Emergency Medicine Australasia (2014) **26**, 76–83 doi: 10.1111/1742-6723.12191

EDUCATION AND TRAINING

Free Open Access Medical education (FOAM) for the emergency physician

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> If you want to know how we practised medicine 5 years ago, read a textbook.
>
> If you want to know how we practised medicine 2 years ago, read a journal.
>
> If you want to know how we practise medicine now, go to a (good) conference.
>
> If you want to know how we will practise medicine in the future, listen in the hallways and use FOAM.

– from International EM Education Efforts and E-Learning by Joe Lex 2012[1]

Introduction

FOAM is 'free open-access med(ical ed)ucation'.[2,3] As such, FOAM is a dynamic collection of resources and tools for lifelong learning in medicine, as well as a community and an ethos. FOAM is continually evolving and growing rapidly, and from anarchic beginnings is increasingly attracting interest from practicing clinicians, trainees, educators, researchers and publishers alike. This article defines FOAM, details its development and considers its role, particularly in relationship to scientific journals, textbooks and medical education as a whole.

FOAM resources, tools, community and philosophy

FOAM is sometimes considered synonymous with 'educational social media for medicine', but it is actually much more than that. Social media refers to the creation and exchange of user-generated content via virtual networks and communities using Internet applications. FOAM resources are predominantly social media based but are ultimately independent of platform or media.[2] They include blogs, podcasts, tweets, Google® hangouts, web-based applications, online videos, text documents, photographs, graphics and even anything else you can create with pen and paper.

Social media has been a potent catalyst for developing and disseminating FOAM resources but from the sharing of these resources has grown a lively, interactive global community of FOAM users and creators. This FOAM community is bound by the loosely woven philosophy that high-quality medical education resources and interactions can, and should, be free and accessible to all who care for patients and especially those that teach others the art and science of medicine. Importantly, FOAM enthusiasts also encourage the re-use and modification of their resources to suit user requirements and local needs. Ultimately, the glue that holds the community together is an ethos of open sharing and collaboration with attribution and recognition of the work of others.

FOAM existed long before the acronym came into being, and the then unnamed FOAM ethos was at the forefront of our minds when we began working on *Lifeinthefastlane.com* years ago. Joe Lex, at the Social Media and Critical Care (SMACC) Conference in 2013, even argued that the origins of FOAM lie in the Hippocratic Oath itself,[4] which states: '… and to teach them this art – if they desire to learn it – without fee and covenant'.[5] Indeed, members of the medical profession throughout history have been willing to share knowledge with those committed to the craft and to seek learning from far-flung places from whoever is in a position to provide it. In the age of social media, this has never been easier.

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Yet, names are important when it comes to making ideas stick and making ideas spread. The term FOAM bubbled into existence when one of us (MDC) was, along with emergency physician Sean Rothwell, lamenting the negative connotations of the term 'Social Media' in the laggardly minds of practicing physicians. As the venue was the International Conference on Emergency Medicine (ICEM) 2012 in Dublin, the answer was naturally to be found at the bottom of a pint of Guinness®. Since then, FOAM has exploded and grown rampantly, and there are now over 240 blogs and podcasts devoted to free open-access medical education using the FOAM banner in emergency medicine and critical care alone.[6] Some of the most established and well-regarded examples are listed in Table 1. There are also numerous other resources that can be considered as FOAM but that do not explicitly embrace the label.

Twitter® has been central to the development of the FOAM community.[7] This might be surprising to those whose minds meld Twitter® with the marketing machine of Justin Bieber but not to anyone who actually knows how to use this valuable tool. Twitter® is free to access and allows users to selectively follow people who have interesting or useful things to share. Tweets are, notoriously, limited to just 140 characters. This forced brevity ensures users must 'cut to the chase' when getting points across or sharing resources. Twitter® users can also follow topics, in addition to individuals, when tweets are labelled with a unifying hashtag. For instance, FOAM tweets can be labelled with a hashtag, allowing them to be rapidly identified by a search for #FOAMed (unfortunately #FOAM leads to not-so-educational tweets). Currently on Twitter® there are 630 people who have registered as followers of FOAM.[2] Some that we suggest Australasian emergency physicians would benefit from following are listed in Table 2.

FOAM and the traditional medical journal

FOAM is sometimes portrayed as being at loggerheads with 'the establishment', including traditional medical journals. We think this is overstated, and both social media and FOAM have a growing role in the post-publication analysis of scientific research and in bridging the gap between research and practice.

There has been a push from some quarters to make FOAM more 'journal like', and a common criticism of FOAM is that it is not peer reviewed in the traditional sense.[8] However, FOAM is not scientific research. Instead, FOAM is a useful way of disseminating, discussing, dissecting and deliberating over the products of that research – as well as exploring issues where research findings do not apply, or simply do not exist. FOAM is more akin to the editorials and commentary articles that appear in medical journals, usually solicited by editorial request and without traditional peer review – except that FOAM authors do not require invitations from editors-in-chief to share their thoughts. Unlike scientific research, FOAM opinions and arguments live or die by being hammered on 'the anvil of Truth' that is free and open debate and discussion.

Peer review, although widely held to be central to the scientific process, has significant flaws.[9] Many journals are now looking at means of improving this process, including consideration of various forms of post-publication peer review. Indeed, Pubmed® Commons[10] is now being trialled and others have argued for a 'publish then filter' model of scientific publication, perhaps involving crowd-sourced peer review.[11] In a sense, FOAM is already part of this post-publication peer-review process. For example, a blog post on *Intensive Care Network*[12] recently led to a correction in the *New England Journal of Medicine*.[13] Online journal clubs abound, and there are entire blogs dedicated to critical appraisal and discussion of the scientific literature (such as *Emergency Medicine Literature of Note*[14] and *EM Nerd*[15]). The significance of, and the caveats to, the scientific literature have never been so widely discussed, disseminated and deliberated on, and never so quickly. This was most evident with widespread FOAM discussion of the negative outcome of the targeted temperature management trial within days of its publication.[16] FOAM, because of the media used, is potentially subject to a more pervasive peer-review process that the scientific literature itself. A difference is that this occurs post-publication. The major drawback is that the review process might be 'hit-and-miss', with more popular resources, such as *EMCrit.org*, being subject to great scrutiny and discussion, whereas new blogs and podcasts with few subscribers might have little.

A more pertinent criticism of FOAM is the variable degree of scholarship. In its least scholarly form, FOAM is the equivalent of a corridor conversation – some tweets are essentially unreferenced bullets shot from the hip, as are some opinion-based blog posts. Yet other FOAM products, such as Paul Young's '*Fever, Friend or Foe?*' blog post,[17] are extensively referenced and are as scholarly as any other publication. Thus, *caveat emptor* applies in FOAM, just as it does when we read scientific

Table 1. Recommended emergency medicine FOAM blogs, podcasts and websites

- *Academic Life in Emergency Medicine* – http://academiclifeinem.com/ – US-based scholarly blog covering all facets of emergency medicine and education
- *EKG Videos* (Amal Mattu) – http://ekgumem.tumblr.com/ – video lectures on emergency ECG topics by a world renowned emergency cardiology expert and educator
- *Boring EM* – http://boringem.org/ – a Canadian blog focusing on FOAM and the supposedly less exciting aspects of emergency medicine
- *BroomeDocs* – http://broomedocs.com/ – a remote general practice blog based in Broome, Western Australia, highly relevant to emergency physicians
- *Critical Care Reviews* – http://criticalcarereviews.com – a comprehensive approach to staying current with the critical care literature
- *Don't Forget The Bubbles* – http://dontforgetthebubbles.com – an engaging case-based question-and-answer guide to emergency paediatrics
- *Dr Smith's ECG Blog* – http://hqmeded-ecg.blogspot.com.au/ – a blog by an ECG expert dedicated to advanced emergency medicine ECG interpretation
- *EM Nerd* – http://emnerd.com – whimsical and enlightening delves into important articles from the emergency medicine literature
- *EMCrit blog* – http://emcrit.org/ – Scott Weingart's singular approach to emergency medicine critical care
- *Emergency Medicine Ireland* – http://emergencymedicineireland.com/ – Irish blog on emergency medicine, with an emphasis on applied anatomy
- *Emergency Medicine Literature of Note* – http://www.emlitofnote.com/ – exactly what it claims to be!
- *EMPEM.org* – http://empem.org/ – Perth-based podcast discussing all aspects of emergency paediatrics
- *ERCAST* – http://blog.ercast.org/ – curbside consults podcasted by American emergency physician Rob Orman
- *Free Emergency Medicine Talks* – http://freeemergencytalks.net/ – Joe Lex's enormous collection of talks recording from emergency medicine and critical care conferences around the world
- *iTeachEM.net* – http://iteachem.net/ – a blog about education for clinical educators created by the authors and Baltimore-based emergency medicine educator Rob Rogers
- *Life in the Fastlane* – http://lifeinthefastlane.com/ – blog and website created by the authors (CPN and MDC) dedicated to all aspects of emergency medicine and critical care
- *Pediatric EM Morsels* – http://pedemmorsels.com/ – a comprehensive American blog on emergency paediatrics
- *PHARM* – http://prehospitalmed.com/ – a prehospital and retrieval medicine blog and podcast from northern Australia, with an emphasis on airway management
- *Resus.ME* – http://resusme.em.extrememember.com/ – Cliff Reid highlights breaking research in resuscitation medicine
- *Skeptics Guide to Emergency Medicine* – http://thesgem.com/ – a podcast that scrutinises the medical literature by Canadian Ken Milne from the Best Evidence in Emergency Medicine (BEEM) group
- *SMACC* podcast on Intensive Care Network – http://www.intensivecarenetwork.com/index.php/icn-activities/smacc-2013/podcasts – podcasted talks from the SMACC conference
- *SMART EM* – http://www.smartem.org/ – a podcast in which New York-based emergency physicians David Newman and Ashlee Shreeves 'deep dive' into the medical literature
- *Sonocave* – http://thesonocave.com/ – Australian blog providing high-quality ultrasound education resources
- *Sonospot* – http://sonospot.wordpress.com/ – American blog dedicated to all things ultrasound
- *StEmlyns* – http://stemlynsblog.org/ – an outstanding UK-based blog on all aspects of emergency medicine led by Simon Carley, one of the founders of BestBETs.org
- *The Poison Review* – http://www.thepoisonreview.com/ – American blog highlighting toxicology in the medical literature and other media
- *The Trauma Professional's Blog* – http://regionstraumapro.com/ – comprehensive American blog on the assessment and management of trauma
- *TJDogma* – http://tjdogma.com/ – an educational blog by a former Chair of ACEM Fellowship Examination Committee
- *Ultrasound Podcast* – http://www.ultrasoundpodcast.com/ – entertaining and highly educational American podcast on emergency ultrasound
- *UMEM Education Pearls* – https://umem.org/educational_pearls/ – bite-sized educational morsels from the faculty at the University of Maryland

Table 2. Selection of recommended FOAM Emergency Physicians using Twitter® (the authors are @precordialthump and @sandnsurf)

- @_NMay – Natalie May, Emergency Physician, UK
- @Akutdok – Katrin Hruska, Emergency Physician, Sweden
- @amalmattu – Amal Mattu, Emergency Physician, USA
- @andyneill – Andy Neill, Emergency Registrar, Ireland
- @APGvD – Pieter Van Driel, Emergency Physician, Netherlands
- @bedsidesono – Mike Stone, Emergency Physician and Sonographer, USA
- @Brent_Thoma – Emergency Medicine trainee and Simulation Fellow, Canada
- @cliffreid – Cliff Reid, Emergency Physician and Retrievalist, Australia
- @criticalcarenow – Haney Mallemat, Critical Care and Emergency Physician, USA
- @EDExam – Andy Buck, Emergency Physician, Australia
- @eleytherius – Michelle Johnston, Emergency Physician, Australia
- @EM_Educator – Rob Rogers, Emergency Physician, USA
- @EM_Manchester – Simon Carley, Professor of Emergency Medicine, UK
- @emcrit – Scott Weingart, Emergency Physician and Intensivist, USA
- @First_do_noharm – Diana Egerton-Warburton, Emergency Physician, Australia
- @GomorraDoc – Sean Scott, Emergency Physician/Intensivist, Australia/Italy
- @HawkmoonHEMS – Brain Burns, Emergency Physician and Retrievalist, Australia
- @joelex5 – Joe Lex, Emergency Physician, USA
- @karelhabig – Karel Habig, Emergency Physician and Retrievalist, Australia
- @louiseacullen – Louise Cullen, Emergency Physician, Australia
- @Lwestafer – Lauren Westafer, Emergency Medicine Trainee, USA
- @m_lin – Michelle Lin, Emergency Physician, USA
- @MedEmIt – Gemma Morabito, Emergency Physician, Italy
- @slahri – Sa'ad Lahri, Emergency Physician, South Africa
- @smaccteam – Oliver Flower, Roger Harris and Chris Nickson and the Organisers of the SMACC conference
- @SocraticEM – Victoria Brazil, Emergency Physician, Australia
- @sonospot – Laleh Gharahbaghian, Emergency Physician and Sonographer, USA
- @srrezaie – Salim Reziae, Emergency Physician, USA
- @TessaRDavis – Paediatric Emergency Medicine trainee, Australia
- @Turtle1doc – Natalie Thurtle, Emergency Medicine trainee and MSF doctor, UK

research or any other source of information – all physicians need to develop critical thinking skills and appraise the merits of whatever information they are using. On the other hand, FOAM creators should strive to produce referenced scholarly works whenever possible, for the sake of their own credibility and to aid the user in making up his or her own mind.

As alluded to earlier, knowledge translation continues to be difficult to achieve in medicine, and there remain significant gaps between research and practice.[18] Scientific research in the clinical sciences is essentially worthless unless it alters patient outcomes. Social media and FOAM have the potential to play a major role in knowledge translation. This is demonstrated by the rapid dissemination of the 'delayed sequence intubation' concept[19,20] and the 'NODESAT' approach to apnoeic oxygenation.[19,21] The CRASH2 investigators have also used social media and web-based tools to promote the use of tranexamic acid in trauma,[22,23] whereas tweets about articles appear to correlate with future citations[24] and social media releases lead to more downloads of research articles.[25]

If the rise of open access medical publishing continues as expected, the distinction between FOAM and medical journals might blur. Regardless, it seems inevitable that traditional medical journals will continue to explore the role of social media in their peer review and knowledge translation strategies.

FOAM and the traditional medical textbook

So, while FOAM and medical journals complement more than they clash, can the same be said for the

relationship between FOAM and textbooks? Even prominent FOAM advocates, such as Joe Lex and Scott Weingart, still advocate that trainees must read at least one of the major emergency medicine textbooks 'cover to cover'.[26] The underlying rationale for this, we believe, is to ensure that 'all the bases' are covered – that all the core topics of our specialty are studied by trainees. FOAM is considered too heterogenous, with too much emphasis on 'sexy topics', such as awake intubation and the intricacies of surgical airway, with not enough on important topics, such as hand hygiene and cultural competency.

It is naïve to believe that any one textbook meets the learning needs of a given trainee. The curriculum and the learning requirements are determined by the colleges, in our case the ACEM.[27] Although there are a number of recommended reading texts suggested by ACEM, trainees are entitled to use whatever resources are available to meet these needs. In many cases, FOAM resources are the most accessible, most up-to-date, most engaging and sometimes even the highest quality resources available (targeted temperature management after cardiac arrest is a timely example[16]). Where this is not the case, interaction with a clinical teacher, exploration of the primary scientific literature or consultation of a text can fill in the gaps. As FOAM continues to grow, the gaps are shrinking.

Does this mean that FOAM should have its own curriculum?[28] We think not – as the trainee curriculum is clearly defined by the college. FOAM resources can be linked to the ACEM curriculum, for instance, providing a comprehensive base for trainee knowledge needs (e.g. ACEM's *Best of Web* project[29]). Importantly, in addition to these basic training requirements, learners need to develop their own personal 'curriculum' that will evolve over time according to their changing requirements and those of their patients. By learners, we mean physicians at every stage of their careers, not just trainees. Again, FOAM resources help meet these needs.

So is the textbook dead? The monolithic tome of yore certainly should be. Bulky texts that are out-of-date before they are published, with editor-defined content, that are non-learner and non-location centric and are unchallengeable in a public forum have a dwindling role to play in medical education. A textbook of the future needs to integrate many of the characteristics of FOAM resources: instantly updatable, continual post-publication review, user interactivity, multimedia integration, platform independent, cloud based and adaptable to local needs.

FOAM and medical education

FOAM is an adjunct to existing medical education approaches, not a replacement.

FOAM resources are easily accessible and are portable. This makes them ideally suited to asynchronous learning[30] and the 'flipped classroom' model.[31] Asynchronous learning allows trainees to educate themselves using resources that suit their needs when the time is right for them. This is useful in the emergency medicine setting where shift work is the norm, and trainees have different degrees of knowledge and understanding about different topics. This model is also suited to trainees who are isolated or in remote locations, distant from specialist clinical teachers. A remarkable feature of FOAM is its capacity for tacit knowledge sharing.[32] Through, videos, audio discussions and iterative interactions knowledge that is otherwise difficult to express in stand alone texts or lectures can be transferred. FOAM facilitates practical solutions to problems that research has yet to answer and that textbooks have no room to discuss.

The 'flipped classroom' model[31] is a useful way to utilise FOAM. Asynchronous learning resources can be studied by participants prior to each education session and negates the need for lecture preparation. This allows the bulk of the valuable teaching time to be devoted to higher level facilitated peer-group discussion, simulation or other interactive and team-based learning approaches rather than one-way didactic sessions. This guards against FOAM resources being misunderstood by learners if they do not have sufficient base knowledge or clinical experience to appreciate the nuances and ramifications. No single technology or educational resource can replace bedside mentoring by an expert clinician educator, but adjunctive, asynchronous learning combined with a flipped classroom gives learners the best of both worlds.

The future of FOAM

The future of FOAM is exciting. Although currently centred within the realms of emergency medicine – it continues to grow[6] and its scope is expanding rapidly (e.g. the rise of subspecialty Twitter® hashtags, such as #FOAMcc for critical care, #FOAMped for paediatrics and #FOAMtox for toxicology). Existing resources are being continually updated, revised and remodelled to create tailored geo-centric and specialty-specific solutions.

We hope to see FOAM, where appropriate, improve in its degree of scholarship and become increasingly recognised by employers, academic institutions and specialty colleges. Appropriate referencing of text-based resources is the key to scholarly credibility and should be used where appropriate. We feel it is unlikely that FOAM will ever become truly peer reviewed in the traditional sense, despite experiments, such as the 'expert peer review' system used by *Academic Life in Emergency Medicine*,[33] because of the apparent advantages of crowd-sourced post-publication peer review by FOAM users.

An important limitation to the expansion of FOAM is the 'cost of free'. At this time FOAM resources are created largely by altruistic, motivated individuals, in their own time and at their own cost. One solution adopted by Scott Weingart of *EMCrit.org* is to provide the content for free but require a fee for obtaining CME points.[34] Other possible models include jobs boards, advertising, donations and institutional funding to support the cost of hosting and website development.

Confidentiality, maintaining patient privacy and obtaining appropriate consent are also key issues to consider when creating online educational resources.[35] These factors are especially important as creators of FOAM content do not control the destiny of their educational material. These resources might be modified and reused in ways unimaginable to the original creator. There are also concerns about managing one's online professional persona and the public perception of frank and open debate involving healthcare professionals discussing issues at or beyond the limitations of their knowledge.[35] Regardless of whether we are acting in the real world, or in a virtual world online, the principles of medical professionalism still apply. Anonymity is too be avoided and health professionals using social media need to remember that anything they say online will stay online. Cloud conversation is the equivalent of shouting through a megaphone in a stadium full of people during a televised event.

It is a challenge to define the value, validity, utility and return-on-investment of FOAM resources.[36] As with any educational platform, demonstrations of benefit are elusive. Current metrics are based on the rapid growth in the use of the resources, number of page views and downloads as well as individual testimonials of the benefits of FOAM resources in passing medical examinations and in solving clinical problems.

Table 3. Ten tips for FOAM beginners (modified from iTeachEM.net[36])

1.	Sign up to Twitter®
2.	Register as FOAM user
3.	Be identifiable, don't be anonymous
4.	Be professional
5.	Be active – don't let anyone be wrong on the Internet!
6.	Be generous with your criticism and with what you share
7.	The more you put in, the more you get out
8.	Use the key FOAM resources mentioned in this article to get started
9.	Use filters to beat information overload, and be a filter yourself
10.	Have fun and don't take it too seriously!

How the emergency physician can get involved in FOAM

FOAM allows emergency physicians to interact with colleagues around the world, including many of the shining lights of our specialty. For those interested in teaching, it enlarges the classroom of students and helps ensure that many hours of hard work are not limited to a small group teaching session but can be reused in other times and places by anyone. Anyone interested in helping others will be excited by the opportunities provided by the global FOAM community. Finally, we are in the midst of an ongoing war of ideas – some good, some bad – both in the minds of healthcare professionals and trainees as well as patients and the wider community. We have a moral imperative to ensure that high-quality resources are accessible to inform all of these groups and to do our best to not let anyone be wrong on the Internet.

A simple guide to getting involved in FOAM has been published as 'Ten Tips for FOAM Beginners' on the *iTeachEM.net* blog,[37] as summarised in Table 3. Key resources that will help the beginner get started are '*The LITFL Review*',[38] which provides a weekly digest of recommended FOAM resources published over the preceding week in emergency medicine, critical care and paediatrics. It also includes links to all the sites listed in Table 1 and many others. For those that find following multiple websites difficult, all blogs that have embraced the FOAM concept from around the world are collated into one feed at FOAMEM[39] making this website a one-stop shop for comprehensively tracking new FOAM resources. Finally, GoogleFOAM[40] provides a rapid, effective search engine for finding relevant FOAM resources when you need them.

Conclusion

FOAM is a dynamic collection of tools and resources, an ethos and an exciting global movement. It is an adjunct to traditional teaching and an aid to knowledge translation, as well as providing accessible and reusable resources that allow meaningful and rapid interaction with the creator. FOAM is not without flaws and challenges, but these are recognised and being managed. FOAM can be integrated into an asynchronous learning and 'flipped classroom' model of education, or used to supplement existing educational approaches. Importantly, FOAM does not replace the need for an experienced clinical educator at the bedside. Finally, it is easy to get involved and, as emergency physicians, we have a moral imperative to take part in the ongoing battle for the hearts and minds of health professionals, patients and the wider community in a sea of misinformation.

Acknowledgements

Thanks to Aidan Burrell for reviewing the manuscript and to all the FOAM community for helping to refine the ideas presented in this paper over the past 6 years.

Competing interests

CPN and MDC founded Lifeinthefastlane.com and now as editors head the team that runs it. MDC is a section editor for *Emergency Medicine Australasia*.

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