

## Free Open Access Medical Education: A National Needs Assessment

Alvin Yang<sup>1\*</sup>, Maria Mathews<sup>2</sup>, Adrienne Wakabayashi<sup>2</sup> and Munsif Bhimani<sup>3</sup>

<sup>1</sup>Department of Family Medicine Enhanced Skills in Emergency Medicine, Western University, London, Ontario, Canada

<sup>2</sup>Department of Family Medicine, Western University, London, Ontario, Canada

<sup>3</sup>Department of Family Medicine Enhanced Skills in Emergency Medicine, Western University, London, Ontario, Canada

**\*Corresponding Author:** Alvin Yang, Department of Family Medicine Enhanced Skills in Emergency Medicine, Western University, London, Ontario, Canada.

**Received:** October 25, 2021; **Published:** November 23, 2021

### Abstract

**Purpose of the Study:** Free Open Access Medical Education (FOAM) refers to the collection of online medical educational resources. This study describes resident and program director usage of FOAM in Emergency Medicine, assesses residents' needs for increased faculty support, and describes program directors' perceptions of curriculum adoption.

**Study Design:** An online survey was distributed to Canadian residents and program directors of Family Medicine, Family Medicine Enhanced Skills in Emergency Medicine, and Emergency Medicine programs that offered training in English. Research objectives were represented using descriptive statistics.

**Results:** The survey was completed by 161/1322 (12.2%) residents and 23/40 (57.5%) program directors. Nearly all residents (99.4%) used FOAM each week. Many residents never or rarely evaluated evidence quality (50.3%) despite a majority wanting their resources to be evidence-based (92.9%). Most residents valued faculty recommendation (76.8%) and at least sometimes wanted more program guidance on FOAM use (70.1%); however, they rarely or never received it (79.3%). A majority of program directors (52.6%) believed their programs could possibly benefit from more FOAM integration, although top barriers were lack of faculty familiarity (73.7%) and lack of evidence quality assurance (68.4%). The top strategy for integration was distributing a list of residency-approved resources (76.5%).

**Conclusion:** Residents frequently use FOAM to learn Emergency Medicine concepts but rarely evaluate evidence quality. They desire increased faculty guidance but rarely receive it. Program directors are open to incorporating more FOAM into their curricula but lack familiarity. Future directions could involve the creation of a curated list of residency-approved resources for dissemination to residents.

**Keywords:** Emergency Medicine; FOAM; FOAMed; Medical Education; Social Media

### Abbreviations

AIR: Approved Instructional Resources; ALiEM: Academic Life in Emergency Medicine; CAPER: Canadian Post-M.D. Education Registry; CaRMS: Canadian Resident Matching Service; CCFP: Canadian College of Family Physicians; CCFP-EM: Canadian College of Family Physicians with Enhanced Skills in Emergency Medicine; EM: Emergency Medicine; FOAM: Free Open Access Medical Education; LITFL: Life in the Fast Lane; PD: Program Director; RCPSC-EM: Royal College of Physicians and Surgeons of Canada – Emergency Medicine; US: United States

**Citation:** Alvin Yang, et al. "Free Open Access Medical Education: A National Needs Assessment". *EC Emergency Medicine and Critical Care* 5.12 (2021): 11-27.

### Introduction

As traditional education resources become outdated rapidly, there is a need to re-examine how medical trainees access up-to-date medical knowledge [1,2]. There is currently a high usage and acceptance of digital learning resources within medicine, and social media is widely used by clinicians for reference purposes [3]. Free Open Access Medical Education (FOAM) represents the collection of online educational resources (e.g. blogs, podcasts), the movement towards using social media for learning, and the community of educators and consumers. Within the Emergency Medicine (EM) community, trainees frequently use FOAM. A national survey of Canadian EM residents found that a majority used free online resources for general EM education [4]. A national survey of EM residents in the United States (US) found over 97% of respondents spent at least one hour per week engaging in extracurricular education, with podcasts leading over textbooks to be the most popular learning modality [5]. Most EM residents stated podcasts changed their clinical practice either 'somewhat' or 'very much' [6]. It is evident that FOAM has increasingly become a valuable and effective learning resource.

A leading barrier to effective FOAM adoption by trainees and residency programs is quality assurance. An overwhelming majority of EM residents reported they chose podcasts based on word-of-mouth recommendations from peers, lecturers, or faculty members [6]. However, residents did not always feel that providing literature references in FOAM were important and rarely evaluated evidence quality [4,5]. Furthermore, there was poor agreement amongst trainees and faculty when recommending online educational resources using gestalt-based quality appraisals [7]. In fact, over 40 individual gestalt ratings were required to reliably establish a community standard of quality [8].

While FOAM has been more widely adopted by US residency programs, it is unknown whether Canadian programs consistently provide structured recommendations on appropriate resources for personal consumption or offer formal integration into the curricula [9-12]. As such, trainees may not have optimal learning resources or environments. Using self-reported electronic survey data, we aimed to: 1) describe current resident and faculty usage patterns of EM FOAM; 2) assess residents' needs for increased faculty support on EM FOAM use; and 3) describe faculty perceptions of adopting EM FOAM into residency curricula.

### Materials and Methods

The study consisted of a cross sectional survey of Family Medicine (CCFP), Family Medicine Enhanced Skills in Emergency Medicine (CCFP-EM), and Emergency Medicine (RCPSC-EM) residents and Program Directors (PD) at English residency programs in Canada. Email invitations were sent to study-eligible Canadian CCFP, CCFP-EM, and RCPSC-EM residency programs. Programs that provided training exclusively in French were excluded as they had decreased exposure to the predominantly English FOAM community. A separate email invitation was sent to the respective PDs.

The study consisted of two electronic Qualtrics surveys: the Resident Survey and the PD Survey. Each survey had a slightly different set of questions (Appendices 1 and 2). Responses were collected from March 2 to May 31, 2020. The surveys were designed by consensus of study authors who were informed by previous Canadian and US national surveys on EM resident FOAM use [4-6]. Questions were pre-tested on CCFP, CCFP-EM, and RCPSC-EM residents, a PD, and a person not in medicine. Their feedback was used to clarify questions and refine content.

PD and resident responses were recruited through the initial invitation and two reminder emails. Survey completion was voluntary, and all responses were anonymous. To increase response rates, entry into a draw for ten \$50 Amazon gift cards for residents and one \$100 Amazon gift card for PDs was used as an incentive for survey participation.

Total sample frame for response rate calculations were estimated from program data from the Canadian Resident Matching Service (CaRMS) website and a national census from the Canadian Post-M.D. Education Registry (CAPER) [13,14]. Data from incomplete surveys were included. Research objectives were represented using descriptive statistics (frequencies and proportions for categorical data). Statistical comparisons between residents and PDs were not performed as the large number of comparisons would subject results to type I errors. The small PD population would also increase the risk of type II errors.

This study received ethical approval from The Western University Health Sciences Research Ethics Board.

## Results

### Response rate

Of 21/40 (52.5%) programs that agreed to forward study invitations to their residents, 161/1322 (12.2%) resident responses were collected. Responses were collected from 23/40 (57.5%) PDs. There were fourteen incomplete responses included in the analysis, for which participants entered demographic information and answered some but not all of the questions. Demographic data are presented in table 1. Of ninety-four CCFP residents, fifty (53.2%) were interested in practicing EM in some capacity in the future; seventeen (18.1%) were unsure. Of eight CCFP PDs, six (75.0%) did not currently practice EM.

	Residents (n = 161) n (%) <sup>a</sup>	PDs (n = 23) n (%)	Total (n = 184) n (%)
<b>Program type</b>			
CCFP	94 (58.4%)	8 (34.8%)	102 (55.4%)
CCFP-EM	23 (14.3%)	3 (13.0%)	26 (14.1%)
RCPSC-EM	44 (27.3%)	12 (52.2%)	56 (30.4%)
<b>Training level</b>			
PGY-1	47 (29.2%)		
PGY-2	66 (41.0%)		
PGY-3	27 (16.8%)		
PGY-4	13 (8.1%)		
PGY-5	8 (5.0%)		
<b>Graduate status</b>			
CMG	135 (83.9%)		
IMG	26 (16.1%)		
<b>Primary language</b>			
English	152 (94.4%)	23 (100%)	175 (95.1%)
French	3 (1.9%)	0 (0%)	3 (1.6%)
Other	6 (3.7%)	0 (0%)	6 (3.3%)
<b>Age (years)</b>			
21 - 30	98 (60.9%)		
31 - 40 <sup>b</sup>		5 (22.7%)	
41 - 50	61 (37.9%)	12 (54.5%)	
51 - 60		3 (13.6%)	
Prefer not to state	2 (1.2%)	2 (9.1%)	
<b>Gender</b>			
Female	81 (50.3%)	7 (30.4%)	88 (47.8%)
Male	78 (48.4%)	14 (60.9%)	92 (50.0%)
Non-binary	1 (0.6%)	1 (4.3%)	2 (1.1%)
Prefer not to state	1 (0.6%)	1 (4.3%)	2 (1.1%)

**Table 1:** Demographics.

PD: Program Director; CCFP: Certification in College of Family Physicians, Family Medicine; CCFP-EM: Family Medicine Enhanced Skills in Emergency Medicine; RCPSC-EM: Royal College of Physicians and Surgeons of Canada, Emergency Medicine; PGY: Post-Graduate Year; CMG: Canadian Medical Graduate; IMG: International Medical Graduate.

<sup>a</sup>Column percentages are proportions of respondents that answered the specific question.

**FOAM usage**

Nearly all residents (99.4%) used FOAM in a typical week (Table 2). Residents most commonly used blogs or websites (82.3%), smartphone apps (81.3%), and podcasts (77.4%); Twitter was least commonly used (20.5%). With the exception of eTextbooks, more residents spent 1 - 2 hours per week on each FOAM modality rather than over 2 hours. Nineteen PDs (82.6%) used FOAM in a typical week. They most commonly used smartphone apps (78.3%), primary literature (65.2%) and program related lectures (59.1%). Blogs or websites (50.0%) and podcasts (30.4%) were occasionally used; wikis were least commonly used (18.2%).

Average hours per week spent on FOAM				
FOAM Modality	None n (%) <sup>a</sup>	Any Use n (%)	1-2 n (%)	> 2 n (%)
<b>Residents</b>				
Any modality	1 (0.6%)	160 (99.4%)		
Blogs or websites	28 (17.7%)	130 (82.3%)	97 (61.4%)	33 (20.9%)
Smartphone apps	30 (18.8%)	130 (81.3%)	71 (44.4%)	59 (36.9%)
Podcasts	36 (22.6%)	123 (77.4%)	89 (56.0%)	34 (21.4%)
Program-related lectures	36 (22.8%)	122 (77.2%)	74 (46.8%)	48 (30.4%)
Videos	47 (30.1%)	109 (69.9%)	86 (55.1%)	23 (14.7%)
Primary literature	65 (40.9%)	94 (59.1%)	79 (49.7%)	15 (9.4%)
eTextbooks	65 (41.1%)	93 (58.9%)	44 (27.8%)	49 (31.0%)
Traditional textbooks	77 (48.4%)	82 (51.6%)	52 (32.7%)	30 (18.9%)
Conferences	109 (69.4%)	48 (30.6%)	38 (24.2%)	10 (6.4%)
Wikis	108 (70.6%)	45 (29.4%)	35 (22.9%)	10 (6.5%)
Twitter	124 (79.5%)	32 (20.5%)	21 (13.5%)	11 (7.1%)
<b>PDs</b>				
Any modality	19 (82.6%)	4 (17.4%)		
Blogs or websites	11 (50.0%)	11 (50.0%)	9 (40.9%)	2 (9.1%)
Smartphone apps	5 (21.7%)	18 (78.3%)	12 (52.2%)	6 (26.1%)
Podcasts	16 (69.6%)	7 (30.4%)	6 (26.1%)	1 (4.3%)
Program-related lectures	9 (40.9%)	13 (59.1%)	8 (36.4%)	5 (22.7%)
Videos	17 (77.3%)	5 (22.7%)	5 (22.7%)	0 (0%)
Primary literature	8 (34.8%)	15 (65.2%)	14 (60.9%)	1 (4.3%)
eTextbooks	15 (65.2%)	8 (34.8%)	7 (30.4%)	1 (4.3%)
Traditional textbooks	13 (59.1%)	9 (40.9%)	6 (27.3%)	3 (13.6%)
Conferences	13 (59.1%)	9 (40.9%)	9 (40.9%)	0 (0%)
Wikis	18 (81.8%)	4 (18.2%)	3 (13.6%)	1 (4.5%)
Twitter	15 (68.2%)	7 (31.8%)	1 (4.5%)	6 (27.3%)

**Table 2:** Time spent on individual FOAM modalities.

FOAM: Free Open Access Medical Education; PD: Program Director.

<sup>a</sup>Row percentages are proportions of respondents that answered the specific question.

Residents most commonly used Life in the Fast Lane (LITFL; n = 79; 59.8%), EM Cases (n = 66; 50.0%), EM:RAP (n = 50; 37.9%), CanadiEM (n = 31; 23.5%), and EMCrit (n = 27; 20.5%). They largely preferred content on clinical reasoning (n = 108; 72.5%) over procedural (n = 27; 18.1%), basic science (n = 7; 4.7%), professional (n = 4; 2.7%), or other (n = 3; 2.0%) topics. Comments listed other topics to

include “current trends in EM (e.g. COVID, opioid-free EDs)” and “specialists’ pro tips for EM”. PDs most commonly used LITFL (n = 11; 100%), EM Cases (n = 11; 100%), EM:RAP (n = 7; 63.6%), CanadiEM (n = 3; 27.3%), and Academic Life in Emergency Medicine (ALiEM; n = 3; 27.3%).

### FOAM selection and barriers to use

Top important factors in residents’ selections of FOAM resources were ease of access (94.8%), authors using evidence-based medicine (92.9%), and authors providing unbiased content (81.9%) (Table 3). Top important factors in PDs’ selections of FOAM resources were ease of access (94.1%), faculty recommendation (88.2%), authors using evidence-based medicine (82.4%), and references provided (82.4%). A high proportion of residents (74.8%) and PDs (88.2%) stated faculty recommendation to be important or very important in selecting a resource. A minority of residents (43.2%) and PDs (11.8%) stated entertainment value to be important or very important. Half of all residents (50.3%) and PDs (55.6%) never or rarely evaluated evidence quality (Table 4).

Factors in selecting specific FOAM resources			
	Not + Minimally Important n (%) <sup>a</sup>	Neutral n (%)	Important + Very Important n (%)
<b>Residents</b>			
Ease of access	1 (0.6%)	7 (4.5%)	147 (94.8%)
Authors used evidence-based medicine	1 (0.6%)	10 (6.5%)	144 (92.9%)
Authors provided unbiased content	5 (3.2%)	23 (14.8%)	127 (81.9%)
Faculty recommendation	14 (9.0%)	22 (14.2%)	119 (76.8%)
Resident recommendation	14 (9.0%)	25 (16.1%)	116 (74.8%)
Clearly identifiable author and credentials	14 (9.0%)	39 (25.2%)	102 (65.8%)
References are provided	20 (12.9%)	34 (21.9%)	101 (65.2%)
Resource is peer-reviewed	17 (11.0%)	48 (31.0%)	90 (58.1%)
Entertainment value	33 (21.3%)	55 (35.5%)	67 (43.2%)
<b>PDs</b>			
Ease of access	0 (0%)	1 (5.9%)	16 (94.1%)
Authors used evidence-based medicine	0 (0%)	3 (17.6%)	14 (82.4%)
Authors provided unbiased content	0 (0%)	4 (23.5%)	13 (76.5%)
Faculty recommendation	1 (5.9%)	1 (5.9%)	15 (88.2%)
Resident recommendation	5 (29.4%)	3 (17.6%)	9 (52.9%)
Clearly identifiable author and credentials	0 (0%)	5 (29.4%)	12 (70.6%)
References are provided	0 (0%)	3 (17.6%)	14 (82.4%)
Resource is peer-reviewed	1 (5.9%)	3 (17.6%)	13 (76.5%)
Entertainment value	8 (47.1%)	7 (41.2%)	2 (11.8%)
Barriers to using FOAM			
	Never + Rarely n (%)	Sometimes n (%)	Often + Always n (%)
<b>Residents</b>			
Information overload	17 (11.3%)	47 (31.3%)	86 (57.3%)
Hard to find appropriate resources for specific learning needs	41 (27.2%)	66 (43.7%)	44 (29.1%)
Hard to ensure evidence quality	46 (30.5%)	69 (45.7%)	36 (23.8%)

Unfamiliarity with FOAM in general	70 (46.1%)	52 (34.2%)	30 (19.7%)
Not useful information	48 (31.8%)	75 (49.7%)	28 (18.5%)
Distracting and disruptive	93 (61.6%)	43 (28.5%)	15 (9.9%)
Hard to access	121 (80.1%)	15 (9.9%)	15 (9.9%)
Privacy concerns	139 (92.1%)	10 (6.6%)	2 (1.3%)
<b>PDs</b>			
Information overload	2 (11.1%)	4 (22.2%)	12 (66.7%)
Hard to find appropriate resources for specific learning needs	6 (33.3%)	6 (33.3%)	6 (33.3%)
Hard to ensure evidence quality	4 (22.2%)	6 (33.3%)	8 (44.4%)
Unfamiliarity with FOAM in general	7 (36.8%)	4 (21.1%)	8 (42.1%)
Not useful information	4 (22.2%)	6 (33.3%)	8 (44.4%)
Distracting and disruptive	7 (38.9%)	5 (27.8%)	6 (33.3%)
Hard to access	10 (58.8%)	4 (23.5%)	3 (17.7%)
Privacy concerns	12 (70.6%)	4 (23.5%)	1 (5.9%)

**Table 3:** Resource selection and barriers.

FOAM: Free Open Access Medical Education; PD: Program Director.

<sup>a</sup>Row percentages are proportions of respondents that answered the specific question.

	Never + Rarely n (%) <sup>a</sup>	Sometimes n (%)	Often + Always n (%)	Unsure n (%)
<b>Residents</b>				
How often do you evaluate FOAM evidence quality?	77 (50.3%)	48 (31.4%)	28 (18.3%)	
How often do you receive FOAM guidance from your residency program?	119 (79.3%)	24 (16.0%)	4 (2.7%)	3 (2.0%)
How often do you want more FOAM guidance from your residency program?	36 (24.5%)	54 (36.7%)	49 (33.3%)	8 (5.4%)
How often does your program integrate FOAM into its curriculum?	104 (69.8%)	28 (18.8%)	12 (8.1%)	5 (3.4%)
How often do you wish there was more FOAM integration into your program?	35 (23.5%)	72 (48.3%)	41 (27.5%)	1 (0.7%)
<b>PDs</b>				
How often do you evaluate FOAM evidence quality?	10 (55.6%)	5 (27.8%)	3 (16.7%)	
How often does your program provide FOAM guidance to residents?	4 (21.1%)	9 (47.4%)	6 (31.6%)	0 (0%)
How often does your program integrate FOAM into its curriculum?	4 (21.1%)	8 (42.1%)	4 (21.1%)	3 (15.8%)
	<b>No n (%)</b>	<b>Possibly n (%)</b>	<b>Yes n (%)</b>	<b>Unsure n (%)</b>
Do you think your program could benefit from more FOAM integration?	3 (15.8%)	10 (52.6%)	2 (10.5%)	4 (21.1%)

**Table 4:** Quality assessment habits and residency program support.

FOAM: Free Open Access Medical Education; PD: Program Director.

<sup>a</sup>Row percentages are proportions of respondents that answered the specific question.

Barriers to FOAM use for residents were information overload (57.3%), difficulty in finding appropriate resources for specific learning needs (29.1%), and difficulty ensuring evidence quality (23.8%) (Table 3). Top barriers to FOAM use for PDs were information overload (66.7%), difficulty ensuring evidence quality (44.4%), and no useful information (44.4%).

### FOAM guidance and curriculum integration

The majority of residents (79.3%) never or rarely received FOAM guidance from their residency programs (Table 4). Residents sometimes (36.7%), often or always (33.3%) wanted more FOAM guidance. Relevant comments included “FOAM is one of my primary learning tools - much more up-to-date than textbooks” and “FOAM greatly enriches my residency training and I think the majority of my co-residents would agree”. Most residents (69.8%) stated their programs never or rarely integrated FOAM into the curricula. Almost half of residents (48.3%) sometimes wished there was more FOAM integration. A minority of residents rarely or never (23.5%) wanted FOAM integration.

Close to half of the PDs stated their programs only sometimes provided FOAM guidance (47.4%) or integrated FOAM into the curricula (42.1%) (Table 4). A majority (52.6%) believed their programs could possibly benefit from more FOAM integration. Top perceived barriers to curriculum integration were lack of faculty familiarity (73.7%) and lack of evidence quality assurance (68.4%) (Table 5). Top strategies for integration were distributing a list of residency-approved resources (76.5%) and a flipped classroom approach (64.7%).

Barriers to integrating FOAM into the curriculum	n (%) <sup>a</sup>
Lack of faculty familiarity	14 (73.7%)
Lack of evidence quality assurance	13 (68.4%)
Information overload	11 (57.9%)
Over-reliance on FOAM as primary method of literature critical appraisal	11 (57.9%)
Lack of resources (e.g. time, expertise) to create a list of residency-approved resources	11 (57.9%)
Lack of resources (e.g. time, expertise) to create program-specific FOAM content	10 (52.6%)
Lack of research demonstrating objective measurable effect on resident learning	7 (36.8%)
Potential source of distraction or disruption	7 (36.8%)
Concern of privacy and confidentiality	5 (26.3%)
Concern over professionalism	3 (15.8%)
Concern regarding accessibility (e.g. no smartphone access)	2 (10.5%)
Lack of existing resources for specific learning needs	2 (10.5%)
Strategies for integrating FOAM into the curriculum	
Distribute a list of residency-approved resources	13 (76.5%)
Flipped classroom approach (i.e. introduce content to trainees before formal education sessions)	11 (64.7%)
Asynchronous learning approach (e.g. trainees participate in a program-specific forum)	8 (47.1%)
Workshops for faculty and residents on FOAM use	8 (47.1%)
Create a social media account (e.g. Twitter, Instagram) to promote learning resources and educational opportunities	6 (35.3%)
Create novel FOAM content (e.g. podcast) with faculty and/or residents	3 (17.6%)
Other (free comment)	1 (5.9%)

**Table 5:** Program directors' perceptions on FOAM integration barriers and strategies.

FOAM: Free Open Access Medical Education.

<sup>a</sup>Column percentages are proportions of respondents that answered the specific question.

## Discussion

Traditional educational materials become outdated rapidly. Over 20% of high-quality systematic reviews were outdated within 2 years of publication [2]. Even online evidence-based textbooks, which could implement revisions quicker than traditional texts, contained 23 - 60% of topics with potentially outdated treatment recommendations at a given time [1]. In contrast, FOAM content can be rapidly updated to reflect best current literature, and its integration into residency curricula could offer a means to provide current information. Self-directed learning in health professions education has been associated with moderate improvement in knowledge compared with traditional teaching methods [15]. A systematic review found social media tools to be associated with improved knowledge, attitudes, and skills compared to traditional teaching methods [16,17]. Podcasts and blogs have also been found to be useful for extracurricular knowledge acquisition [18].

Our study found that nearly all surveyed Canadian CCFP, CCFP-EM, and RCPSC-EM residents used FOAM each week, similar to the high usage reported in previous studies [4-6,19]. Top used modalities were blogs, websites, smartphone apps, and podcasts. Twitter, despite being one of the leading platforms for EM FOAM dissemination, was surprisingly the least used modality [9,20,21]. Clinical reasoning was the most preferred content. Similar to a previous survey, the majority of residents never or rarely evaluated evidence quality despite wanting their FOAM content to be evidence-based [5]. This contradiction may be explained by the fact that most residents experience information overload from an abundance of resources available. While a majority of residents valued faculty recommendation and desired more guidance on FOAM use, they felt they rarely received it. Many residents also wanted more formal FOAM integration into their curricula. These results show that residents found FOAM to be an enriching component of their learning and desired more direction in selecting appropriate resources.

The typical resident's FOAM usage patterns, such as low Twitter utilization and preference for shorter podcasts, must be considered when recommending content [4-6,19,22,23]. Our proportions of residents and PDs who stated entertainment value to be important in resource selection were similar to that of a previous survey, which found residents to place significantly more value on entertainment than PDs [4]. Faculty may consider recommending content from resources they commonly use (i.e. LITFL, EM Cases, EM:RAP, CanadiEM), as residents often use the same resources and may be familiar with their content format.

A previous survey of Canadian EM programs found PDs to use less FOAM than residents [4]. Similarly, nearly 20% of our surveyed PDs did not use any FOAM in a typical week. PDs used less blogs, websites, and podcasts, which were the most popular modalities used by residents. Similar to residents, most PDs also never or rarely evaluated evidence quality. As a result, they may be ill equipped to provide appropriate guidance to residents. Nonetheless, the majority of PDs believed their programs could benefit from more FOAM integration. This careful optimism may be encouraged by the observation that reported cases of implementations have been well received by residents [10-12]. Top reported barriers to integration were lack of faculty familiarity and lack of evidence quality assurance. Popular strategies included distributing a list of residency-approved resources and a flipped classroom approach. Alternative approaches include asynchronous learning and involving residents in creating novel FOAM content. For example, University of Ottawa's RCPSC-EM residents create FOAM for journal clubs and grand rounds summaries, and Western University's CCFP and CCFP-EM residents contribute to a CCFP-EM podcast [24,25]. Introducing FOAM early on during residents' formative years of training can kindle an interest in life-long learning and increase uptake in their future careers.

To address the unreliability of informal quality appraisals, educators could make use of existing quality evaluation tools. For example, the ALiEM Approved Instructional Resources (AIR) scale is a moderately to highly reliable five-question tool used by medical educators to rate online resources. It displays a fair correlation with expert educator gestalt in evaluating resource quality and has been used by ALiEM to recommend a series of high-quality EM resources [26-28]. In addition, the METRIQ-5 and METRIQ-8 scores were novel instruments developed to appraise FOAM quality. Higher scores were associated with increased odds of receiving an ALiEM AIR certification, thereby allowing for the possible identification of better-quality resources [29]. Although further validation of these tools may be required, their



adaptation may offer an early standardized approach to ensuring evidence quality when consuming FOAM.

Our surveys results were susceptible to various forms of bias, such as social desirability, recall, and non-response. However, survey structure and content were based on previously used instruments, pre-tested with a representative group of residents and educator and conducted on a well-defined population at a national level [4-6]. Free text comments allowed for additional descriptive insight not constrained by closed-ended questions.

The chosen study population may limit the generalizability of results to other residency programs. Residency programs that trained exclusively in French were excluded as a general paucity of French EM online resources and variable trainee abilities to use English resources likely resulted in limited FOAM exposure; their unique perspectives would not be reflected in our results. PDs were surveyed as they were educational opinion leaders responsible for developing longitudinal resident curricula. However, their opinions may not be representative of all resident educators. Certain FOAM resources in the survey (e.g. EM:RAP) produced both free and paid content. While our survey focused on free open access resources, participants may have provided responses based on paid content from otherwise free-to-access databases.

Although our PD response rate was similar to those of previous national surveys, the resident response rate was relatively lower [4-6,19,30]. As our survey was distributed during the COVID-19 pandemic, PD and resident participations may have been affected by additional clinical and administrative burden.

### Conclusion

Most residents use FOAM for learning EM but are burdened by information overload and rarely evaluate evidence quality. Residents desire additional guidance from their programs on appropriate FOAM use, but rarely receive it. Many PDs believe their programs could benefit from more FOAM integration, but common barriers include faculty unfamiliarity and lack of evidence quality assurance. Strategies such as distributing a list of faculty-approved resources, combined with the use of validated quality evaluation instruments, may offer a solution to increasing FOAM guidance and integration in residency programs.

### Acknowledgements

The authors would like to thank Teresa Chan, MD, MHPE, and Jonathan Sherbino, MD, MEd, FRCPC, for sharing their FOAM expertise in facilitating manuscript dissemination.

### Conflicts of Interest

Alvin Yang is a CCFP resident at Schulich School of Medicine and Dentistry and a colleague of Western University's participating residents. Munsif Bhimani is the Program Director of Schulich School of Medicine and Dentistry's CCFP-EM program, which may have resulted in a power dynamic over Western University's participating residents. The study invitation email and survey splash page stated that students' academic standings would not be affected by survey participation. There was no external influence outside of email recruitment to encourage resident survey participation. The survey only asked for partial identifiers and individual participants were not identifiable.

### Appendix 1: Resident Survey

1. Which school are you attending?

- Dalhousie University
- McGill University
- McMaster University
- Memorial University of Newfoundland
- Northern Ontario School of Medicine
- Queen's University
- University of Alberta

- University of British Columbia
  - University of Calgary
  - University of Manitoba
  - University of Ottawa
  - University of Saskatchewan
  - University of Toronto
  - Western University
2. Which residency program are you in?
- Family Medicine (CCFP)
  - Family Medicine with Enhanced Skills in Emergency Medicine (CCFP-EM)
  - Emergency Medicine (RCPSC-EM)
- 3A. (If CCFP) Which year of residency are you in?
- PGY-1
  - PGY-2
- 3B. (If RCPSC-EM) Which year of residency are you in?
- PGY-1
  - PGY-2
  - PGY-3
  - PGY-4
  - PGY-5
  - PGY-6
4. Are you a Canadian or International Medical Graduate?
- Canadian Medical Graduate
  - International Medical Graduate
5. What is your primary language?
- English
  - French
  - Other
6. How old are you?
- 21-25
  - 26-30
  - 31-35
  - > 35
  - Prefer not to state
7. What is your gender?
- Female
  - Male
  - Non-binary
  - Prefer not to state

8. (If CCFP) Are you interested in practicing Emergency Medicine (EM) in any capacity in the future?

- Unsure
- No
- Yes

9. FOAM (Free Open Access Medical Education) is a collection of free online educational resources (e.g. blogs, podcasts, tweets). On average, how much do you use the following resources for studying Emergency Medicine (EM) (hours/week)?

	None	1-2	3-4	5-6	>6
Podcasts	0	0	0	0	0
Videos	0	0	0	0	0
Blogs or websites	0	0	0	0	0
Wikis	0	0	0	0	0
Smartphone apps	0	0	0	0	0
Twitter	0	0	0	0	0
eTextbooks	0	0	0	0	0
Traditional textbooks	0	0	0	0	0
Primary literature	0	0	0	0	0
Program-related lectures	0	0	0	0	0
Conferences	0	0	0	0	0

10. If you use FOAM, list up to 3 of your top used resources (e.g. EM:RAP podcast, LITFL website).

- (Free text box 1)
- (Free text box 2)
- (Free text box 3)

11. How often do you evaluate the quality of evidence when using EM FOAM (e.g. check that there are references)?

- Never
- Rarely
- Sometimes
- Often
- Always

12. How important are the following factors when deciding which EM FOAM resources to use?

	Not important	Minimally Important	Neutral	Important	Very Important
Resident recommendation	0	0	0	0	0
Faculty recommendation	0	0	0	0	0
Ease of access	0	0	0	0	0
Entertainment value	0	0	0	0	0
Authors used evidence-based medicine	0	0	0	0	0
Authors provided unbiased content	0	0	0	0	0
Resource is peer-reviewed	0	0	0	0	0
References are provided	0	0	0	0	0
Clearly identifiable author & credentials	0	0	0	0	0

13. How often are the following factors barriers to using EM FOAM?

	Never	Rarely	Sometimes	Often	Always
Unfamiliarity with FOAM in general	0	0	0	0	0
Hard to find appropriate resources for specific learning needs	0	0	0	0	0
Hard to ensure evidence quality	0	0	0	0	0
Information overload	0	0	0	0	0
Not useful information	0	0	0	0	0
Distracting and disruptive	0	0	0	0	0
Hard to access (e.g. lack of smartphone)	0	0	0	0	0
Privacy concerns	0	0	0	0	0

14. How often do you currently receive structured guidance on personal EM FOAM use from your residency program (e.g. distribution of a list of faculty-approved resources, seminar on appropriate FOAM use)?

- Unsure
- Never
- Rarely
- Sometimes
- Often
- Always

15. How often do you wish your residency program provided MORE structured guidance on personal EM FOAM use (e.g. distribution of a list of faculty-approved resources, seminar on appropriate FOAM use)?

- Unsure
- Never
- Rarely
- Sometimes
- Often
- Always

16. How often does your residency program currently integrate EM FOAM into its formal curriculum (e.g. assigning FOAM readings at home before attending in-person seminars, faculty-supervised FOAM creation)?

- Unsure
- Never
- Rarely
- Sometimes
- Often
- Always

17. How often do you wish there was MORE structured integration of EM FOAM into your formal residency curriculum (e.g. assigning FOAM readings at home before attending in-person seminars, faculty-supervised FOAM creation)?

- Unsure
- Never

- Rarely
- Sometimes
- Often
- Always

18. Which topics covered by EM FOAM would you find most beneficial?

- Basic science (e.g. disease pathophysiology)
- Clinical reasoning (e.g. STEMI management)
- Procedural (e.g. arterial line insertion)
- Professional (e.g. treating drug-seeking patients)
- Other (specify on next page)

19. Do you have any other comments?

- (Free text area)

## Appendix 2: Program Director Survey

1. Which residency program are you affiliated with?

- Family Medicine (CCFP)
- Family Medicine with Enhanced Skills in Emergency Medicine (CCFP-EM)
- Emergency Medicine (RCPSC-EM)

2. What is your primary language?

- English
- French
- Other

3. How old are you?

- 31-35
- 36-40
- 41-45
- 46-50
- 51-55
- >55
- Prefer not to state

4. What is your gender?

- Female
- Male
- Non-binary
- Prefer not to state

5. (If CCFP) – do you currently practice Emergency Medicine (EM) in any capacity?

- No
- Yes

6. FOAM (Free Open Access Medical Education) is a collection of free online educational resources (e.g. blogs, podcasts, tweets). On average, how much do you use the following resources for reviewing Emergency Medicine (EM) content (hours/week)?

	None	1-2	3-4	5-6	> 6
Podcasts	0	0	0	0	0
Videos	0	0	0	0	0
Blogs or websites	0	0	0	0	0
Wikis	0	0	0	0	0
Smartphone apps	0	0	0	0	0
Twitter	0	0	0	0	0
eTextbooks	0	0	0	0	0
Traditional textbooks	0	0	0	0	0
Primary literature	0	0	0	0	0
Program-related lectures	0	0	0	0	0
Conferences	0	0	0	0	0

7. If you use FOAM, list up to 3 of your top used resources (e.g. EM:RAP podcast, LITFL website).

- (Free text box 1)
- (Free text box 2)
- (Free text box 3)

8. How often do you evaluate the quality of evidence when using EM FOAM (e.g. check that there are references)?

- Never
- Rarely
- Sometimes
- Often
- Always

9. How important are the following factors when deciding which EM FOAM resources to use?

	Not important	Minimally Important	Neutral	Important	Very Important
Resident recommendation	0	0	0	0	0
Faculty recommendation	0	0	0	0	0
Ease of access	0	0	0	0	0
Entertainment value	0	0	0	0	0
Authors used evidence-based medicine	0	0	0	0	0
Authors provided unbiased content	0	0	0	0	0
Resource is peer-reviewed	0	0	0	0	0
References are provided	0	0	0	0	0
Clearly identifiable author & credentials	0	0	0	0	0

10. How often are the following factors barriers to using EM FOAM?

	None	Rarely	Sometimes	Often	Always
Unfamiliarity with FOAM in general	0	0	0	0	0
Hard to find appropriate resources for specific learning needs	0	0	0	0	0
Hard to ensure evidence quality	0	0	0	0	0
Information overload	0	0	0	0	0
Not useful information	0	0	0	0	0
Distracting and disruptive	0	0	0	0	0
Hard to access (e.g. lack of smartphone)	0	0	0	0	0
Privacy concerns	0	0	0	0	0

11. How often does your residency program currently provide structured guidance to residents on personal EM FOAM use (e.g. distribution of a list of faculty-approved resources, seminar on appropriate FOAM use)?

- Unsure
- Never
- Rarely
- Sometimes
- Often
- Always

12. How often does your residency program currently integrate EM FOAM into its formal curriculum (e.g. assigning FOAM readings at home before attending in-person seminars, faculty-supervised FOAM creation)?

- Unsure
- Never
- Rarely
- Sometimes
- Often
- Always

13. Do you think your program could benefit from more EM FOAM integration into the formal curriculum?

- Unsure
- No
- Possibly
- Yes

14. What are barriers to integrating EM FOAM into your curriculum? (Check all that apply)

Lack of faculty familiarity	0
Lack of evidence quality assurance	0
Lack of resources (e.g. time, expertise) to create a list of residency-approved resources	0
Lack of resources (e.g. time, expertise) to create program-specific FOAM content	0
Lack of existing resources for specific learning needs	0
Lack of research demonstrating objective measurable effect on resident learning	0
Information overload	0
Potential source of distraction or disruption	0
Over-reliance on FOAM as primary method of literature critical appraisal	0
Concern regarding accessibility (e.g. no smartphone access)	0
Concern over privacy and confidentiality	0
Concern over professionalism	0

15. How do you think EM FOAM can be effectively integrated into your curriculum? (Check all that apply; include options already performed)

Distribute a list of residency-approved resources	0
Create a social media account (e.g. Twitter, Instagram) to promote learning resources and educational opportunities	0
Create novel FOAM content (e.g. podcast) with faculty and/or residents	0
Flipped classroom approach (i.e. introduce content to trainees before formal education sessions)	0
Asynchronous learning approach (e.g. trainees participate in a program-specific forum)	0
Workshops for faculty and residents on FOAM use	0
Other (specify on next page)	0

16. Do you have any other comments?

- (Free text area)

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**Volume 5 Issue 12 December 2021**

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