

Seven-Year Follow-Up of an Online Critical Care Curriculum

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ABSTRACT

Background: In July of 2013, the University of Maryland launched MarylandCCProject.com. This free-access educational website delivers asynchronous high-quality multidisciplinary critical care education targeted at critical care trainees. The lectures, presented in real time on-site, are recorded and available on the website or as a podcast on iTunes or Android. Thus, the curriculum can be easily accessed around the world.

Objective: We sought to identify the impact this website has on current and former University of Maryland critical care trainees.

Methods: A 32-question survey was generated using a standard survey generation tool. The survey was e-mailed in the fall of 2019 to the University of Maryland Multi-Departmental Critical Care current and graduated trainees from the prior 7 years. Survey data were collected through December 2019. The questions focused on user demographics, overall experience with the website, scope of website use, and clinical application of the content. Anonymous responses were electronically gathered.

Results: A total of 186 current trainees and graduates were surveyed, with a 39% ($n = 72$) response rate. Of responders, 76% (55) use the website for ongoing medical education. The majority use the website at least monthly. Most users (63%, $n = 35$) access the lectures directly through the website. All 55 current users agree that the website has improved their medical knowledge and is a useful education resource. Platform use has increased and includes users from around the world.

Conclusion: Based on our current data, the MarylandCCProject remains a valuable and highly used educational resource, impacting patient care both during and after critical care fellowship training.

Keywords:

critical care education; asynchronous education; distance learning

(Received in original form August 2, 2020; accepted in final form January 14, 2021)

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*N.G.S. is Associate Editor of *ATS Scholar*. His participation complies with American Thoracic Society requirements for recusal from review and decisions for authored works.

This article has a data supplement, which is accessible from this issue's table of contents at www.atsjournals.org.

ATS Scholar Vol 2, Iss 2, pp 224–235, 2021

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DOI: 10.34197/ats-scholar.2020-0114OC

Despite vast technological advancements over the past century, traditional models of postgraduate medical education using clinical experience and in-person didactic instruction have remained the foundation of most training programs and have been largely unchanged. Busy clinical responsibilities, work schedules modified to comply with Accreditation Council for Graduate Medical Education duty hour requirements, off-campus rotations, and, most recently, pandemic-induced shifts toward virtual learning have challenged trainees' availability for in-person education. Concurrently, mounting pressure exists on faculty to increase clinical productivity, leaving less time available dedicated to teaching (1). As a result, postgraduate training programs must identify and implement innovative teaching methods outside the confines of the physical classroom to offer asynchronous education adaptable to the time constraints of the learner.

In July of 2013, the University of Maryland launched "Maryland.CCProject.com," a free-access educational website designed to deliver asynchronous, high-quality, multidisciplinary critical care education targeted primarily to critical care trainees. The curriculum is regularly updated to account for changes in practice guidelines, featuring evolving and novel topics in critical care (e.g., vaping-induced lung injury, coronavirus disease [COVID-19] updates) from speakers across the world representing a multitude of clinical backgrounds. The lectures, usually presented in real time at the University of Maryland, are recorded and made available free of charge on the MarylandCCProject website or as a

podcast on iTunes or Android. The lectures are readily accessible across both desktop and mobile platforms, and the website features a user-friendly search function. In this way, this state-of-the-art multidisciplinary curriculum can be accessed throughout the globe to anyone with an Internet connection. The educational site received the Innovations in Fellowship Education award at the 2014 Annual Meeting of the American Thoracic Society (2). To justify the requisite ongoing maintenance and innovation invested in the website, we sought to better understand its impact on trainees. We hypothesized that Maryland.CCProject.com positively impacts critical care trainees' clinical practice and medical education, such that trainees would continue to use the site even after graduation.

METHODS

The University of Maryland Institutional Review Board deemed this study exempt. Using a standard survey generation tool (www.surveymonkey.com), a subset of authors created a 32-question survey that assessed the ongoing clinical and educational impact of the MarylandCCProject website on respondents' practices. The initial 13 questions focused on respondents' demographics and prior experience with this educational platform, and the subsequent 19 questions addressed their clinical application of the educational material. The survey was distributed via e-mail in the fall of 2019 to current trainees and graduates from the academic years 2013 to 2019 for all Pulmonary and Critical Care Medicine, Critical Care Medicine, Surgical Critical Care,

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Neurocritical Care, and Anesthesiology Critical Care fellowship programs at the University of Maryland. For graduates of the fellowship programs, the survey was e-mailed to the last known e-mail addresses on file. Survey data were collected through December 2019. Responses were anonymous and analyzed.

As an exploratory measure, we also examined website usage location demographics, yearly page views, and new user data starting with the year after the first graduating fellowship class through the most recent complete year of data (2014–2019). We chose to analyze website data starting on January 1, 2014, to also allow for a 6-month website design and content ramp-up period. Data were extracted from the Google Analytics platform. Geographic data were reviewed for location, and low- and middle-income countries (LMICs) were grouped together according to the most recent World Health Organization and World Bank designation (3). A statistical analysis was conducted using Prism v 8.0 (Graph-Pad Software). Data were assessed for normality using the D’Agostino and Pearson omnibus normality test. A repeated measures one-way analysis of variance with Sidak *post hoc* testing was performed to compare differences in usage metrics between years. A *P* value of <0.05 was considered statistically significant.

RESULTS

Of the 186 current trainees and graduates of the University of Maryland critical care fellowships that were surveyed, 39% (*n* = 72) responded. The largest percentage of respondents was from current fellows (23.6%, *n* = 17). The remaining 55 of the 72 respondents were relatively evenly distributed across previous fellowship

classes (Table 1). The majority of respondents were male (70.8%, *n* = 51). The majority of respondents practice in the Northeast (33.3%, *n* = 24) and Mid-Atlantic regions (38.9%, *n* = 28). Most responders practice in university-based academic settings (62.5%, *n* = 45), followed by community academic settings (27.8%, *n* = 20), with a minority practicing in community nonacademic settings (9.7%, *n* = 7).

The practice and continuing medical education patterns of the responders is depicted in Table 1. Of respondents, 76% (*n* = 55) use the website as a source of ongoing medical education. The statistics of the website usage by these respondents are displayed in Table 2. Most responders accessed the website monthly (63%, *n* = 35) and spent more than 30 minutes on the website per visit. The lecture videos (91%, *n* = 50) were used the most, followed by the lecture summaries (73%, *n* = 40), and the audio recordings were used least (53%, *n* = 29). Most users (63%, *n* = 35) accessed the audio recordings of lectures (MP3s) directly through the website (Maryland.CCProject.com) with the remainder listening to the podcasts via iTunes. The majority preferred the lecture videos as expected based on reported usage patterns (58%, *n* = 32). Despite the reported usage patterns above, more users preferred the audio recordings (27%, *n* = 15) over the lecture summaries (15%, *n* = 8).

All 55 users of the MarylandCCProject “agree” or “strongly agree” that the website has improved their medical knowledge, is a useful education resource, provides topics that are pertinent to daily practice, and provides an overall positive educational experience (Table 3). Regarding clinical application, 85% (*n* = 47) of users agreed that MarylandCCProject.com expanded

Table 1. Demographics, practice, and educational patterns of survey respondents (*n* = 72)

	<i>n</i> (%)
Age group, yr	
30–34	28 (38.9)
35–39	30 (41.7)
40–44	11 (15.3)
45–49	2 (2.8)
50–54	1 (1.4)
Sex	
Male	51 (70.8)
Female	20 (27.8)
Nonbinary	1 (1.4)
Location of medical school	
United States	59 (81.9)
Caribbean	1 (1.4)
Other (international)	12 (16.7)
Geographic area of practice	
Northeast	24 (33.3)
Mid-Atlantic	28 (38.9)
Southeast	5 (6.9)
Midwest	4 (5.6)
South	4 (5.6)
West	3 (4.2)
Northwest	1 (1.4)
Southwest	1 (1.4)
International	2 (2.8)
Residency	
Internal Medicine	30 (41.7)
Surgery	16 (22.2)
Emergency Medicine	13 (18)
Other	13 (18)

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Table 1. Demographics, practice, and educational patterns of survey respondents ($n = 72$) (continued)

	<i>n</i> (%)
Type of hospital practice	
University academic	45 (62.5)
Community academic	20 (27.8)
Community nonacademic	7 (9.7)
Year of fellowship graduation	
2013 or earlier	5 (6.9)
2014	6 (8.3)
2015	10 (13.9)
2016	4 (5.6)
2017	10 (13.9)
2018	13 (18)
2019	7 (9.7)
2020 or later	17 (23.6)
Years in practice and training	
0–3	33 (45.8)
4–6	34 (47.2)
7–9	3 (4.2)
10–12	2 (2.8)
Hours per week caring for critical care patients	
<30	17 (23.6)
30–45	25 (34.7)
46–55	7 (9.7)
56–65	10 (13.9)
>65	13 (18.1)
Does your hospital provide CME	
Yes	48 (66.7)
No	24 (33.3)
Does your hospital require annual CME	
Yes	54 (75)
No	18 (25)

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Table 1. Demographics, practice, and educational patterns of survey respondents ($n = 72$) (continued)

	<i>n</i> (%)
Does your practice allot protected time for CME	
Yes	40 (55.6)
No	32 (44.4)
Do you use MarylandCCProject.com for CME	
Yes	55 (76.4)
No	17 (23.6)

Definition of abbreviation: CME = continuing medical education.

their skillset and 91% ($n = 50$) agreed that the education provided by this website impacted patient care.

Geographic user data for the entire time period of 2014–2019 are depicted in Figure 1. The five most common locations of website users were the United States (63%), LMICs (14.1%), Australia (4%), the UK (3%), and Canada (2%). The average number of new users per month for each year and the yearly total page hit metrics are depicted in Figure 2. User engagement increased significantly between 2014 and 2018, with a decrease in 2019.

DISCUSSION

The paradigm of medical education is shifting. This shift is driven by learners who are demanding knowledge from experts in an instantaneous manner, unencumbered by historical obstacles such as geography or availability of said experts. The MarylandCCProject reflects this paradigm shift. Previously survey data showed that MarylandCCProject access was instrumental in improving trainees' medical and procedural knowledge and changed the way trainees practiced medicine (2). The current study demonstrates that at least some current and former trainees continue to frequently

use the website's asynchronously and impactful critical care curriculum.

Currently available online medical education content has been created at a variety of price points by an amalgam of authors of varying experience and expertise, from students to practicing providers, professional societies, and private industry. Furthermore, the content consumed by the learner often originates from the top of a Google search page, which may be the result of search engine optimization strategies rather than quality. Professional societies provide an array of online educational materials, created by credible teachers and peer-reviewed but often at significant cost to the learner. The use of free open-access medical education has greatly increased in recent years, partially as a response to the high cost of society-based educational materials. In 2002, fewer than 10 websites, blogs, and podcasts dedicated to critical care education existed. In contrast, more than 180 emergency medicine and critical care websites, 140 blogs, and 40 podcasts were online in 2013 (3). Although publicly available resources are regularly used by students and trainees, concerns exist about the quality and effectiveness of the content (4–6). Technical issues, variable learner participation, and

Table 2. Usage statistics of the respondents who continue to use the platform ($n = 55$)

	<i>n</i> (%)
How often do you access MarylandCCProject?	
Daily	2 (3.6)
Weekly	10 (18.2)
Monthly	23 (41.8)
Quarterly	20 (36.4)
MarylandCCProject session average length, min	
<15	3 (5.5)
15–30	18 (32.7)
31–60	29 (52.7)
61–90	4 (7.3)
>90	1 (1.8)
Watched lecture videos on MarylandCCProject	
Yes	50 (91.0)
No	5 (9.1)
Listened to lecture MP3s	
Yes	29 (52.7)
No	26 (47.3)
Method of accessing lecture MP3s	
Website directly	35 (63.6)
Podcasts (iTunes)	20 (36.4)
Read lecture summaries	
Yes	40 (72.7)
No	15 (27.3)
Easy to navigate and user-friendly	
Yes	52 (94.6)
No	3 (5.5)
Preferred modality	
Video lectures	32 (58.2)
Audio recordings	15 (27.3)
Lecture summaries	8 (14.6)

Table 3. MarylandCCProject usage and clinical application responses ($n = 55$)

Question Stem	Strongly Agree [n (%)]	Agree [n (%)]	Neutral [n (%)]	Disagree [n (%)]	Strongly Disagree [n (%)]
Able to read and follow slides	23 (42)	24 (44)	7 (13)	—	1 (2)
Able to comprehend and follow audio	23 (42)	18 (33)	12 (22)	1 (2)	1 (2)
Has improved my medical knowledge	33 (60)	22 (40)	—	—	—
Has taught me useful new skills	26 (47)	21 (38)	8 (15)	—	—
Is a useful educational resource	38 (69)	17 (31)	—	—	—
Topics pertinent to my daily practice	34 (62)	21 (38)	—	—	—
Has impacted the care of my patients	28 (51)	22 (40)	5 (9)	—	—
Has changed how I practice medicine	22 (40)	19 (35)	14 (25)	—	—
Overall MarylandCCProject experience is positive	39 (71)	16 (29)	—	—	—
If CME credit offered, MarylandCCProject would meet my CME needs	26 (47)	22 (40)	6 (11)	1 (2)	—
I prefer use of MarylandCCProject over other CME modalities	17 (31)	16 (29)	20 (36)	2 (4)	—

Definition of abbreviation: CME = continuing medical education.

privacy and security concerns are also cited as common challenges and concerns about such educational platforms (7, 8).

To address these issues, the MarylandCCProject was created as a free repository for critical care education delivered by vetted experts that is readily accessible in any environment via smartphone, tablet, or computer. When reviewing our website usage data, several patterns emerge. New users and website hits steadily increased over time through 2018, which is not explained by retained or return users based on the volumes seen. This may reflect a growing interest in free educational content and would be consistent with the recognized increase in demand for web-based educational resources by trainees (9). Although we are limited in our ability to fully assess the reason for the slight decline in website hits and new users in 2019, one possibility

would be that the aforementioned and continued growth of free online educational content has begun to result in a dilution of the potential audience across multiple platforms. Another possibility is that there was a simple decrease in search engine-directed traffic to the MarylandCCProject platform for 2019. Further longitudinal study and data collection may provide more insight.

An additional pattern to note in our website usage data is that although a majority of users were located in the United States and other high-income countries, users in LMICs collectively were the second largest user group of the MarylandCCProject platform. High use in LMICs demonstrates that high-quality, free educational content is of value to users in a wide variety of clinical care environments, greatly increasing the potential of this platform to positively impact care delivery globally.

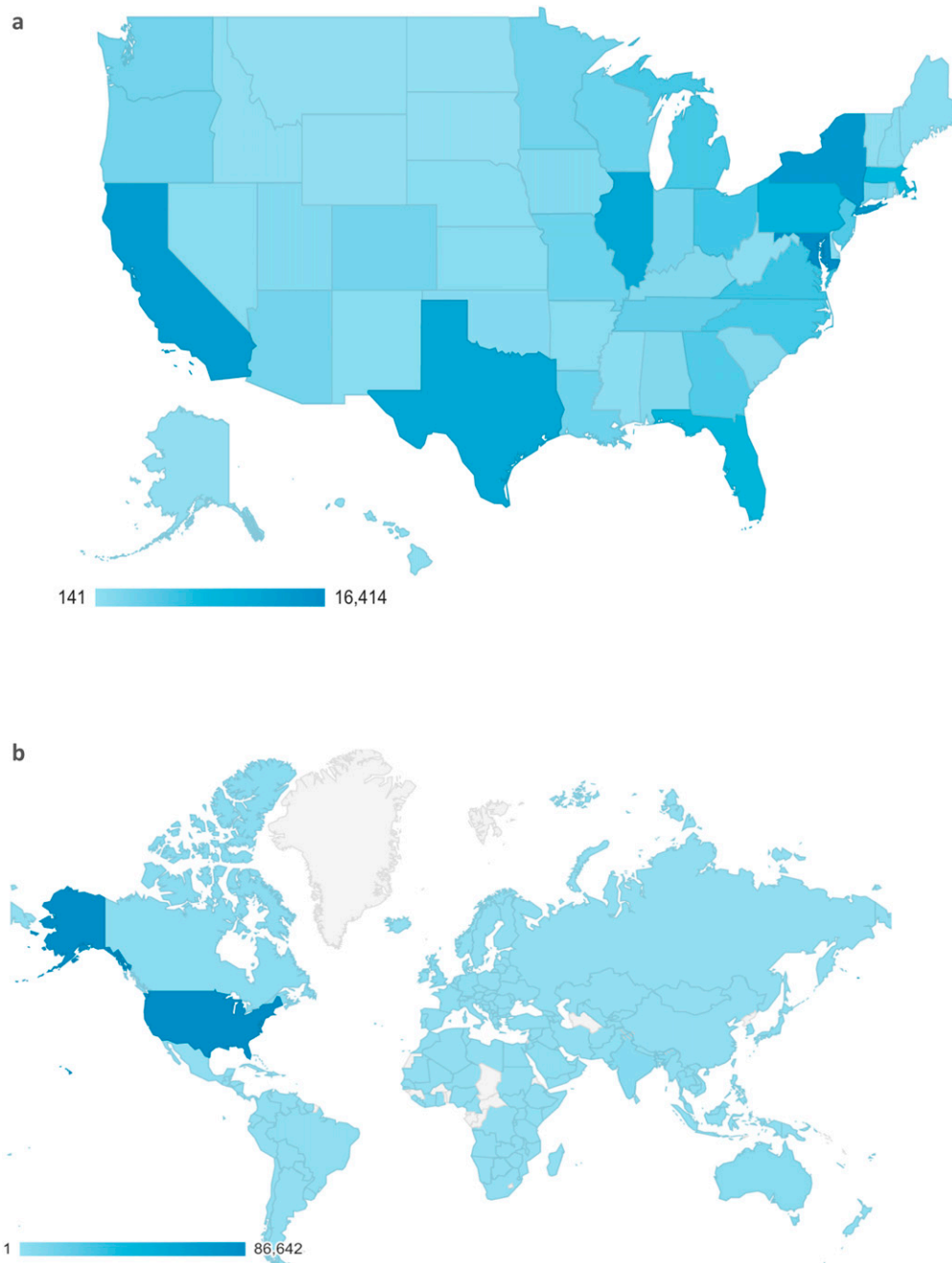


Figure 1. Geographic distribution of users of the MarylandCCProject website. (A) United States. (B) World.

Our data suggest that our audience most frequently used videos and summary documents. Interestingly, respondents preferred audio recordings over lecture summaries despite using the summaries more often. One possibility is that users may use video recordings to provide the audio content while “on the go” or to

optimize valuable downtime while in transit. By providing a variety of modalities for delivering educational content, we hope that learners can use the one that best matches their needs.

This study has several limitations. First, a significant proportion of the respondents to our survey were from current fellows

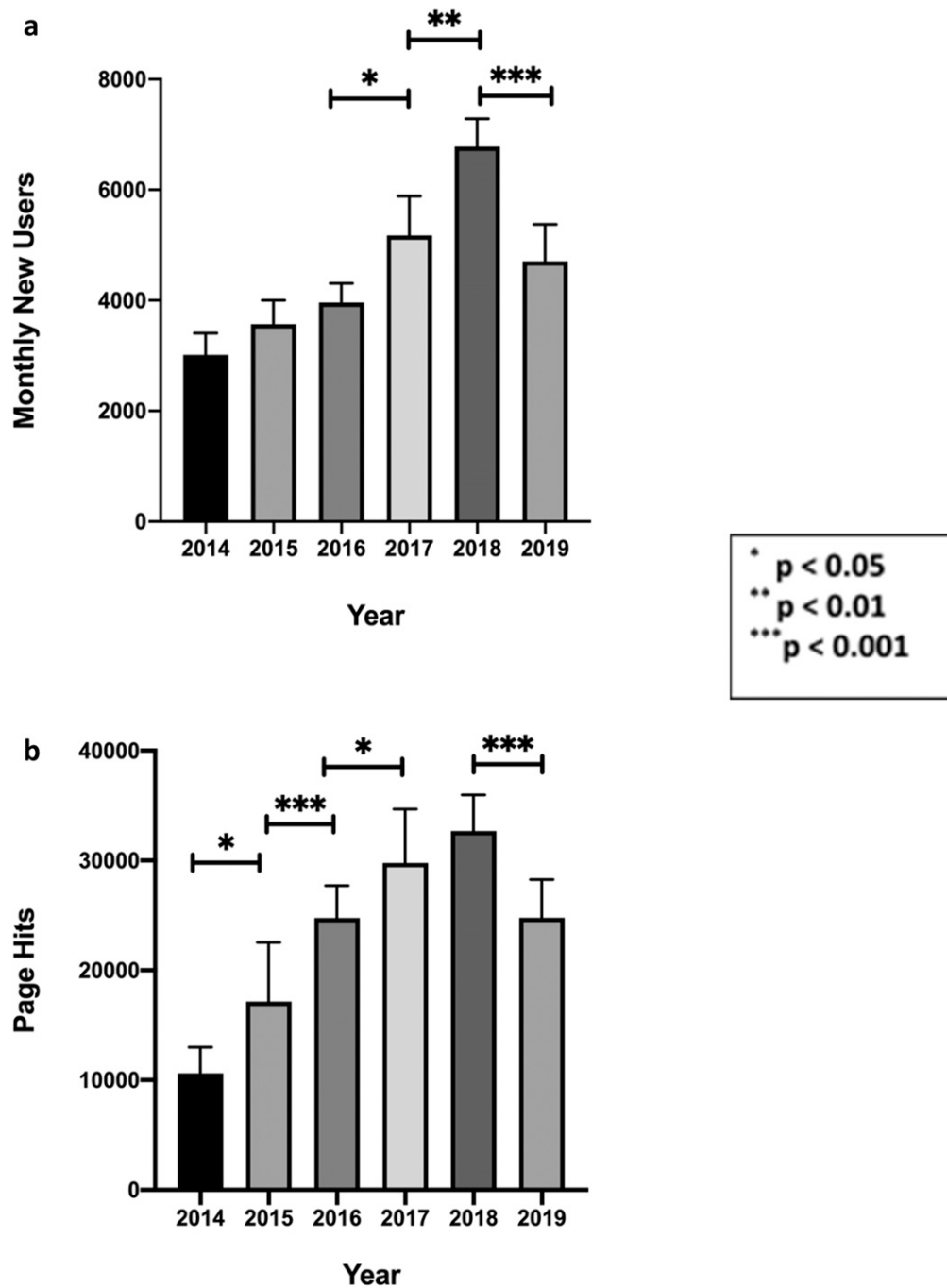


Figure 2. MarylandCCProject website usage data. (A) Monthly new users. (B) Page hits.

(23.6%, $n = 17$). Although seemingly a source for potential bias in respondents who could hesitate to provide critical feedback, the anonymous nature of the survey should have sufficiently mitigated this risk. Moreover, because these participants represent a demographic of great interest

for this study, their high response rate is preferred. Current fellows are likely highly motivated to interact with the platform when clinical duties interfere with their ability to attend in-person lectures, and their lack of clinical experience and topic mastery demands more intensive learning

effectively integrated into their busy schedules. They may also be motivated by an impending high-stakes board examination within the following 1–3 years (whereas former fellows taking the survey were unlikely to need to take their board exams for at least another 5 yr). Second, the majority of the respondents to our survey were male (70.8%, $n = 51$), which correlates with our fellowship demographics historically for the time period of fellows who were surveyed. This may limit the generalizability of these results, as women increasingly apply for critical care fellowships and this ratio now approaches 1:1. Another weakness is that this study is a survey analysis that contains no objective measures.

Perhaps the most significant limitation of this study is that only 39% of our identified study subjects responded to the survey, which introduces concern for self-selection or nonresponse bias. Although it is unknown if survey nonresponders use the platform, it is possible that the lack of response to an e-mail with “MarylandCCProject” in the subject line indicates that the recipient does not use the platform regularly. This would set up a dichotomy whereby responders represent

a different demographic with variable traits compared with nonresponders and could limit the generalizability of the study. Although a low survey response rate limits the conclusions that can be generated, it is still possible to gather useful data for improving the educational value of the platform and improving future surveys. This is particularly true if active users are those most likely to respond and nonresponders can generally be assumed to be less likely to use the platform. Future studies should work to improve the participant response rate and could correlate participants’ survey responses with more objective measures of job performance or critical care knowledge.

Conclusions

The MarylandCCProject demonstrates the proof of concept that high-quality critical care education can be delivered asynchronously online and via podcasts. Access to this convenient, up-to-date, and vetted fund of knowledge continues to guide medical practice for current trainees and program graduates.

Author disclosures are available with the text of this article at www.atsjournals.org.

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