

Challenges facing early- and mid-career researchers: potential solutions to safeguard the future of evidence-based medicine

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The challenges facing the evidence-based medicine (EBM) movement are well documented[1,2]. Yet, the problems facing early- and mid-career researchers (EMCRs) working in the ecosystem of EBM have not been articulated. The coming together of a cohort of EMCRs from across the globe enabled this articulation[3]. The 2019 EBMLive conference (see Box 1) provided a space for EMCRs to discuss problems, exchange ideas and create a list of potential solutions. This article outlines four key problems faced by EMCRs and their potential solutions (see Box 2).

Problem 1: Tokenistic training of evidence-based medicine

Ninety-five per cent of medical schools in the United States (US) and Canada integrate EBM into their curricula[4]. Yet, EBM is not prioritized. Instead, it is incorporated into other activities within the curricula, and formal assessment of EBM competency progressively decrease as one's clinical training advances[4]. In the United Kingdom (UK), core EBM topics are taught but few medical schools provide time in the curricula for students to practice and assess their skills[5]. Evidence on the level and implementation of EBM training for health scientists is less clear. However, we anticipate that training varies widely depending on one's degree or degrees, discipline, experience, university and country. Given the lack of consensus on the best methodology to teach EBM[6], we propose the development of a standardized, evidence-based curriculum for all health professionals and scientists with a focus on research biases, conflicts of interest, and transparent and reproducible research practices.

Evidence that illustrates the potential harm of biases in clinical practice and research must be included when teaching students and training scientists about research biases[7]. Health care trainees and scientists must be taught that payments as small as a meal may affect their prescribing practices[8] or the direction of their study's results, and the importance of reporting and declaring such payments or competing interests. Teaching health care professionals how to communicate medical uncertainties and stopping treatment when standard practice provides no benefit, or is harmful, is essential. Overall, adequate time must be allocated to ensure learners practice critical appraisal skills and open science. In doing so, the next generation of health professionals and scientists will conduct more robust and reproducible science, improving the translation of their research for patients, policymakers, funders and front-line clinicians.

Problem 2: Emphasis of quantity over quality

The culture of "publish or perish" is well established in academia[9]. For EMCRs, this pressure to publish is considerable. Employers, institutions and funding bodies use the metric of one's publications to make judgements that can defer the progression of one's career, impede employment opportunities and inhibit the development of becoming an independent researcher. More recently, this metric is determining the speciality and career pathway of junior doctors working in the UK. Important contributions to research, such as enrolling participants in clinical trials which do not warrant authorship, are not accounted for in the scoring system of specialist training posts[10]. This shallow focus on publication metrics perpetuates research waste, scientific misconduct and poor research practices[11,12]. Furthermore, research metrics compound the current environment of limited research funding and difficulty publishing for EMCRs, such that most studies need to be large and multi-centre.

The current system needs restructuring. Instead of focusing on the number of publications, journal impact factors, or h-index's, we need to evaluate research contributions based on their quality and the likely impact on society. To do this, we propose the incorporation of a new metric system (e.g. the Altman Index[13], see Box 3) and a change in cultural expectations of employers, institutions and funding bodies. To bring about this culture change, we need meaningful leadership and mentorship from the EBM community.

Problem 3: Lack of meaningful mentorship

Mentorship that champions the integrity of science along with career success, is lacking. Initiatives to embed research integrity and ethical conduct of research seems crowded out by a preoccupation with outputs and grant funding. In such an environment, it is not surprising that EMCRs lack insight or resolve to resist poor research practices, and in some cases, scientific misconduct. Senior academics have an important role to play in helping EMCRs achieve their career goals rather than promoting their research and career agendas. Without meaningful mentorship, EMCRs may choose to leave academia, creating a generational gap.

To create future leaders of EBM, senior academics must invest time and training in becoming meaningful mentors[14]. They must provide moral leadership and practical guidance so that junior researchers can succeed while maintaining their integrity. For mentors and mentees, the principles outlined by Professor Sharon Straus and the late David Sackett are a practical and evidence-based template for positive mentorship[15]. Mentoring needs to be made tangible and measurable, built into academic job descriptions, audited objectively and funded accordingly. There is also evidence that matching mentors and mentees based on ethnicity improves outcomes however, this is not the case for gender-matched pairs[16]. Thus, the suitability of mentors for mentees must also be considered.

Problem 4: Increasing administration burdens

The distinction between 'academic' and 'non-academic' activities is no longer clear-cut[17]. The onus of administration usually falls on those who are most junior. Without large grants or adequate research teams or support, EMCRs must manage mandatory bureaucratic structures such as ethical committees, funding reports, manuscript formatting edits, and local research governance. This, coupled with a heightened sense of expectation for outputs, teaching, embedding patients and the public in research, practising open and transparent science, can make life as an EMCR overwhelming. Currently, administrative burdens block innovation and inhibit progress for EMCRs.

To foster emerging leaders in medical research, funders, employers, ethics committees, finance teams, journals and publishers should streamline processes. Practical solutions include the agreement on one manuscript style for writing all publications and using one form or system for applying to all ethics committees such as the Integrated Research Application System (IRAS) in the UK[18]. Other possible solutions include the use of literate programming to write and generate living manuscripts that can be easily transferred to different journal styles[19]. Preprint servers such as medRxiv[20] may also play a significant role in ensuring the open and accessible publication of research findings.

Conclusions

EMCRs can make significant contributions to fixing the problems in medical research. Yet, the current structures and systems need an overhaul. We propose that the training of EBM, research metrics, mentorship and administration processes must be revised and improved to ensure that there is a future for evidence-based healthcare.

Box 1

The EBMLive Conference (www.ebmlive.org) is a joint partnership between the Centre for Evidence-Based Medicine and the *BMJ*, designed to “*develop, disseminate, and implement better evidence for better healthcare.*” Since inception, EBMLive has worked tirelessly to include the voice of students and early career researchers. Building on previous work, the inaugural Doug Altman Scholarship[3] and Building Capacity Bursaries were launched in 2019 to fund the travel and attendance of early career researchers from across the globe to attend the conference.

Box 2

In the lead up to the EBMLive conference, Doug Altman Scholars submitted personal and general problems they have faced as early career researchers. The responses were synthesized and shared with the Scholars to generate further discussion. During EBMLive, the problems and ideas for potential solutions were discussed and presented during dedicated sessions for early-mid career researchers. The key list of problems facing early- and mid-career researchers and their potential solutions are as follows:

1: *Tokenistic training of evidence-based medicine*

- Develop a standardized, evidence-based curricula for teaching evidence-based medicine
- Incorporate the teaching of research biases, conflicts of interests, and medical reversal into curricular

2: *Emphasis of quantity over quality*

- Restructure research metrics to focus on research quality and impact
- Institutions, employers and funding bodies must change the culture and current expectations of publication

3: *Lack of meaningful mentorship*

- Mentorship should be built into academic job descriptions and audited objectively
- Mentees should be matched with suitable mentors

4: *Increasing administration burdens*

- Streamline current processes
- Global use and acceptance of preprint servers

Box 3

The Altman Index [13]

- A quantitative metric for scientific integrity and commitment to open-access science
- The Altman index would be calculated based on different components of open scientific practice including (but not necessarily limited to):
 - Pre-registration of methods
 - Software

- Data
- Publication (pre-print and print)

Each of these components would be linked to a unique project ID. The Altman index (A) is still a work in progress, but could be calculated in the following manner:

$$A = X_1 + X_2 + \dots + X_i$$

Where:

- X = fraction of open access criteria fulfilled for a given publication
- i = project identification

As an example, an early-career researcher who has completed three projects might have contributed to open science in the following way:

Project ID	Criterion fulfilled					X
	Pre-registration	Software	Data	Pre-print	Print	
1	Y	Y	N	Y	N	3/5
2	Y	Y	Y	Y	Y	5/5
3	N	N	N	N	N	0/5

So:

$$\begin{aligned}
 A &= X_1 + X_2 + X_3 \\
 &= 3/5 + 5/5 + 0/5 \\
 &= 8/5 \\
 &= 1.6
 \end{aligned}$$

Although all projects this scientist completed were considered in the calculation, only those that fulfilled at least one of the open access criteria contributed to the overall Altman index. In this way, all efforts to practice open science are recognised.

Altman index could then be linked to ORCID, where a more detailed breakdown of a scientist's Altman index could be provided. The Altman index could then be considered alongside (or even in place of) current metrics such as publication impact factor when hiring for academic positions or allocating research grants.

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