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## Association for Academic Surgery

# Development and Utilization of a Medical Student Surgery Podcast During COVID-19

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ARTICLE INFO

*Article history:*
Received 30 November 2020
Revised 22 February 2021
Accepted 26 March 2021
Available online 8 April 2021

*Keywords:*
Podcast
Covid-19
Education
Cost-analysis
Medical students

ABSTRACT

*Background:* The 2019 coronavirus disease (COVID-19) pandemic drastically reduced learning opportunities for medical students. We sought to determine the cost and success of implementation of a podcast for a surgical department in a large academic hospital.

*Methods:* We created a podcast series for Israeli medical students during the COVID-19 epidemic based on the Medical Student Core Curriculum of the American College of Surgeons / Association for Surgical Education. Episodes were available for free download or streaming on a designated website and popular podcast platforms. Podcast analytics were used to measure public listeners and uptake.

*Results:* Total development time was 90 hours at an estimated cost of $7091 USD. A total of 10 episodes were released between March 21, 2020 and August 31, 2020. An average of 9 ± 1.26 h (range 2-6) was required to generate each episode, including 3.4 ± 1.26 h (2-6) for content review and 5.6 ± 2 h (4-10) for audio production. An average episode ran for 35.9 ± 4.3 min (28-42). Podcasts recorded a total of 5678 downloads, with an average of 228 and 336 downloads per episode in the first 30 and 90 days, respectively. The average daily downloads before the students returned to clinical rotations (March 21-April 30) was 48 ± 58.3 (7-283;) compared to 16 ± 7.4 after their return (1-38; $P < 0.01$). Estimated costs to produce a video-based education series would have been significantly more.

*Conclusion:* Podcasts can serve as a cost-effective and quickly produced instructional tool to supplement online learning. Further research is required to determine the efficacy of podcasts versus video-based education modules.



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0022-4804/
https://doi.org/10.1016/j.jss.2021.03.059

## Introduction

Podcasts are internet-based audio recordings that can be accessed online or downloaded to a portable multimedia device.[1] Its origin can be traced to the 1960s when recordings of lectures (including in medical education[2]) were distributed on vinyl records. In 2004, as mobile MP3 players revolutionized audio distribution, the term podcast was coined as a portmanteau of iPod and broadcast.[3] Podcasts have become an increasingly common method to provide medical education.[4] The coronavirus disease 2019 (Covid-19) pandemic dramatically impacted healthcare education as stay-at-home orders and quarantines reduced medical students' academic and clinical exposure.[5,6] In view of prior studies demonstrating that podcasts are an effective modality for remote medical learning, with positive effects on knowledge retention,[7] test performance,[8] and even clinical practice,[9] we sought to determine the costs of developing a podcast and study its utilization for our medical students.

## Material and methods

### *Content development*

"The Guide for General Surgery" podcast series for Hebrew-speaking medical students was created in March 2020 by two residents and a general surgery attending physician at The Chaim Sheba Medical Center, the largest tertiary academic medical center in Israel. Due to the time constraints, secondary to the rapid transition to online education, an official peer review of the content seemed unfeasible and we opted to base the content on the Medical Student Core Curriculum of the American College of Surgeons / Association for Surgical Education.[10] One episode, focusing on the treatment of COVID-19 patients, was based on relevant resources[11] at the time (April 2020).The majority of the episodes started with a concise review of the subject, after which 'patient cases' were discussed with a general surgery attending, and the episode concluded with 10 "tips/tricks" for medical trainees.

Episodes were available for free download or streaming on a designated website (https://israel-surg-podcast.transistor.fm), as well as popular podcast platforms (Spotify, Apple Podcasts). Audio editing was conducted using Audacity software (Audacity team 2020, Version 2.4.2). The Institutional Review Board at Sheba Medical Center authorized a research IRB exemption. The study period was March 15-September 23, 2020 and it is important to note that on March 15, clinical rotations of medical students in Israel were halted due to the COVID-19 pandemic, until resumption of clinical activity on May 1. Clinical rotations in surgical departments ended on July 15.

### *Statistical analysis*

Podcast analytics derived from the hosting platform ("transistor.fm") were used to measure public listeners and uptake. Metrics included number of downloads per episode, user location (by country), and the platform used for streaming or downloading. Student's t-test was used to compare average downloads before and after the students returned to clinical rotations (March 22-April 30, versus May 01-July 15). The Spearman rank correlation was used to quantify the correlation between cost-per-episode and the number of downloads after 30 days. Data were analyzed using STATA software (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC). Descriptive statistics are reported as mean ± standard deviation (range).

### *Cost analysis*

The REC financial framework was developed to estimate the financial costs for technology-based surgical education projects.[12] In this approach, each resource is defined and allotted a value cost in U.S. dollars (USD). For this study, we defined '*project managers*' as the individuals responsible for project proposal, script writing, and storyboard development. The '*subject matter expert*' was defined as the expert in the field who reviews the script and may or may not participate in the recording. The '*editor*' role was defined as the individual responsible for editing content and other duties related to delivering the final product. Podcast development necessitated technical equipment (microphones, cables, headphones, interface, microphone holders) and "opportunity cost," which was defined as the time cost of personnel involved in the production and represent lost revenue-making activity, due to the time inputted into the production. The average general surgeon and surgical resident hourly salaries were estimated using an online American employment platform (ZipRecruiter[13]) at $160 and $30 per hour, respectively. This data was used for approximating the opportunity costs of the *project manager* (MC and RA, surgical residents) and *subject matter expert role* (IA, board certified general surgeon). The estimate reflects the United States, not the local Israeli, salary for generalizability purposes. Cost-per-episode does not include one-time expenses (equipment costs) or maintaining costs (i.e. monthly pay for the web-based platform).

## Results

### *Production*

A total of 10 podcast episodes were produced between March 15 and September 23, 2020. Total development time was 90 h. An average of 9.0 ± 1.3 (range 2.0-6.0) h was required to generate each episode. Content review time, defined as time for preparation of script and technical arrangements, was an average 3.4 ± 1.3 (range 2.0-6.0) h per episode. Audio production time, defined as the time of recording and editing, was an average 5.6 ± 2.0 (range 4.0-10.0) h per episode. An average episode ran for 35.9±4.3 (range 28.0-42.0) min.

### *Audience*

The first episode was launched on March 21, 2020, and the last episode went online on August 24, 2020. Podcasts recorded a total of 5678 downloads in the study period (March 21-September 23), with an average of 89, 228, 288, and 336

**Table 1 – Episode content and audience. All the episodes, excluding number 6, were based on the Medical Student Core Curriculum of the American College of Surgeons / Association for Surgical Education. Content review included review of literature, drafting of script, and scheduling. Production includes recording and audio editing of the episode. Estimated cost per episode is calculated utilizing the REC framework.**

| No. Episode | Subject | Length *(minutes)* | Content review time *(hours)* | Production time *(hours)* | Estimated cost *(USD)* | Downloads | |
|---|---|---|---|---|---|---|---|
| | | | | | | 30 days | Total |
| 1 | Hernia *(inguinal, umbilical, ventral)* | 39 | 4 | 8 | 815 | 339 | 1107 |
| 2 | Biliary disease | 42 | 3 | 6 | 660 | 114 | 615 |
| 3 | Bowel obstruction | 41 | 4 | 5 | 725 | 286 | 697 |
| 4 | Trauma *(initial management)* | 37 | 4 | 6 | 755 | 242 | 665 |
| 5 | Breast disease | 33 | 2 | 4 | 440 | 146 | 524 |
| 6 | Management of COVID-19 patients | 33 | 6 | 10 | 1130 | 429 | 569 |
| 7 | Inflammatory bowel disease | 28 | 3 | 5 | 565 | 158 | 448 |
| 8 | Appendix / appendicitis | 35 | 2 | 4 | 440 | 146 | 394 |
| 9 | Appendectomy | 33 | 2 | 4 | 440 | 163 | 387 |
| 10 | Cholecystectomy | 38 | 4 | 4 | 630 | 260 | 273 |

USD = U.S. dollars.

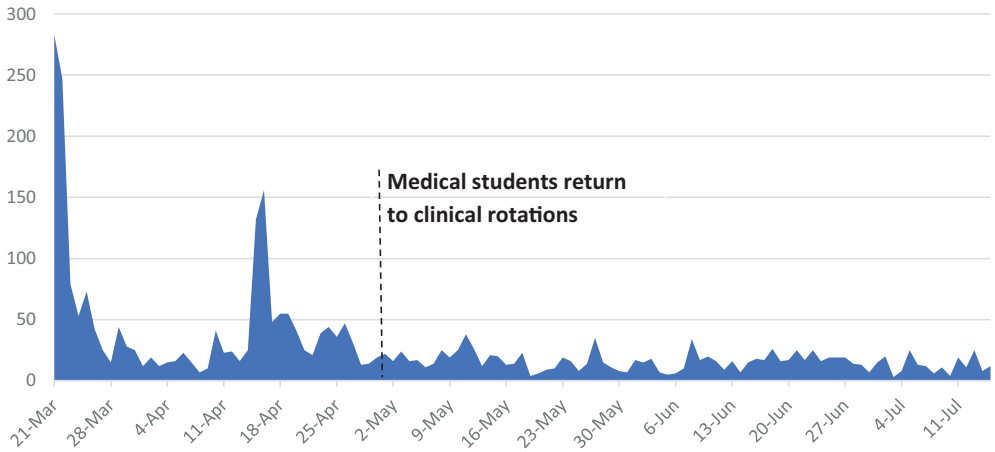


**Figure – General surgery podcast listening trends during the initial Coronavirus Disease 2019 (COVID-19) outbreak. The average daily downloads before the return of Israeli medical students to clinical rotations (March 21-April 30, 2020) was 48 ± 58.3 (7-283;) compared to 16 ± 7.4 after their return (May 1-July 30; 1-38; *P* <0.01).**

downloads per episode in the first 7, 30, 60 and 90 days, respectively. Table 1 summarizes the episodes production time and listening frequency. Figure displays the listening trends from March 21 to July 15. The average daily downloads before the return of medical students to clinical rotations (March 21-April 30) was 48.0 ± 58.3 (range 7-283;) compared to 16.0 ± 7.4 after their return (May 1-July 15; 1-38; $P < 0.01$). Listeners came from 34 countries, the three most common being Israel (88.72%), United States (2.54%) and Hungary (1.55%). The most popular listening platforms were Spotify (50%), Apple podcasts (14%), mobile browser (14%), and desktop browser (10%).

### *Cost-analysis*

The estimated total cost (in USD) to produce a 10-episode podcast series was $7091 USD (Table 2). The cost of the equipment was $379.9, maintenance of the podcast platform cost $19/month, and the editing software was free. Most of the costs (93%) were *opportunity costs*. The approximated costs for the time of the content expert and the project managers participating in the production of the podcast per episode were $180 and $480, respectively. The mean cost-per-episode was 660$ (±214, 440-1130; Table 2). There was a moderate to strong correlation between the episode cost and the number

**Table 2 – REC cost-analysis framework as applied to the 10-episode podcast module for medical students.**

| Roles | | $ USD |
|---|---|---|
| | Project manager | 1800 |
| | Subject matter expert | 4800 |
| | Editors | NA |
| | Actors | NA |
| | Pilot learners / test audience | NA |
| | Peer review team | NA |
| | Post-audio analytics and evaluation team | 0 |
| **Equipment** | | |
| | Editing software | 0 |
| | Recording studio | NA |
| | Radio equipment | |
| | *microphone holders* | 15.98 |
| | *interface* | 159.99 |
| | *microphone foam ball* | 6.7 |
| | *cables* | 19.9 |
| | *headphones* | 118 |
| | *microphones* | 56.42 |
| | Laptop with extra storage space | 0 |
| | Learning management system/platform | 0 |
| | Maintenance costs | 114 |
| **Consumables** | | |
| | Simulation models | NA |
| | Cadaveric models | NA |
| | Procedural equipment | NA |
| | Procedural instruments | NA |
| **Total** | | 7091 |

of downloads after 30 days (Spearman rank correlation=0.73, $P = 0.02$).

## Discussion

Our report on the development and implementation of a general surgery podcast for medical trainees during the COVID-19 outbreak documents the cost of producing the podcast, and its utilization. The project was initially intended for local hospital use, as medical students in Israel had to abruptly stop their clinical rotations in mid-March 2020 due to the COVID-19 outbreak. We hoped that the podcasts would serve as an adjunct to other online learning platforms, due to its inherent advantages of ease of accessibility and integration into daily activities. Anecdotally, students used these podcasts as a supplement to other online surgery education materials, mainly virtual synchronous and asynchronous video lectures and case-based learning sessions.

The estimated total cost to produce a 10-episode podcast series of $7,091 is relatively low compared to other educational modalities as reported in the literature with most of the costs being opportunity costs. Axelsson et al.,[12] using the same REC budget framework for three neurosurgery video modules, estimated each video to cost between $1774 and $4349. Traditional video modules usually require more production personal (videographer, instructional designer, animator and even actors), more expensive equipment, and professional editing. Cassidy et al.[14] utilized animated video clips to create a popular educational module that was less demanding to produce (average of 6.9 hours was required to create one video), but they were rather short (2 minutes). Obviously, the very different nature of the content of these modalities reduces the reliability of such comparisons but can help in analyzing their different cost-effectiveness. Based on our results, the ideal surgical podcast resource would be centrally developed and financially supported from a central organization. Surgeons, surgical residents, or medical students from various institutions could then receive training on how to write and record podcast episodes so that no one institution bears most of the opportunity costs. Central organization would also help ensure that the episode content remains accurate and are easily accessible by all learners.

Our podcasts proved popular with the medical students, with an average of 300 downloads per episode in the first 60 d. An analysis of that figure within local context is telling. The main audience for the podcast was students in medical schools in Israel that are in their clinical studies, during or after surgical rotations, which is an estimated 2200 potential listeners.[15] Thus, a total of almost 6000 downloads for an audience of 2200 medical students is an impressive reach within a relatively short time period. Further research is required to determine if the students have a preferred podcast length and at what playback speed they use most frequently. We intend to explore listener's satisfaction with our surgical podcasts utilizing survey data and possibly focus-groups.

A 2017 review found that there are at least ten active English-speaking podcasts reporting on the field, with a total of 1004 episodes averaging 22.1 min.[4] Published studies report varying outcome measures for utilization (listeners, downloads, platform access) precluding direct comparison. Several studies have demonstrated that podcasts can improve knowledge retention[7] and test performance.[8] To the best of our knowledge this the first study to implement a cost analysis for medical podcast development.

Little is known about the efficacy and effectiveness of podcasts compared to other forms of electronic learning. In a recent qualitative analysis of US and Canadian residents experience with educational podcasts,[16] listeners explained that podcasts are more engaging compared with other learning formats. It is possible, that the auditory method of learning is particularly helpful for certain surgical education topics and allows learners to focus with less visual distractions. An additional major reported advantage of podcasts over other modalities was the possibility to practice other activities while listening, turning "idle time" (e.g., exercising, commuting, cooking) to academically productive time. More research is required to assess the effect of this combination of learning with relatively simple motor tasks.

An important limitation of our work entails the limited assessment of content quality, as the episodes were not peer-reviewed. However, we believe that this issue was minimized to some extent by relying on updated national curricula (Medical Student Core Curriculum of the American College of Surgeons / Association for Surgical Education). It should

be emphasized that the need to accommodate fast changing learning environments should not compromise educational content. We intend to implement an institutional peer-review mechanism to guarantee content quality in the future.

## Conclusions

Podcasts can serve as a cost-effective and quickly produced instructional method to supplement online learning. The success of the podcast, in terms of both cost and uptake by the students, makes it a suitable model for replication by other teaching programs. Further research is required to determine the efficacy of podcasts versus video-based education modules on acquisition and long-term retention of medical knowledge.

## Author contribution

Concept and design: Anteby, Amiel, Cordoba; Acquisition, analysis, or interpretation of data: All authors; Drafting of the manuscript: Anteby, Phitayakorn; Critical revision of the manuscript for important intellectual content: All authors; Statistical analysis: Anteby; Administrative, technical, or material support: All authors; Supervision: Phitayakorn

## Acknowledgment

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Disclosure

Dr. Phitayakorn is an Associate Editor of the Journal of Surgical Research, and as such will be excluded from the entire peer review and editorial process for this manuscript.

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