior might be challenging to observe because general practitioners and GP trainees alike make many judgments during patient visits without fully disclosing all of their concerns. In order for the observer to reflect and genuinely learn from the observation, it is critical to understand the reasoning behind a certain decision. Erroneous personal constructs or knowledge may be inferred by the observer when the correct "why" of the decision cannot be created or recognized. This could result in an inappropriate application of the observed EBM behavior in the future. But at that point, the decision's actual quality becomes secondary: reflection and learning are still possible as long as an observer can identify the actor's use of the three EBM-elements. Over the past three decades, scientific research has made incredible strides that have never been seen before. These have included developing treatments that can change the course and outcome of diseases in every field of medicine, as well as improving our understanding of the pathophysiology of fundamental disease processes and dissecting the cellular machinery at the atomic level. These advancements have also been driven by exponential advances in big data research, computational biology, artificial intelligence (AI), virology, gut microbiomes, proteomics, metabolomics, immunology, and genomics. The development of CRISPR-Cas9 technologies has also created a wide range of exciting prospects in personalized medicine. Despite these developments, clinical research is still outpacing basic research in most medical fields, and their quick transition from bench to bedside is falling short. The cost of clinical trials and drug development is still high [21]–[27]. The environment of clinical trials and drug development remains costly for all parties involved, with a high failure rate. Specifically, there is a significant attrition rate for early-stage developing medicines since over two-thirds of compounds fail in the "valley of death" that separates bench from bedside. Over 1.5 to 2.5 billion dollars are needed to successfully advance a medicine through all stages of development and into clinical practice. Clinical research is facing a crisis as a result of these factors as well as the system's innate flaws and inefficiencies. Therefore, in order to enhance public health, novel approaches are required to involve patients and produce the proof needed to bring new discoveries into the clinic [6], [7], [26], [27], [8]–[10], [21]–[25]. Modern concepts and trial designs should take precedence over conventional clinical research paradigms in order to accomplish this. The use of deep neural networks, machine learning, and multimodal biomedical AI is expected to revolutionize clinical research over the next ten years in a number of areas, including drug discovery, image interpretation, workflow optimization, electronic health record streamlining, and public health advancement. Additionally, there are a lot of opportunities—as well as challenges—to collect data thanks to advancements in wearables, sensor technologies, and Internet of Medical Things (IoMT) architectures. In this Perspective, discuss the key areas that require improvement in the domains of clinical trial design, clinical trial conduct, and evidence generation.

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2. LITERATURE REVIEW

According to Hania Szajewska et al. [8], it is today impossible to think of evidence-based medicine (EBM) in the context of modern healthcare without taking into account the three pillars of the best available research, the patient's values and preferences, and individual professional skill. But neither clinical research nor EBM is flawless, and neither is EBM. This article provides an overview of the fundamental ideas, opportunities, and issues surrounding evidence-based medicine (EBM) and summarises current views on clinical research. Potential fixes for the issues with EBM and clinical research are also covered. The basic principles and constraints of paediatric nutrition were attempted to be discussed if there were specific concerns; if not, the conclusions apply to EBM and clinical research.

Lisanne S. Welink et al. [9] said that in general practice, evidence-based medicine (EBM) applies a sophisticated blend of patient preferences, the best available data, and the clinical judgment of general practitioners (GPs). Both through more deliberate kinds of workplace-based learning and casual observation of each other's sessions, general practitioners and GP trainees can learn how to apply EBM. By examining how much GP supervisors and trainees can recognize each other's EBM behavior through observation and by identifying factors that affect that recognition, this study seeks to provide light on workplace-based EBM learning. It is crucial but challenging to apply evidence-based medicine (EBM) in practice, which is described as integrating patient preferences, clinical knowledge, and the best available evidence when making decisions for specific patients. The Sicily Statement's five steps—ask, acquire, appraise, apply, and evaluate—are followed when teaching EBM. The first three phases of general practice (GP) specialist training include finding the right evidence, gathering it, and evaluating it. But in order to give each patient the best care possible, EBM training should also emphasize EBM behavior, which is the ability to carefully consider the best available data in conjunction with the patient's preferences and one's own clinical competence to make a well-informed choice. It is yet unknown how best to learn EBM behavior in the workplace. An intervention comprising clinically integrated EBM training for trainees and supervisors did not result in enhanced EBM behavior among trainees, according to a study in GP specialty training. We need to understand workplace learning processes better in order to maximize workplace-based EBM learning.

Vivek Subbiah et al. [10] proposed that a fascinating look into the future of next-generation "deep" medicine is provided by the recent developments in wearable technology, data science, and machine learning, which have started to revolutionize evidence-based medicine. Clinical translations in important medical fields are falling behind, despite astounding advancements in basic science and technology. The COVID-19 pandemic revealed systemic flaws in the clinical trial system, but it also brought about some improvements, including as new trial designs and a move toward an evidence-generation approach that is more patient-centric and intuitive. I present my heuristic outlook on the future of evidence-based medicine and clinical trials in this Perspective.

Izet Masic et al. [7] said that the careful, transparent, prudent, and appropriate application of the most up-to-date research in order to make informed decisions about each patient's care is known

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as evidence-based medicine, or EBM. Clinical experience, patient values, and the most up-to-date research data are all integrated into EBM. The movement's goal is to incorporate more excellent clinical research when making decisions about patient care. EBM demands that clinicians learn new competencies, such as conducting effective literature searches and using rigorous criteria of evidence to assess clinical literature. Practicing evidence-based medicine is a continuous, self-directed process of learning based on problems; in this process, taking care of one's own patients necessitates the acquisition of clinically relevant knowledge regarding diagnosis, prognosis, therapy, and other clinical and medical difficulties. Although it is not a "cookbook" containing recipes, its proper use results in more affordable and superior medical treatment. The primary distinction between traditional medicine and evidence-based medicine (EBM) is not that the former takes the evidence into account while the latter does not. Both consider the evidence; however, EBM requires higher quality evidence than is normally employed. The creation of systematic reviews and meta-analyses, which allow researchers to find several studies on a subject, select the best ones, and then critically evaluate them to produce a summary of the best available evidence, is one of the greatest accomplishments of evidence-based medicine. The future generation of EBM-focused clinicians will be responsible for three main tasks: using evidence summaries in clinical practice; developing and updating specific systematic reviews or evidence-based guidelines in their field of expertise; and enrolling patients in treatment, diagnosis, and prognosis studies that form the basis of medical practice.

Ana Fernandez et al. [6] proposed that in addition to discussing the challenges and limitations of evidence-based medicine (EBM) in the contemporary health context, this research tries to describe the contextual circumstances that gave rise to EBM. Our analysis makes use of two frameworks: the unified approach to the philosophy of science, which offers a new context for comprehending the distinctions between the stages of discovery, validation, and implementation in science; and the complex adaptive view of health, which views health and healthcare as non-linear phenomena emerging from their separate components. This research examines the historical evolution, conflicts, and limitations of evidence-based medicine (EMB) in the current healthcare system, with the goal of contributing to the descriptive rational reconstruction of EBM. With its emphasis on the relational interactions of health and healthcare variables and the unified approach to the philosophy of science proposed by Schurz, we approach this analysis from the standpoint of complex adaptive systems science. Further details have been provided elsewhere regarding a complex adaptive understanding of medical knowledge and a complex adaptive view of health as a balanced state between an individual's physical, social, emotional, and cognitive experiences and their consequences for shaping complex adaptive healthcare and healthcare systems as highly responsive to the individual's unique needs. The fundamental tenets of scientific knowledge are organized by the unified approach to philosophy of science, which also updates the position of values in science. It offers a fresh paradigm for comprehending the distinctions between the scientific steps of discovery, confirmation, and application. Its significance for defining novel fields of science as well as the function of various logical deductions in each stage have been discussed elsewhere.

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3. METHODOLOGY

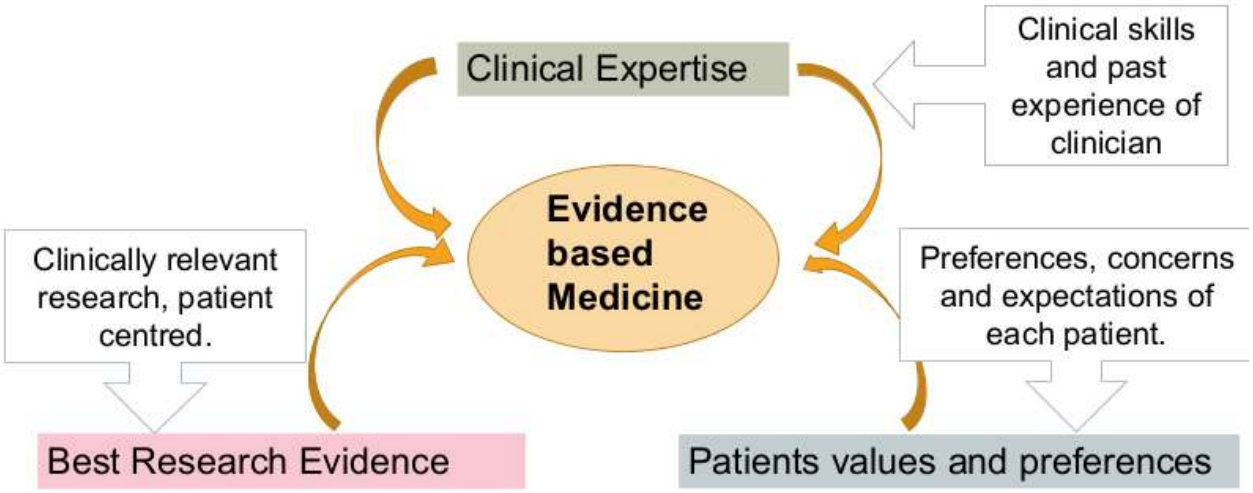

Fig 1 shows three dimensions of Evidence Based Machine

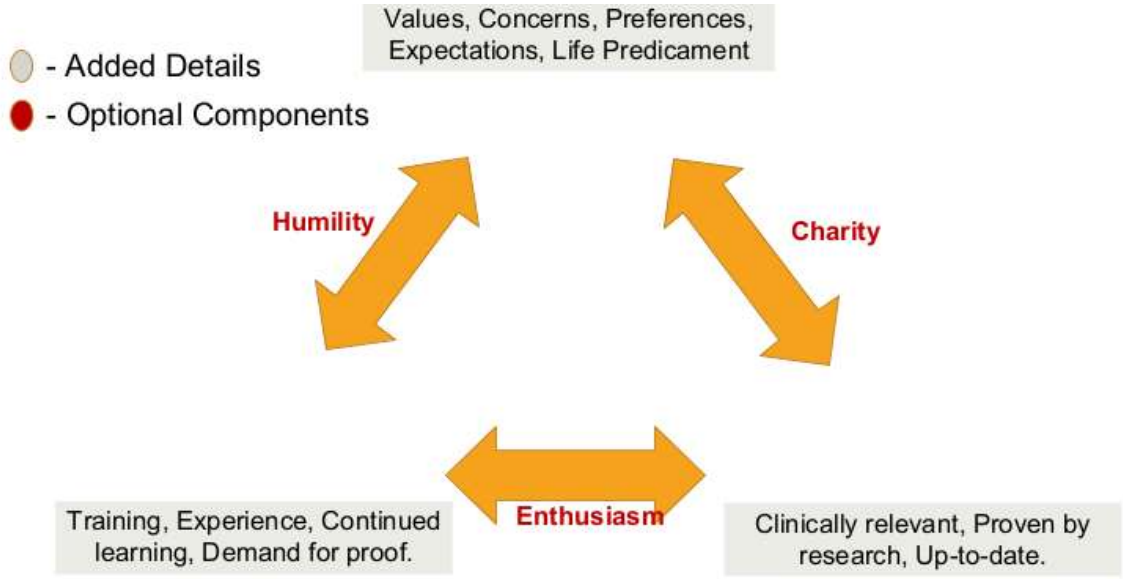

Fig 2 shows the process

Fig 3 shows the EBM process

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Table 1 shows what type of evidence suits the question, problem or issue

Type of question	Ideal type of study
Therapy	Randomized control clinical trials (RCT)
Prevention	RCT > Cohort study > Case control
Diagnosis	Prospective, blind controlled trial comparison to gold standard
Prognosis	Cohort study > Case control > Case series/ Case report
Etiology/Harm	RCT > Cohort study > Case control
Miscellaneous	Basic science, Genetics, Immunology
Cost analysis	Economic analysis

4. RESULTS

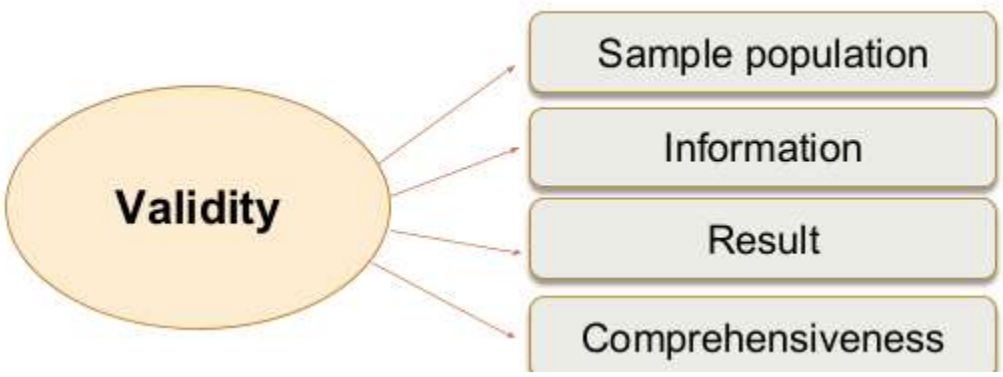

Fig 4 shows validity of evidence

Advantages of EBM after study:

- Clinicians update knowledge base routinely
- Improved understanding of research methods
- Physician becomes more critical in use of data
- Increased confidence in management decisions
- Increased computer literacy, data search technology
- Better reading habits

Disadvantages:

- Learning
- Requires computer skills
- Conferencing, Planning & Review
- **I**nformation overload

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- Requires financial sources and infrastructure
- Cost of care
- Subscription Cost to unavailable journals or references

5. CONCLUSION

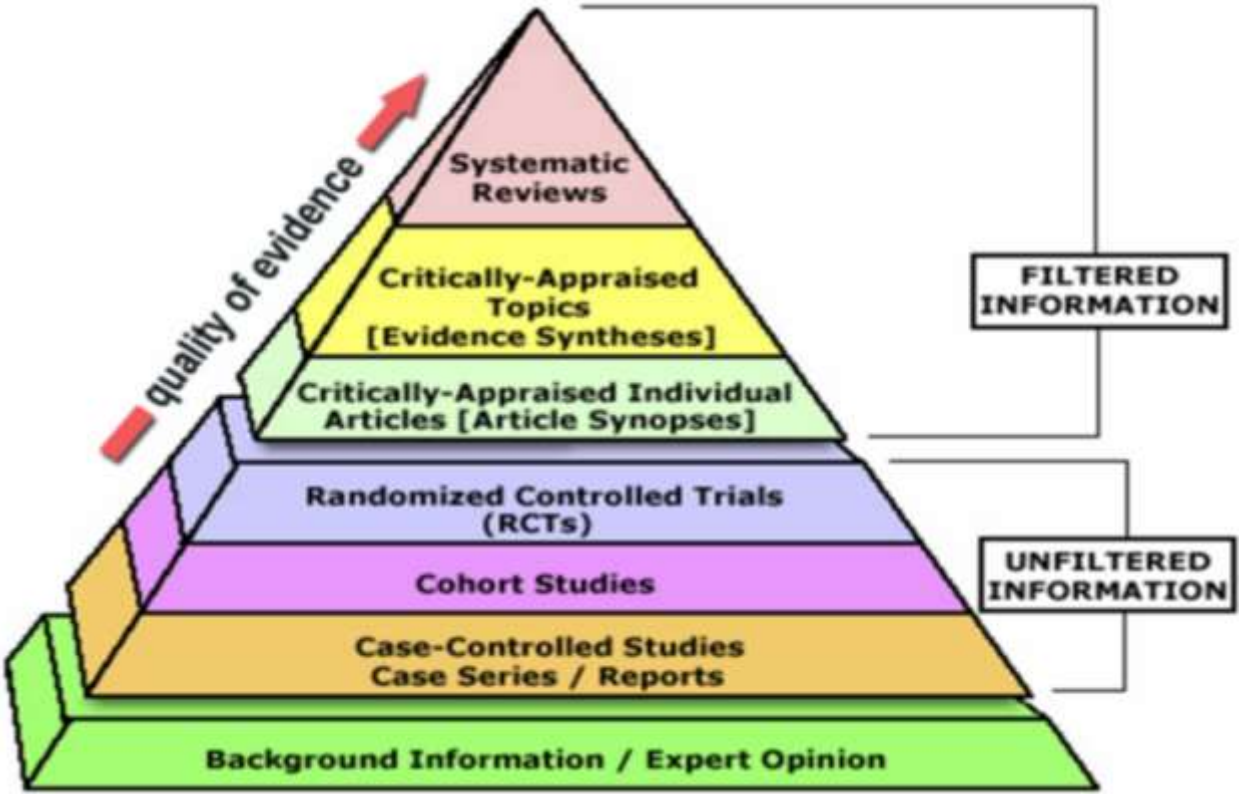

Fig 5 shows the EBM Pyramid

The study aids in identifying the patient's requirements, choices, values, and socioeconomic concerns. Observe the patient's personal priorities. Assisting the patient in comprehending and evaluating the information at their disposal to reach a decision regarding intervention or therapy Acquiring knowledge, Computer proficiency, conference calling, preparation and review, needs infrastructure and funding sources, Care costs, subscription fees to publications or references that aren't available, loss of respect and authority, as seen in figure 5. EBM places a strong emphasis on using data from carefully planned and executed research to guide medical practice. It not only makes individual patient treatment more successful, but it also aids in the creation of health care policies that have an impact on the community. EBM has left a noticeable and perhaps irreversible impression on the field of medicine.

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