Balkan Med J 2022;39:334-9

Podcasting as a Learning Tool in Medical Education: Prior to and During the Pandemic Period

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Podcasting as a Learning Tool in Medical Education: Before and During the Pandemic Period Podcasts have seen significant growth as a medium for medical education over the last 15 years. The COVID-19 pandemic altered the way in which medical education is delivered to learners, including medical students, resident physicians, fellows, and practicing clinicians in the form of continuing medical education. A literature search using Google Scholar, PubMed, and NCBI was conducted to analyze and discuss how podcasts are utilized in medical education-both before and during the pandemic-and how this form of asynchronous education may influence clinical decision-making and patient outcomes. Finally, this review discusses how learners' habits while using podcasts may affect the way in which the information is internalized and the future of using podcasts to supplement medical education.

INTRODUCTION

Podcasts are a digital audio or video file that can be either streamed or downloaded from a website, platform, or server. The marked growth of podcasts is likely a result of increased demand. In 2008, fewer than 10% of Americans reported listening to a podcast within the last month. That number increased to 41% in 2021.[1] The prevalence of podcasting for medical education has accelerated in the last decade.[2] The trend started first in emergency medicine and critical care and has subsequently spread, with educational podcasts emerging in specialties such as neurology, obstetrics/gynecology, otolaryngology, anesthesiology, orthopedic surgery, neurosurgery, internal medicine, and general surgery.[3] Additionally, podcasts geared toward undergraduate medical education, some of which are run by medical students, and have started as a way of offering supplemental education.[4,5] By entering a query for the term "podcast" in PubMed, a year-by-year breakdown of the number of publications with this term in the title shows an increasing trend from 2006 to 2022 (Figure 1). This supports the idea that with more accessibility and availability of podcasts, the medical education community is showing more academic interest in exploring this medium.

The coronavirus disease-2019 (COVID-19) pandemic has greatly affected the landscape of medical education.[6-8] From in-person lectures and presentations to rotations for medical students, the enforcement of social-distancing policies has altered the way how students and trainees are taught. In an age of growing technology, increased smartphone ownership and capabilities, and prevalence of videochat, it is quite possible that the pandemic merely accelerated a trend toward the use of more asynchronous educational methods that was already coming. A literature search using Google Scholar, PubMed, and NCBI was conducted to analyze the trends of podcasting use in medical education. The terms "podcast," "podcasting," "asynchronous," "medical education," and "remote" were all used to search for publications related to the use of podcasts in medical education. A more narrow search (March 2020 through June 2022) was then performed to identify papers published specifically during the pandemic era, and search terms such as "COVID," "COVID-19," "coronavirus," and "pandemic" were included as modifiers. Currently, some reviews have been performed on this topic. However, these reviews covered mainly the pre-COVID era, and some had a narrow scope, looking at the specialty-specific breakdown.[3,9] Thus, this narrative review aimed to

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Received: July 25, 2022 Accepted: August 29, 2022 Available Online Date: September 09, 2022 • DOI: 10.4274/balkanmedj.galenos.2022.2022-7-81

Available at www.balkanmedicaljournal.org

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Cite this article as:
Okonski R, Toy S, Wolpaw J. Podcasting as a Learning Tool in Medical Education: Prior to and During the Pandemic Period. *Balkan Med J.*; 2022; 39(5):334-9.

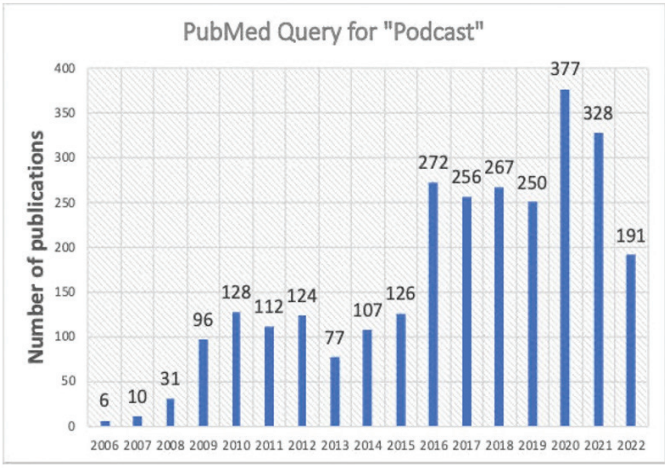

FIG. 1. Number of publications with term "Podcast" in the title from PubMed search based on year from 2006 to 2022.

explore podcasting trends and outcomes leading up to and during the COVID-19 pandemic, in addition to implications for the future of podcast use in medical education.

Growth of Podcasting in Medical Education

Even before the COVID-19 pandemic, educational podcasts for health-profession learners had been increasing. The use of medical podcasting can be traced back to the mid-2000s and has grown rapidly since then.[10] An investigational study found 152 active medical podcasts across all specialties in 2019,[3] not including podcasts produced for undergraduate medical education.

The reasons for the popularity of medical education podcasts are likely multifactorial. Podcasts allow for the dissemination of information asynchronously, at the time of the greatest convenience for the listener. The ability to slow down, speed up, and playback the audio gives listeners a greater flexibility for how the content is consumed compared with more traditional mediums. The widespread ownership of smartphones has made downloading or streaming podcasts easier and more convenient. As of 2020, the Pew Research center reported that 85% of Americans owned a smartphone, up from just 35% in 2011.[11] Globally, smartphone users have increased by approximately 50% between 2017 and 2022, with over 6.2 billion people owning a smartphone in 2021.[12] The ability to download episodes from the streaming platform directly to one's device allows for listening when service is unreliable or WiFi is unavailable. Some podcasts in medical education require paid subscriptions for unlimited access to content, whereas many can be listened to at no cost to the listener. For the creator, podcasting is a relatively low-cost endeavor, allowing for a low bar for entry into the podcasting space.[13] A feasibility study conducted for the creation of an ophthalmology podcast revealed that start-up costs were just $212.18 with $29 monthly expenses.[14] However, this study did not consider opportunity cost, which is an additional consideration. One such study analyzed the creation of an academic surgery podcast that cost $7091 USD for a series of 10 episodes when factoring this in.[15] Notably, many of those involved in medical education are proponents of Free Open-Access Medical education (FOAMed) and are less likely to pursue a profit from the production of the podcast. Additionally, the opportunity for podcasters in the medical education community to put their voice into the production of educational content allows for a more informal, conversational style of teaching and learning.

This is also beneficial for the listener, as one study found that participants cited both education and entertainment as reasons for listening.[16] Given this, it is not surprising that one review found that listeners find learning from podcasts to either be equivalent to, or better than, classroom learning.[13] Similarly, the University of Maryland's MarylandCCProject released a 7-year follow-up study indicating that all users of asynchronous content felt that this medium improved their knowledge of critical care.[17] A survey conducted among emergency medicine clinicians, comparing physicians and advanced practice providers, found that both groups preferred asynchronous learning modalities, such as podcasts and videos over in-person lectures.[18] In addition, a survey of emergency medicine residents found that of those who engaged in extracurricular learning, podcasts were the most popular method.[19] Residents have also reported feeling a greater sense of community after listening to medical education podcasts, including feeling a more human connection to the host and feeling that they could "speak the language" more effectively, making it easier to conduct an intelligent conversation with an attending about a particular topic.[20] This may enhance learning by opening up discussion and facilitating greater patient care. It also may serve as a signal to the attending that the trainee is a more active participant in his or her learning. Multiple studies have found that listeners of medical education podcasts felt more motivated to learn.[9] Additionally, at present, podcasts and other forms of distance learning modalities often offer the opportunity to earn continuing medical rducation (CME) credits,[10] and it appears that the majority of younger physicians prefer obtaining CME in this way compared with more traditional methods.[21]

As there is a well-established subjective value that podcasts provide to learners in medical education, it is important to ensure the accuracy of the information being disseminated. Listeners' subjective experiences should not be discounted, but the information shared should be reliable and evidence-based. For some podcasts, reliability is very evident to listeners, such as those openly reviewing literature or interviewing experts who reference the literature. Many podcasts in medical education also utilize show notes-summary documents that accompany podcast episodes. These documents outline the episode's main points and contain references to resources discussed in each episode, including those with industry sponsorship.[22] While some podcasts are not peer-reviewed traditionally, they often include links to citations so that listeners can see the evidence base behind the discussion. Additionally, podcasts that have websites will often include blog-style explanations of the content, with corresponding citations, diagrams, or flowcharts linked from other peer-reviewed sources. Others, such as those available on The Anesthesia Toolbox, are peer-reviewed by experts in the field. The podcast script is sent

out to 2 or 3 experts for review before recording, just as journal manuscripts are sent out before publication. One scoping review on anesthesiology podcasts found that 73% of podcasts analyzed had evidence of peer review. Podcasts targeted specifically to anesthesiologists, discussed clinical topics, and currently active (within the last 3 months) were all associated with evidence of peer review, whereas podcasts authored by individuals had a negative association with peer review.[23] Listeners' opinions on what makes a podcast reliable are also important. One study sought to answer this question by analyzing podcasts and blogs in emergency medicine and critical care and targeted various quality indicators. The authors found that for podcasts, factors such as clear identification of the author, author disclosure of any affiliations, availability of author contact information, ability for learners to provide feedback, and clear delineation between advertisement and content all ranked toward the top.[24] An important aspect of the peer review process is to incorporate the proper caveats when discussing medical management, as certain countries may have different approved uses for medications, which is particularly important for industry-sponsored podcasts that are subject to local regulations.[22]

The use of podcasts for learning has limitations as discussed in the literature. One qualitative study interviewed emergency medicine residents and discovered that some felt that the quality of learning from podcasts was inferior to other forms of study. This included a lack of deep learning resulting from passive listening, lack of engagement, or distracted listening. Some even noted greater difficulty with retention of information. They felt this made it difficult to translate what was learned to bedside care. Given that a majority of those who listen to medical education podcasts make use of this form of learning while performing other tasks,[27] rather than listening free of distraction, using podcasts as a primary learning tool may limit the ability to internalize the information. There is also the question of disseminating inaccurate information. Many podcasts have some form of peer review,[23] whereas others do not. Listeners certainly can choose to only listen to podcasts that are peer-reviewed, but it is possible that some do not. Because podcasts can be accessed by anyone, those without adequate training, or with no medical training at all, have the potential risk to misinterpret what is discussed, leading to inappropriate application of the information. Moreover, pharmaceutical companies may influence the content of podcasts just as they can with traditional print journals.

In the COVID Era

There is not yet a lot of data on how podcast use changed during the COVID-19 pandemic. However, some studies have attempted to characterize the effect of the pandemic on asynchronous learning.

Siegler et al.[15] analyzed active neurology podcasts (a podcast was deemed active if it had >2,000 mean downloads/month, affiliation with an academic society, or availability of CME credit) and found a trend toward increasing downloads during the COVID-19 pandemic, with a 358% increase in downloads in April 2020 compared with that in March 2020. However, this did not reach significance because of the large variance in median monthly downloads between podcasts. Upon subgroup analysis, a trend was also found toward an increase in downloads among those podcasts affiliated to an academic society; however, this did not meet the threshold for significance ($p = 0.06$), perhaps due to the smaller sample.[27] Another study analyzed both blog post views and podcast downloads across medical specialties during the period of January-March 2020 against April-May 2020. The authors did not find an increase in significance for the number of podcast downloads; however, they did find an increase in views for one blog, particularly during a post-hoc analysis.[28]

There are many possibilities for why these studies have shown mixed results with respect to podcast downloads, which may be related to both the nature of how podcasts are downloaded, and the way in which listeners utilize them. One possibility is that because podcasts can be automatically downloaded by the apps that host them, the total download numbers may not have increased despite a possible increase in plays. Briefly, the smartphone app may have been downloading all of the episodes before the pandemic, but only some were being listened to. During the pandemic, perhaps the same number were being downloaded, but it is possible that a higher percentage were being listened to. Moreover, it is possible that there was not an increase in downloads because there was not a net increase of listeners during this period. The pandemic increased burnout rates in clinicians, and it may have led to a decreased drive to learn during free time, including listening to podcasts. Consumers of medical education podcasts often multitask while listening, primarily while in the car or while exercising.[26] Conceivably, during these moments, clinicians did not want to focus on learning medicine while engaging in other activities owing to the exhaustion they felt from the pandemic.

The COVID-19 pandemic saw increasing rates of mental health struggle, including anxiety and depression, particularly among healthcare workers.[29] In spite of this, one study found decreased burnout, anxiety, and depression among medical students switching to an online curriculum toward the beginning of the pandemic. The proposed mechanism offered greater flexibility with respect to time and travel, greater motivation for self-education, and ability to combine studying with personal time.[30] These benefits can be also garnered from other asynchronous forms of education, such as podcasting.

Podcasts in the medical education space also used their platforms to discuss and disseminate information about treating patients with COVID-19. Podcasts in critical care, emergency medicine, internal medicine, neurology, and others have been involved in educating clinicians about caring for patients with COVID-19 and its sequelae. In an age of increased smartphone usage, social media, and asynchronous learning modalities, podcasts have been recognized as a means to rapidly disseminate public health information.[31] Given the novelty of the COVID-19 pandemic, social media was relied upon by clinicians in the early pandemic

to disseminate information among colleagues.[32] The Curbsiders Internal Medicine podcast, for instance, had several episodes during the early pandemic period regarding the transmission of the virus, quarantining, proper personal protective equipment, diagnosis, and treatment guidelines.[33] The Anesthesia and Critical Care Reviews and Commentary podcast had a series of episodes during this time about airway management, COVID-19 in pregnancy, and lessons about managing these patients in the intensive care unit.[34] The podcast Emergency Medicine Cases authored episodes on how to prepare a hospital emergency department (ED) for a COVID-19 surge, diagnosis, and management in the ED setting.[35] Rather than waiting on peer-reviewed literature, which could take several months to begin to show up, the rapidly evolving nature of the early pandemic required a faster means of propagating information to clinicians. Podcasts were a way by which-as early as February and March of 2020-anecdotal experiences from physicians across the world could be shared before peer-reviewed literature could be published.

Podcasting for Med Ed: A Limited Tool or the Future?

Whether the pandemic permanently increased the demand for distance learning modalities, such as podcasts, remains to be seen. Given the general trend of increased podcast listenership and increased availability of podcasts in medical education, it appears unlikely that podcast use will decrease.

Going forward, further investigation of the effect of podcast listening on educational and clinical outcomes is important. Thus far, no studies have looked at these outcomes during the pandemic era, but some prior studies have attempted to answer these questions. Lien et. al. found a 22% improvement in test scores from baseline when using podcasts as the study modality. This study also found that learning from blog posts had a 29% improvement from baseline.[36] Both of these improvements were significant, but the difference between these two was not, perhaps indicating that learning from written blog content may be comparable to auditory learning. Another study looked at utilizing podcasts versus a written synopsis for appropriate treatment of pediatric gastroesophageal reflux. While one method had no benefit over the other in practice-changing behavior, both groups saw significant improvements in adherence to guidelines.[37] Another small study observed an improvement from baseline knowledge about electroencephalogram when using video podcasts over traditional didactic learning and those with greater podcasting experience had greater improvements.[38] In another study, listening to podcasts led to significantly better improvements in knowledge retention in medical students regarding orthopedic diseases compared with a textual-based learning approach.[39] These are small studies, and more data are needed, but similar findings have been produced in neurology and among Ob/Gyn residents.[40-42] Most of the studies looking at podcasting altering practice patterns and behaviors were conducted done through surveys. One such survey of the effect of podcast education on internal medicine residents found that 55% of the sample changed their practices as a result of listening to podcasts.[43]

Although smaller survey-based studies appear to demonstrate non-inferiority of podcast-based learning over more traditional methods, it is important to consider that for education, a one-size-fits-all approach may not be appropriate. For instance, using the Felder-Silverman style of learning, researchers from Vienna provided a questionnaire to students to find the proportion falling into each category. Accordingly, 87% of the students had a visual preference over a verbal preference.[44] While the importance of learning style has been called into question, these findings may suggest that audio podcasts should consider providing visual aids, either in the show notes or on a website. Additionally, podcast producers could consider the use of video podcasts to appeal to the learners who prefer visual learning.

Understanding that podcast learners often multitask while listening is important; one study found that nearly half of listeners listened while driving, and about a quarter either listened while completing chores or exercising.[26] There is a preponderance of evidence that multitasking with other forms of media hinders learning.[44-46] Perhaps, listening in a quiet environment, free of distraction, taking notes-as is often done with more conventional means of studying-would be more conducive to learning. However, an important distinction may be related to the type of activity being performed while learning. For instance, exercising while learning has not been demonstrated to negatively affect memorization, and it has even been shown to produce a greater ability for word recall than learning while not exercising.[47] Thus, more work is needed to determine the relative advantages and disadvantages of different forms of multitasking while listening to podcasts.

The growing availability of podcasts before and during the peri-pandemic period may be reflective of the increased demand for a diverse set of options for learners to acquire knowledge. With this increased availability, it will be important to consider agreed upon ethical standards, such as mandating disclosures and industry sponsorships, as is often the case with publishing in academic journals. More research is needed on concrete learning and clinical outcomes, but so far, podcasts have not been shown to be inferior, and some small studies have shown improved learning outcomes. As inaccurate information could be disseminated, podcasts in medical education often come with a disclaimer stating that this information should not be taken as medical advice. In addition, although nothing is stopping non-medical professionals from accessing information, this problem is not unique to medicine and could be a criticism of legal or financial podcasts. This potential risk is seemingly inseparable from the goals of FOAMed, which is to provide easily accessible medical education to learners free of cost. Thus, learners should weigh the quality of the data being presented, examine the references, and discuss it with others before changing practice. Whether podcast listening increased during the pandemic is unclear. However, the ability for podcasts to reach a wide audience, at any time and place, to give flexibility and control to the learner and to offer CME credits gives them an advantage, and they will likely continue to play an important role in medical education, as we navigate the ongoing COVID-19 pandemic and beyond.

Author Contributions: Concept- R.O., S.T., J.W.; Design- R.O., S.T., J.W.; Data Collection or Processing- R.O., S.T., J.W.; Analysis or Interpretation- R.O., S.T., J.W.; Literature Search- R.O., S.T., J.W.; Writing- R.O., S.T., J.W.

Conflict of Interest: No conflict of interest was declared by the authors.

Funding: The authors declared that this study received no financial support.

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