Comparison of an Emergency Medicine asynchronous learning platform usage before and during the COVID-19 pandemic: a retrospective analysis

Blake Briggs, Iltifat Husain, Madhuri Mulekar

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Abstract

Background: The coronavirus disease 2019 (COVID-19) pandemic challenged medical educators due to social distancing. Podcasts and asynchronous learning platforms help distill medical education in a socially distanced environment. Medical educators interested in providing asynchronous teaching should know how these methods performed during the pandemic.

Objective: The purpose of this study was to assess the level of engagement for an emergency medicine (EM) board review podcast and website platform, before and during the COVID-19 pandemic. We measured engagement via website traffic, including such metrics as visits, bounce rate, unique visitors, and pageviews. We also evaluated podcast analytics, which included total listeners, engaged listeners, and number of plays.

Methods: Content was designed after the American Board of EM Model, covering only one review question per episode. Website traffic and podcast analytics were studied monthly from two time periods of 20 months each, pre-pandemic (July 11, 2018, to February 31, 2020) and during the pandemic (May 1, 2020, to December 31, 2021). March and April 2020 data were omitted from the analysis due to variations in closure at various domestic and international locations. Results underwent statistical analysis in March 2022.

Results: 132 podcast episodes and 93 handouts were released from July 11, 2018, to December 31, 2021. Mean number of listeners/podcast increased significantly from 2.11 to 3.77 (t test, P<.0001); mean number engaged/podcast increased from 1.72 to 3.09 (t test, P<.0001); and mean number of plays/podcast increased from 42.54 to 69.23 (t test, P=.0122). Similarly, mean number of visits/posting increased from 5.85 to 15.39 (t test, P<.0001); mean number of unique visitors/posting increased from 3.74 to 10.41 (t test, P<.0001); mean number of pageviews/posting increased from 17.13 to 33.32 (t test, P<.0001). Note that, all measures showed decrease from November 2021 to December 2021.

Conclusions: During the COVID-19 pandemic, there was increased engagement for our EM board review podcast and website platform over a sustained period, specifically through website visitors and number of podcast plays. Medical educators should be aware of the increasing usage of web-based education tools, and that asynchronous learning is favorably viewed by learners. Limitations include inability to view Spotify analytics during the study period, and confounding factors like increased popularity of social media inadvertently promoting the podcast.

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Conclusion

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Keywords: asynchronous learning; medical education; podcast; COVID-19

Introduction

As the field of medical education evolves, web-based media and online study tools are finding larger audiences each year.[1] The COVID-19 pandemic dramatically changed the landscape of medical education. Suddenly in March and April 2020, all learning was switched to virtual platforms, greatly challenging educators and hastening the switch to web-based media.[2,3,4]

Prior studies have demonstrated that podcasts have positive effects on knowledge retention and test performance.[5,6] Multiple studies have previously been published on the effectiveness of virtual learning during the COVID-19 pandemic via remote learning and online modules.[7,8] To our knowledge, no prior studies have measured engagement for a medical podcast and website platform both before and during the COVID-19 pandemic. As asynchronous teaching continues to increase in popularity among students, medical educators might be curious about the popularity of such materials during the pandemic. The purpose of this study was to assess the level of engagement for

an emergency medicine board review podcast and platform, comparing pre-COVID-19 to during the COVID-19 pandemic. It was hypothesized that the pandemic would increase the number of website visitors, pageviews, and podcast episode plays.

Methods

This retrospective analysis was conducted from March 5, 2022, to April 30, 2022. The study is Institutional Review Board exempt. Data was collected by the study authors from July 11, 2018, when the first podcast episode was released, to December 31, 2021. Emergency Medicine Board Bombs (EMBB) was launched by two academic emergency medicine physicians in July 2018. The goal of this asynchronous educational platform was to increase first time pass rate among residents and attendings taking their in-service exam and boards, respectively. EMBB is a peer-reviewed resource and functions at no cost to the learner. EMBB has never been formally assigned to any formal, academic curriculum; its educational platform is entirely free and open access to all learners. The website has podcasts and printable study guides that function as summaries of various common pathologies encountered in the emergency department and on the board exams. EMBB was chosen as the podcast to be studied out of convenience to their occupation in academic emergency medicine and interest in education.

Each podcast episode was structured to quickly cover one multiple choice question, discussion of correct/incorrect answers, and the relevant subject matter. Audio editing was conducted using Apple Garageband, a free service provided to those who own Apple hardware. The podcast was available for free streaming on a designated website, emboardbombs.com, as well as dedicated podcast platforms (Apple Podcasts, Soundcloud, and Spotify). Questions for each episode were modeled after the American Board of Emergency Medicine (ABEM) certification exam. *The Model of the Clinical Practice of Emergency Medicine* (EM Model), serves as the basis for ABEM content and was followed in drafting podcast episodes.[9]

Medical source material was derived from *Tintinalli's Emergency Medicine* as well as UpToDate and

EB Medicine.[10,11,12] The educational platform was self-funded from the creators.

Podcast analytics were derived from Apple Podcasts Connect which is a free service provided for all Apple Podcast hosts. It provides data on total listeners, engaged listeners, and number of plays.[13] Listeners were defined by Apple as the number of unique devices that played more than 0 seconds of an episode. Engaged listeners were defined as the number of devices that played at least 20 minutes or 40% of an episode within a single session. Of note, pausing or stopping an episode did not count as starting a new session. Number of plays was based on the number of unique devices where the play duration is greater than 0 seconds. Spotify does not publish podcast statistics, and therefore their user data could not be obtained.

The website learning platform was hosted on Squarespace. Website traffic analytics were derived from Squarespace, which measured traffic using variables such as visits, bounce rate, unique visitors, and pageviews.[14] Visits were defined as the total number of browsing sessions per visitor on the website within a 30-minute period. A browser cookie from Squarespace was utilized to track views within a 30-minute period. Bounce rate was defined as the number of visitors who navigate away from the website after viewing one page. Unique visitors were defined as the total number of new IP addresses that visited the website. Pageviews were defined as the total number of views across all pages on the website. Pageviews count the number of times a page is viewed. One visit consists of one or more page.

Website traffic and podcast analytics from July 11, 2018, to February 28, 2020, were compared to those from May 1, 2020, to December 31, 2021. May 1, 2020 was chosen as the transition date because during March and April 2020 various schools and residency programs began switching to virtual learning. As the pandemic evolved, medical schools and graduate medical education sites began suspending in-person rotations. The Accreditation Council for Graduate Medical Education announced mid-March that all in-person educational activities, meetings, and site visits were to migrate to virtual occurrences only.[15] By the end of April 2020, all nonessential, in-person

educational activity had ceased.[16]

Statistical Methods

All collected data was organized in an Excel spreadsheet and analyzed using statistical software JMP Pro 16.0.0 (A product of SAS, Inc., Cary, NC) in March 2022. All numerical data was summarized using mean and standard deviation. Variation in monthly data from pre-COVID-19 and during COVID-19 periods was compared using Levene's test, whereas the means per month were compared using a two-sample t-test after accounting for differences in variations if any.[17,18] Additionally, a nonparametric Mann-Whitney U test was also used to compare analytics from two time periods. Time series plots were used to study trends in monthly data. Significance level of 0.05 was used to determine significance of outcomes.

Results

During the study period from July 11, 2018, to December 31, 2021, a total of 132 podcast episodes and 93 study guides were created. The first podcast episode was released on July 11, 2018.

From July 11, 2018, to February 28, 2020, 68 episodes were released, along with 30 study guides. From May 1, 2020, to December 31, 2021, 59 podcasts were released, and 53 handouts were published. Note that 5 episodes and 10 handouts were released during March-April 2020 which were also available to learners during the COVID-19 pandemic. This resulted in total 225 postings (132 podcasts and 93 handouts) being available to learners during the COVID-19 pandemic (see Table 1).

	# podcasts	# handouts	# Postings
Pre-COVID-19	68	30	98
In-between period	5	10	15
During COVID-19	59	53	112
Total (during)	132	93	225

Table 1: Number of podcasts, handouts, and total postings during pre-COVID-19, in-between, and during COVID-19 period

Time series presented in Figure 1 show month-to-month changes in podcast and website visit analytics during pre-COVID-19 and COVID-19 periods and differences in changing patterns. Although higher outcomes were observed during COVID-19 period in all six podcast and website

visit measurements compared to pre-COVID-19 period, not all changes showed linear patterns of increase. In fact, number of unique visitors, visits, and page reviews showed decreasing trend after reaching a peak around the middle of the COVID-19 period. However, at the end of 20-month period, they still remained higher than pre-COVID-19 level. During the pre-COVID-19 period, number of listeners per month steadily increased from 39 to 338. During the COVID-19 period it continued to increase, reaching a maximum number of listeners at 672. A similar trend was observed for number engaged per month, increasing from 28 to 289 during pre-COVID-19 period and reaching a maximum of 555 during the COVID-19 period. Although a similar trend was observed for total number of plays with increase from 412 to 11,879 during pre-COVID period; a sharp drop was observed during the period of uncertainty (March-April 2020). Again, during the COVID-19 period, total number of plays increased from 4,547 to 14,296. Number of visits during the pre-COVID period increased from 218 to 1,064; there was further increase in the COVID-19 period, reaching 4,664 in January 2021. Number of visits started declining thereafter, reaching a low of 1,879. Number of unique visitors and pageviews showed patterns similar to that of the number of visits. The number of unique visitors increased steadily during the pre-COVID-19 period from 138 to 620. It increased to 3,222 in January 2021 but started declining to a low of 2,293. The number of pageviews also increased steadily during the pre-COVID period from 610 to 3,405; in the COVID-19 period it increased to 11,326 in November 2020, only to steadily decrease to a low of 5,389 in December 2021. Note that, all measures showed decrease from November 2021 to December 2021.

Comparison of podcast and website visit analytics are presented in Table 2. It shows that, regardless of differences in the number of podcasts and handouts available during two time periods, variation in analytics from month-to-month did not differ significantly during the two time periods under study except for bounce rate and number of visitors. Significantly higher variation as measured by standard deviation was observed in bounce rate (0.07 vs 0.05, Levene's test, P=.0358) and number of unique visitors (523.45 vs 179.62, Levene's test, P=.0049) during COVID-19 pandemic compared to the

pre-COVID-19 period. Percent increase in mean analytics from pre-COVID-19 period to during COVID-19 ranged from 24% to 539% with mean number of unique visitors showing the highest percent increase and bounce rate the lowest. The number of visits increased by 504% whereas number of listeners, engaged, and total plays each increased by more than 200%. Percent increases in the average monthly analytics indicate considerable increase in visits and usage of podcasts from pre-COVID-19 to during COVID-19 period.

Although, periods of similar length, i.e. 20 months each were used for comparison, the number of postings available during these two periods differed considerably because as new postings were made available, the earlier posting were still available for review for visitors. To account for the differences in the number of postings, analytics were adjusted by computing outcome per posting available. For example:

Number of listeners per podcast was computed as follows:

- Pre COVID-19: # of listeners/podcast = # listeners/68
- During COVID-19: # listeners/podcast = # listeners/132

Note that this accounts for all podcasts that were available to listeners. Pre-COVID-19 accounts for all podcasts put out during that time and during COVID-19 used all podcasts available, i.e. those that were put out pre-COVID-19, in-between, and during COVID-19 periods. Number engaged and total plays were adjusted similarly by number of podcasts. Number of visits, unique visitors, and pageviews were adjusted similarly using all postings (i.e. podcasts plus handouts). Bounce rate was adjusted similarly using per 100 postings because rate of per posting resulted in very small numbers and this change from per posting to per 100 postings does not affect outcome of statistical tests.

Resulting comparisons of outcomes are listed in Table 3, which shows significant increase in mean rates for all analytics except mean bounce rate/100 postings from pre-COVID-19 to during COVID-19. Bounce rate/100 postings showed significant decrease from pre-COVID-19 to during COVID-19 (0.55 to 0.30 per 100 podcasts, t test, $P<.0001$). Mean number of listeners/podcast increased significantly from 2.11 to 3.77 (t test, $P<.0001$); mean number engaged/podcast increased from 1.72

to 3.09 (t test, *P*<.0001); and mean number of plays/podcast increased from 42.54 to 69.23 (t test, *P*=.0122). Similarly, mean number of visits/posting increased from 5.85 to 15.39 (t test, *P*<.0001); mean number of unique visitors/posting increased from 3.74 to 10.41 (t test, *P*<.0001); and mean number of pageviews/posting increased from 17.13 to 33.32 (t test, *P*<.0001). Even non-parametric comparisons using Mann-Whitney U test gave the same results.

	Pre/ during COVID-19	**N**	**Mean**	**Std Dev**	**Min**	**Max**	**P (Levene's test)**	**% increase In mean**
Listeners	Pre	20	143.20	80.93	39	338	0.5407	247.31 %
	During	20	497.35	99.84	270	672		
Engaged	Pre	20	117.15	68.17	28	289	0.4792	247.84 %
	During	20	407.50	82.19	218	555		
Plays total	Pre	20	2892.85	2764.59	412	11879	0.9476	215.88 %
	During	20	9137.80	2315.19	4547	14296		
visits	Pre	20	573.20	321.17	178	1064	0.0641	504.30 %
	During	20	3463.85	689.29	1879	4664		
bounce rate	Pre	20	0.54	0.05	46%	62%	0.0358	24.07%
	During	20	0.67	0.07	52%	75%		
unique visitors	Pre	20	366.55	179.62	114	620	0.0049	538.99 %
	During	20	2342.20	523.45	1170	3222		
pageviews	Pre	20	1678.60	1041.70	443	3405	0.2731	346.60 %
	During	20	7496.65	1577.68	5183	11326		

Table 2: Comparison of podcast and website visit analytics pre-COVID-19 and during COVID-19 periods

	Pre/during	N	Mean	Std Dev	Min	Max	Median	Interquartile Range	P (t test)	P (Mann Whitney U test)
Listeners/podcast	Pre COVID	20	2.11	1.19	0.57	4.97	1.60	1.60	<.0001	<.0001
	During COVID	20	3.77	0.76	2.05	5.09	3.82	0.94		
Engaged/podcast	Pre COVID	20	1.72	1.00	0.41	4.25	1.34	1.24	<.0001	<.0001
	During COVID	20	3.09	0.62	1.65	4.20	3.22	0.84		
Plays total/podcast	Pre COVID	20	42.54	40.66	6.06	174.69	29.71	38.45	.0122	.0005
	During COVID	20	69.23	17.54	34.45	108.30	69.95	25.85		
Visits/posting	Pre COVID	20	5.85	3.28	1.82	10.86	5.07	6.40	<.0001	<.0001
	During COVID	20	15.39	3.06	8.35	20.73	15.64	3.61		
Bounce rate/100 postings	Pre COVID	20	0.55	0.05	0.47	0.63	0.54	0.08	<.0001	<.0001
	During COVID	20	0.30	0.03	0.23	0.33	0.30	0.05		
Unique visitors/posting	Pre COVID	20	3.74	1.83	1.16	6.33	3.60	3.50	<.0001	<.0001
	During COVID	20	10.41	2.33	5.20	14.32	10.65	2.70		
Pageviews/posting	Pre COVID	20	17.13	10.63	4.520	34.745	13.98	21.51	<.0001	<.0001
	During COVID	20	33.32	7.01	23.036	50.338	32.49	9.74		

Table 3: Comparison of podcast and website visit analytics rates per posting available to viewers pre-COVID-19 and during COVID-19 periods

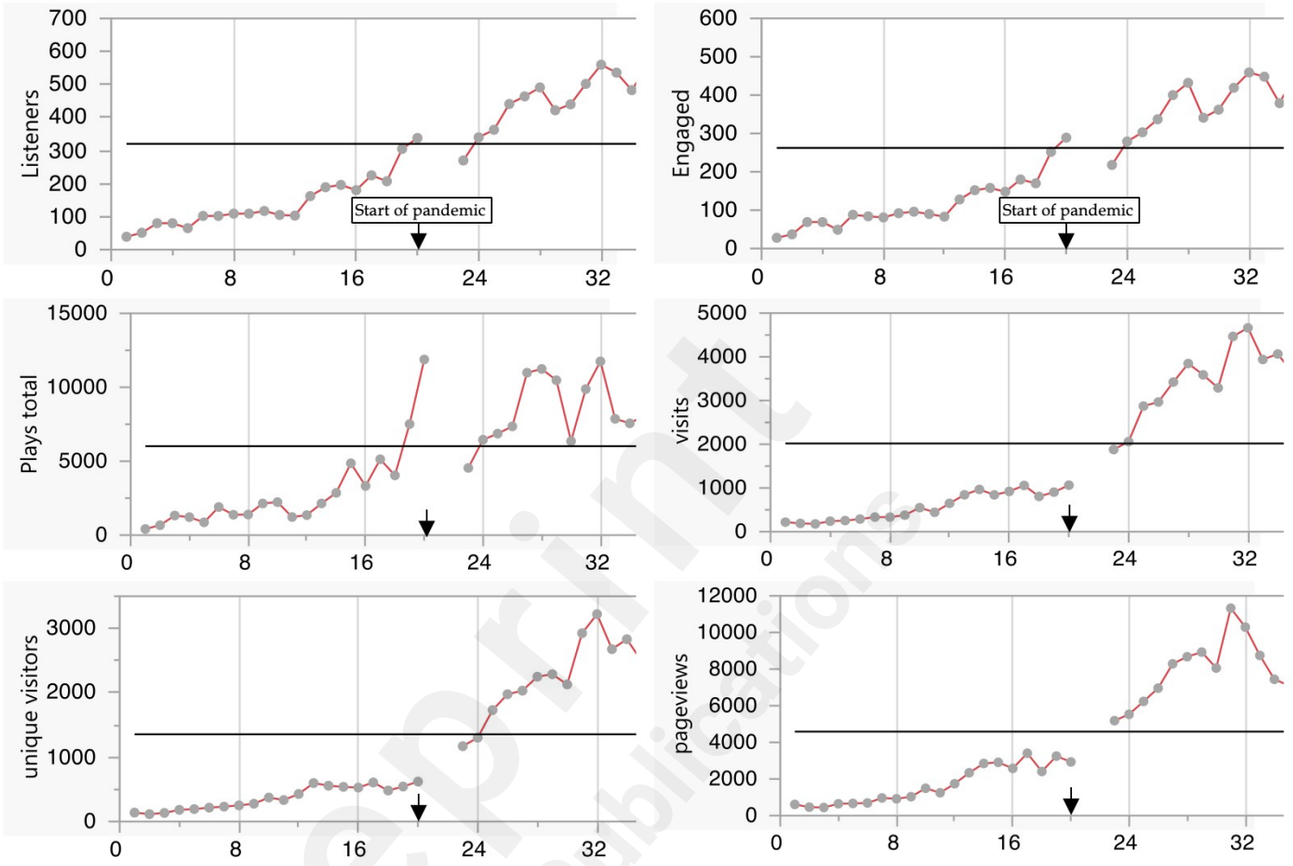

Figure 1: Monthly change in podcast and website visit analytics pre-COVID-19 and during COVID-19 periods. The arrowhead marks the start of the pandemic.

Discussion

The results demonstrate that our online EM board review podcast and platform experienced significant increased levels of engagement during the COVID-19 pandemic. Our learning platform included multiple media, such as portable document format study guides, video and picture-based modules, and online question banks. The aim was for the podcast and handouts to be integrated into an asynchronous study plan, as the platform provided easy accessibility and use.

Podcasts have been welcomed by those looking for a non-traditional method of learning in recent years, most notably those practicing in EM, where it is the most represented specialty that regularly hosts podcasts.[19,20,21] A survey in 2014 showed EM residents devote more time to podcasts than journals, citing podcasts as “the most beneficial” for education.[19] In another large survey, 80% of EM residents had listened to medical podcasts at least once.[22]

Traditional lectures continue to be replaced by various digital teaching methods and this was hastened by the arrival of COVID-19. Podcasts’ major benefit is their customization to fit learner’s educational goals as well as time constraints, allowing users to optimize their study goals while balancing work and private life.

In terms of feasibility, the podcast required a dedicated amount of time and monetary investment. The cost of standard microphones, basic recording software, and a website to host the podcast required approximately 300 to 400 US dollars annually. In terms of hourly commitment, approximately 5 hours weekly is needed to record, edit, and publish podcast episodes, as well as write and publish study guides.

Future studies are needed to investigate listener demographics, as well as method of listening. Further research is needed to measure test performance and knowledge retention. A comparative

study of test performance and knowledge retention from in-person workshops and online podcasts is also needed. Another future area of study will be to observe if the effects of the COVID-19 pandemic on asynchronous web-based learning are sustained.

Limitations

A restricted sample size is one limitation of this study. Spotify and Android do not publish podcast statistics, and therefore user data from both these platforms could not be obtained. According to Reuters in a survey of 2,012 listeners, 20% use Apple Podcasts as their application of choice from 2019-2020, which is the second largest market share.[23] However, our website archives visits by operating system as well as desktop versus mobile device. During the study period, we observed that 68% of users accessed our website using iPhone operating system.

Another limitation is association versus causation. Given the retrospective study design and nature of the COVID-19, it is difficult to completely credit the pandemic for increased podcast engagement. Confounding variables could also be a limitation, such as increased usage of social media during quarantine resulting in better promotion of the podcast and website.

One potential confounding variable was the launch of a procedural module in May 2020. This web-based learning instruction was an airway module, with recorded intubation videos and a pre- and post-assessment. However, when reviewing website analytics, this was not a frequently viewed page on the website, accounting for only 2.59% of total website pageviews. It cannot entirely account for the sudden increase in website visitors and podcast listeners. Thus, in this study, we can only establish differences observed in analytics between two time periods.

No quantitative data was tracked regarding listener exam performance, in particular in-training or board examinations. The purpose of this study was to assess the level of engagement for an emergency medicine board review podcast and website platform, before and during the COVID-

19 pandemic. Future research should be aimed at assessing whether this educational intervention is and effective form of test preparation.

Conclusion

During the COVID-19 pandemic, there was an accelerated level of engagement for our emergency medicine board review podcast and website platform over a sustained period. This educational platform is a feasible, low-cost asynchronous study tool. Medical educators should be aware of the increasing usage of web-based education tools, and that asynchronous learning is favorably viewed by learners.

Acknowledgement

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Abbreviations

COVID-19: Coronavirus Disease 2019

EM: Emergency Medicine

EMBB: Emergency Medicine Board Bombs

ABEM: American Board of Emergency Medicine

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