

The importance of critical literacy and lifelong learning in medicine: an interview with Dr. Allan Garland

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Abstract

I met Dr. Garland in my first year of medical school where he was the regular preceptor for my Population Health tutorials. Since then, he has also been my tutorial leader for a series of sessions on critical evaluation of literature in different fields of medicine. From him, I have learned about the importance of actively engaging with the methodology and design of medical research as opposed to simply glancing at the results and discussion. He also taught me about the fundamental weakness of our frequentist approach to research and the extension of that weakness to clinical practice. These ideas, among many others he taught us, have been crucial to my developing understanding of evidence-based best practices. However, not everyone gets the opportunity to spend every other week discussing these things with him. I sat down with Dr. Garland for an interview about critical literacy in medicine to introduce the topic to readers who might not otherwise get the same opportunity as I have. This interview examines the pitfalls of study design and statistical analysis, the importance of being able to critically evaluate literature as a future physician, and how to develop these skills over one's career.

(This interview has been lightly edited and condensed for clarity). References were cited retrospectively for context by EP after the sentence ending and condensed for clarity.

Keywords: evidence-based medicine, medical education, research methodology

Where do you begin when talking about critical literacy in medicine?

The biggest problem in modern medicine is the failure to adhere to evidence-based best practices. This takes two forms: 1) doing things that are not indicated, and 2) failing to do things that are indicated. This has everything to do with critical literacy in medicine. When we read a journal article, we are forced to believe everything we read, especially if we do not know how to critically evaluate the article, distinguish good from bad and right from wrong, and understand the limitations of the way we decide what is likely to be true.

This is a problem because most of what is in the literature turns out to be wrong. This may have to do with poor study design or poor data analysis. This may have to do with the fact that the way we determine what is likely to be true is through the use of p-values and the null hypothesis. (And notice that I say "likely to be true", not "what is true"). This approach, known as the frequentist approach to statistical inference, is intrinsically weak.^{1,2} As a result, it is not surprising that a substantial fraction of studies that have no obvious flaws in their design or analysis cannot be reproduced. Or, at least when they are, they find a much smaller effect size than the first study. This

is pretty common. In fact, the journals that have the largest fraction of papers subsequently found to not be right are the NEJM, JAMA, and The Lancet.³ Why? Because those are journals that like to publish the very first study on something. However, it is not uncommon that the very first study on something turns out to be wrong because of the intrinsically weak way we look at what is likely to be true in medicine.^{4,3}

What is critical literacy in medicine?

First, it means understanding the nature of study design, including its pitfalls. This is so that you can identify limitations in a journal article. For instance, randomized trials, which are pretty straightforward at first glance, have many potential problems. In these trials there are inclusion and exclusion criteria. You can read papers on these trials that show how many participants they started out with and how many participants they ended up with that they analyzed based on these criteria. You realize that the number of participants they analyzed after applying the inclusion/exclusion criteria may be 5% of what they started out with. This means that even if these results are completely true in the universe for that 5% of people, we still do not know if it applies for the other 95% of people. This illustrates one of the problems with randomized trials: they often

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have restrictive inclusion/exclusion criteria that require extrapolation to figure out if the results apply to your patients. There are weaknesses in every study design of course, not just RCTs. You could point out things in observational cohort studies too. For example, if there is a cohort study where they fail to adjust for a potentially important confounder, then you do not know if the answer is right or wrong.

Second, it means understanding statistical analysis. We think that statistical analysis that passes peer review means that it is okay. However, with very few exceptions, I only know of three journals (NEJM, JAMA, and The Lancet) that have in-house biostatisticians who review every paper that is accepted. Otherwise, it is dependent entirely on the knowledge of reviewers. Unfortunately, most journal reviewers are not methodologists. They are content experts. So, they may be no better than the average person at understanding whether an analysis is appropriate. As a result, there is a great deal of bad analysis in the literature. For example, the single biggest statistical analysis problem in my experience is the failure to account for multiple comparisons.⁵ So, the meaning of a p-value as weak as it is, is weakened further if there is more than one comparison done (i.e. more than one p-value reported). This dramatically increases the Type 1 error rate. Unfortunately, the problem is not recognized by many reviewers.

Why is critical literacy in medicine important? Many physicians are not academics. Why should it matter to them whether they can appraise evidence when they may simply follow clinical practice guidelines anyways?

Because we want to do the right things for people clinically. How do you know what the right things to do are? How do you know what you should do? Where should we get our evidence-based best practices? The literature. How do we decide what we should do? The literature, but a critical evaluation of the literature. If you cannot distinguish between something that is likely to be true from “can’t tell”, that is a problem. (“Can’t tell” here referring to the fatal design or analysis flaws that prevent you from claiming something as likely to be true).

Clinical practice guidelines are written when a professional society brings a group of experts together to talk about the best available evidence. So, those groups usually do have some methodologists in them. But, usually, it is the weight of the evidence that rules. How many RCTs do we have? Whether those RCTs are well-designed or contain problems is given less consideration. Nonetheless, groups of experts who come together to parse the literature and help the individual practitioner avoid reading 72 papers on a topic is helpful.

However, everybody has to learn to read research papers, even if they are not researchers. To be an informed physician you have to read the literature. You could wait until a professional group puts together a set of practice guidelines. But that is not always done

quickly. And, if you want to stay current, you have to read the literature. Specifically, read literature about the kinds of patients you have. I have not taken care of general internal medicine patients for decades, so I stopped reading that literature long ago. But, I read the literature on COPD and asthma and critical care cases. You have to figure out what to read, which journals or sources are most germane to the patients you are going to take care of. That is what you spend your time on. You need to know how to read them meaningfully and critically even if you are not a researcher.

How can medical students, residents, and early-career physicians learn to be more critically literate?

Historically, this is a topic that medical schools hardly teach. However, through the University of Manitoba’s recent curriculum redesign, critical evaluation has been incorporated as one of the longitudinal themes in the curriculum. I am responsible for a small module on critical evaluation of the literature in the PH2 course. Is it worth something? Yes. Is it enough? Well, if I had my druthers, it would be more prominent because I think that learning how to meaningfully read and critically evaluate the literature is just as important as knowing which anti-hypertensive to use first. Nevertheless, we are doing better.

It remains difficult to teach in residency.⁶ Even to the extent that we do teach it, what you don’t see is it generally modelled on the wards. So, when you’re on clinical rotations, whether you’re a medical student or a resident, there is very little discussion about these things. Instead, we mention how the results of a paper showed something important. But did it really? We should talk about how the paper showed something important. That is the purpose of journals clubs. In our internal medicine residency program, we changed journal clubs this year. Whereas, it used to be a free-for-all discussion of results, the papers presented are now meant to be a practicum in critical evaluation. So, each paper is chosen to highlight some methodological issues which are then discussed. Will our 18 journal club presentations every year for three years teach you everything you need to know? No. But, but you can learn about 54 important topics, and that will certainly help.

Unfortunately, evidence shows that most practicing physicians do not possess the learned knowledge to be able to critically evaluate the literature.^{7,8} Again, we have done a terrible job in medical schools across the world at teaching critical evaluation skills. There is Continuing Medical Education (CME) for reading journal articles, but there is no critical evaluation portion. It is hard. There is no one-stop shopping. There are some attempts to address this though. For example, there is the JAMA Users’ Guide to Medical Literature.⁹ This is a compilation of papers published in JAMA in the 1990s about how to read this kind of paper, that kind of paper, and the other kinds of papers. While it addresses study designs very well, it does not address statistical analysis to the same extent. This is a good

resource, but it is still not enough.

Overall, I think we need to do a much better job at teaching this and it needs to start in medical school. It should continue in residency and should continue in CME. We have a long way to go, but we are better than we were in my day where I learned nothing about this.

Although we try to teach about this starting right in medical school, the truth is that if you do not learn how to critically evaluate the literature on your own, by the time you are done with your training it is hopeless. This is because when you are done with your training, nobody will ever teach you anything ever again. Going to a national conference a few times a year is not going to keep you current in your area. The only way to keep current is to read, read, read and to critically read, read, read. This is so that when you read a study where the design is poor, you can say “I don’t know if this is true or not, so I’m not going to practice based on this until I see more.” If you read a study where the study design is fine, but the analysis is problematic, you can say “I don’t know if this is right or not, so I’m going to have to wait for more evidence before I make a determination.” You need to be able to critically read the literature and make that critical evaluation yourself.

What is the most common mistake medical students, residents, and early-career physicians make when learning how to critically evaluate medical literature?

I don’t think there is a most common. I think that there is a general lack of understanding of the big questions. One of the biggest things that people do not understand is the nature of evidence. Understanding the nature and limitations of the way we decide what is likely to be true is fundamental. But, there are no shortage of issues. Choose any kind of paper. There are basic things like what a p-value means and does not mean. But, depending on the papers you read, there are also a myriad of subtle pitfalls that you will never know about if you do not hear about them. Students are not taught about them. A strong example of this is the immortal time bias.^{10,11} So, there are lots of things to learn. And the truth is, to really be sophisticated enough to be able to read all kinds of papers, you almost need to be a biostatistician. However, the truth is also that the majority of papers are of just a few types. And you can learn those issues if you’re taught them. But, again, we have not done a very good job of systematically teaching them in the past. And there are still really no expectations across the country that we should to teach them.

Another thing is that, just because we are limited to the best available data we have now, does not mean we should become nihilists about data. Yes, the frequentist approach has serious limitations among the many other problems in interpreting the literature. However, we are always going to be limited by that. New evidence showing that older evidence was likely wrong does not mean that anecdotal evidence trumps best available evidence. And none of these problems gives us the freedom to ignore evidence we do not like (or what is contrary

to what we already practice). We should instead always practice on the best available data. The findings we should believe are those which are reproducible and durable over time.

For instance, one of our faculty members at a journal club debate a few years ago said, “What have we learned from all the randomized trials done on critical care in the last 20 years? Nothing, because most of them have just shown that we don’t know what we’re doing.” And it is true that most of the major themes of critical care literature in my lifetime have been to debunk things that we thought were beneficial but now we know are not beneficial. Let’s call these scientific “reversals”. Well, these reversals are actually useful. Some believe that slow, incremental improvements in outcomes are not a result of any new magic bullets, but because we have progressively stopped doing things that are harmful that we used to think were beneficial. I think that is the reason that critical care outcomes have improved in the last 25 years. But, when people say, “Well, I can’t believe anything in the literature because there are reversals,” it is because they do not understand the limitations of what they read. They do not understand the nature of how we try to get at truth. And again, reproducibility is the only way we can really approach truth.

If you could impart one idea to physicians in order to improve their ability to critically appraise the literature, what would it be?

I will say two things. First, you need to read in your area of clinical practice. Second, you need to learn the knowledge and skills to be able to critically evaluate the literature. That is not easy. There is a lot to it. We have talked about the big two: study design and statistical analysis. From here, continued learning is hard, but it is possible and it is very important because otherwise we are forced to believe everything we read. The day you finish your training will be the last day anyone ever really tries to teach you anything. You must critically read!

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