Letter to Editor ISSN 2639-846X

Anesthesia & Pain Research

# The Effect of EMR on Evidence-Based-Medicine

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**Received:** 28 Jan 2022; **Accepted:** 30 Jan 2022; **Published:** 30 Jan 2022

**Citation:** Ramin Safakish. The Effect of EMR on Evidence-Based-Medicine. Anesth Pain Res. 2022; 6(1): 1-4.

Dear Editor

As an anaesthesiologist (Queen's graduate) with a background in "programming", it comes as no surprise to anyone how much I've adored Electronic Medical Records (EMR) since their introduction 12 years ago! Before I go over the content of my letter, I need to give a brief background. Let us take a moment to remember the age of paper charts, so that we can all appreciate the major differences that I will point out in this letter. I would like to compare the quality of evidence from that age to that of the last few years. In 2004, right at the end of paper charts, when huge scanning machines were beginning the digitalization of paper charts, I started working in the anaesthesiology department in Kingston, Ontario, Canada. I remember the depth of my resentment toward 200+ pages of a paper chart for Mr. S., a 70-year-old patient. I had to find the most recent echocardiogram results within 10 minutes. That was all the time that I had at 2 am, while Mr. S. was in the ER and needed emergency surgery. I absolutely had to find the most recent echocardiogram record to decide on the anaesthesia technique! If any anaesthesiologist reads these lines and was working on seniors, they would understand the stress (really, a visceral feeling) and remember the taste of adrenaline (and perhaps bile!) when making these decisions.

I was one of the few doctors who loved (and from time to time, hugged!) the computers, and tried to find the Echo results in the scanned part of the chart. Unfortunately, only 10-20% of charts, including the results of the test and a copy of the digital dictation from the cardiologist, had been digitalized. After spending five minutes logging into windows (so painful!) and then into EMR, I still did not have a way of searching for "echo" since initially EMR was only a big digital box of pictures of paper charts. Even more frustrating, when I could not find the results online, I had to go to the massive paper chart and start looking at each page as fast as possible. I don't miss those on-call nights! So many people's lives depended on how fast I could pass through every page…

Fast forward, in 2009, I still had to use paper charting since EMR was not ready for digital charting for anaesthesiologists (at least not in my hospital). Sadly, even though in 2009 almost all paper charts were digitalized, still the EMR was more like a glorious cabinet for the same old papers! Everything was scanned as a picture! Therefore, there was no search function since the program could not find a word in an image. As a result, at least twice a week, you would find me going page-by-page through charts, but this time it was computer images for each page, one after another, looking for needed information. Every time I was called to provide anaesthesia for an emergency operation, I had to spend much valuable time finding the information before deciding on 1) the technique of anaesthesia, 2) the kind of monitoring (invasive or non-invasive), 3) whether central line was needed or not and 4) a plan to increase preload or decrease afterload… Don't get me wrong; this time, I was looking into the EMR.

Now we get to the point of his letter, the value of a retrospective research. Obviously, the retrospective data gathering from paper charts was time consuming, very expensive and unreliable. I have done several of those chart reviews for the department of anesthesiology when I was a resident. For younger people who read this, I will explain how we gathered data retrospectively in those days. Briefly, three or four medical students or residents (the 21st century unpaid workers!) were instructed (ordered?) to look into 200 or 300 charts chosen by the researcher and gather specific data. For example, what percentage of patients admitted to the ER for an acute coronary event had an echocardiogram three months

before the admission? It was not unusual to miss a few lines in one of papers, where a community cardiologist mentioned Echo results and Ejection Fraction of 20%(!) without the actual result of the test.

Slowly, overcoming the resistance (or hate!) from almost all health-care workers in the hospital where I worked, people started using EMR. It was impossible to walk on the floor and not hear some inappropriate (!) adjectives toward EMR's mother! Nevertheless, science does not stop for anyone, and progress is inevitable. Therefore, slowly, all the vital signs, including post-up pain, nausea, vomiting, ambulation, and medications, were documented in real-time. More importantly, the data was not an image or scan of a paper; this time it as entered as intended, and it made a data point.

Around the same time, I started practicing in chronic pain, a new department in our community hospital. I was adamant about being paperless for the new chapter of our patients' journey. Gradually, radiologists' reports were available as text and not images of a paper with text on it, therefore, the content was searchable! I won't mention the challenges of convincing experienced (!) clinic staff to enter vital signs, including the weight and pain levels before and after interventions directly into EMR. I frequently stayed for an hour or more at the end of a clinic day and entered paper records into EMR. Eventually, the attitude changed, and people saw how EMR could make life easier.

In 2011, I decided on full-time practice of Chronic Pain management, since there was (and still is) a real shortage of specialist (anaesthesiologist, neurologist, or physiatrist) who are trained in managing patients with chronic non-cancer pain in Ontario, whereas there were enough anaesthesiologists. I moved my practice to the community (out of the hospital) and started paving the road of using EMR for interventional chronic pain practice. At the time, I could not find a suitable EMR for chronic pain management acceptable in Ontario (for billing and other legal requirements). There were many providers in the USA; however, we needed to find one in Canada. Eventually, in 2013, we agreed on one of the EMR programs made in Canada that was suitable for our practice. The EMR was optimized for family medicine; however, it was relatively easy to use. The only issue was using a "flat" and table-based database. However, we had to wait another eight years before technology was robust enough to adapt to an "object-oriented, web-based database." However, this is the topic for another day.

Now it is time to look into my argument about the value of retrospective reports in the age of EMR. Since 2013, every piece of information about our 30,000 patients has been documented digitally and in real-time. Since the digital data in EMR has an exact date and time stamp, those entries are tamper-proof. The history of different drugs and prescriptions, chronic narcotic use (equivalent morphine dose), and vital signs has been constantly and continuously documented in real-time. Moreover, the dose of lidocaine and ketamine ordered and the label for the clinical staff to print, the total dose that was tolerated and administrated intravenously, and lastly and most importantly, the patient's vital signs are entered digitally. In the last few months, we moved to a newer EMR, and now, we can task the EMR to regularly send a text or email (usually every two months) and ask patients about various aspects of their well-being (anxiety, depression, BPI). Their responses are saved directly into EMR as data and not pictures.

For all my adult life I have been exposed to diverse kinds of literature and studies. As a medical student who was an unpaid worker, I helped the medical residents in their studies. Later on, as an anaesthesiology resident, I submitted my own proposal and performed a mini-clinical trial. Lately, as a senior consultant, I developed and published several new techniques in chronic pain management and have been the principal investigator of several studies.

One of the topics of conversation among colleagues who are interested in continued reading of medical literature has been the hierarchies of different forms of studies. In general, the influence of a study in clinical decision-making has been heavily based on this matter. Traditionally, we only accept the results of a few randomized, double-blind prospective clinical investigations when deciding on implementing a new finding into our practice. The study must be performed in a reputable centre, from a country where human rights mean something, and we knew ethical aspects were seriously considered. In the case that such a study is not found, we then look for other forms and designs. The last place to look has usually been a retrospective trial.

I strongly argue that it is time to change our approach. As scientist and physicians who agreed to respect truth and change based on new findings, we must consider studies of a high number of individuals based on EMR, as the highest value evidence. The following is my reasoning:

- We live in a new era, and we must embrace the change.
- Last year, we used EMR data points of 500 patients who had prolotherapy, and after statistical analysis of a very large number of data points, I made a conclusion and sent the study for publication. Even though the study is "retrospective" in nature, I do believe it is the most valuable that a physician can find about this group of patients.
- Unlike controlled, randomized studies, we do not see a bias of intake, since there is no inclusion of exclusion criteria. We had looked at general population, with their flaws and sicknesses, and the results are applicable to any other physician who

practices in a community like my community.

- The information gathered from data of an EMR must be accepted as "high-value" evidence when an editor decides about publishing an article, or a conference mediator decides whom to choose for the lectures.
- All efforts must be used to inform other practitioners worldwide about the new findings. These are the most compelling evidence in the daily practice of medicine.

Before deciding that you are agree or disagree with me, let us look at the designs of a randomized, double-blind prospective and our retrospective study, and evaluate the value of data points precisely, and think about the implication of information on everyday medical practice. For example, I would use one of our recently submitted studies (for publication). The paper is about the effectiveness and side effects of lidocaine and ketamine infusion in non-cancer chronic neuropathic pain patients (adults).

Firstly, I made an example by designing the same study as a randomized, double-blind prospective clinical research. Then, I would change the design, and this time we look at what we had for publication, and the pros and cons of each one.

Randomized double-blind placebo control studies:
Please notice that I tried to keep the discussion to the minimum, and this is just an example. The inclusion criteria would have been (briefly and right to the point)

- Consented
- Adult (18+)
- Suffer from non-cancer chronic neuropathic pain
- Usually, we would specify a form of neuropathic pain and focus on that, in order to get a more homogenous data:

o Diabetic neuropathy
o Post-herpetic neuralgia o …

We would exclude anyone with:

- Mixed neuropathic condition (fibromyalgia and diabetic neuropathy)
- Multiple pain syndromes (neuropathic pain as well as structural pain)
- Co-existing central nervous system disorder (MS or Parkinson's disease)
- History of possible allergic reaction to lidocaine or ketamine
- History of seizure disorder (increased risk with ketamine)
- Major psychiatric disorder (history of, or currently suffers from)
- Certain age - perhaps before 25 and after 70
- High BMI (perhaps >35)
- Sleep apnea
- Uncontrolled hypertension
- Possible hyperthyroid (even a normal T3 and T4 and only a low TSH)
- Kidney failure (any degree)
- Liver failure or active viral disease of the liver
- …

Protocol of our study:

- Technique: the gathering of data points from EMR about the following patients:
- EVERY patient who o Consented to be part of the investigation anonymously o Adult (+18)

o Meet the clinical justification to have IV lidocaine and ketamine infusion.

I am certain that you could see a "bias" in the first design. As soon as the researchers define "inclusion and exclusion" criteria, they impose multiple biases on who can or cannot be part of the study. Whereas, in our study, we did not exclude anyone; completely the opposite, our study was inclusive and the data that we gathered included EVERYONE. You could see the implication and appeal of our study in the daily practice of any physician who tried to manage patients with chronic pain in the community. In real life, you could barely find a person who does not have any co-existing condition and only suffers from a pure, and yet severe diabetic neuropathy that requires treatments.

I do remember that before 2015, we had to decide about changing our practice when considering a group of our patients, due to difficulty finding compelling science and evidence. Even if we had found a randomized controlled trial, unfortunately, the information was not appealing to a real patient in the community. At the same time, what we found was the best evidence available. Not anymore! Now I have evidence that precisely mirrors the group of patients present in my waiting room.

Lastly, by all means and from bottom of my heart, I agree with constant vigilance and supervision of the studies that would be considered very influential. It is most important that a senior researcher from one of the reputable medical schools or well-respected scientific institutes randomly choose a study site and officially ask for raw data. Requesting the raw data could not be easier than getting the data from EMR, since it literally is one click away.

We all remember the incidence of discovery of fraudulent data and generation of a fake study, as much as it was shocking and unbelievable. I could not believe the disgraced anaesthesiologist who manufactured data (not even manipulated) and published them, and because of the importance and influence of the article, it was cited in several other publications.

Therefore, in the end, I am hoping that the editor finds this letter valuable and publishes it. By doing so, every practitioner in 2022

could have a chance to consider the value of evidence and science achieved by using the data gathered from EMR. Considering the integrity of data points, the data points are tamper resistant (protected against manipulation), as EMR programs constantly records the footstep of anyone who accesses any patient’s file.

Now you have it. Please consider using EMR and adopting the new millennium's remarkable changes. As I always say, computers and the internet are among the essential parts of everyone's life, if they work!