

Analysis of The Oral Cavity: Portal to Health and Disease, a massive open online course in oral medicine



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Objective. The aims of this study were to (1) analyze the demographic characteristics of learners participating in The Oral Cavity: Portal to Health and Disease (TOC), the first massive open online course in oral medicine, and (2) assess worldwide interest in accessible, high-quality oral medicine education.

Study Design. TOC development and design was reviewed in detail to provide background for course organization and content. Learner demographic characteristics were gathered and analyzed to identify course participation and engagement.

Results. TOC premiered on September 17, 2017 as a novel source for oral medicine–based information. By March 1, 2020, TOC had 18,122 learners, of whom 4,641 enrolled. This sample included all age groups and genders, people of varied educational and employment backgrounds, and participants from 6 continents. Learners rated the course 4.9 out of 5 stars and submitted many positive reviews.

Conclusions. TOC provided oral medicine–based education to individuals with interests in dental, medical, and allied health professions. Interest in oral medicine–related education was supported by high learner engagement in this course with wide global distribution. (Oral Surg Oral Med Oral Pathol Oral Radiol 2020;130:659–666)

Oral medicine is the specialty of dentistry responsible for the oral health care of medically complex patients and for the diagnosis and management of medically related disorders or conditions affecting the oral and maxillofacial region.¹⁻⁴ Practicing dentists are required to complete continuing dental education to maintain dental licensure, and oral medicine–based courses are often sought after for this purpose.⁵ Expanding knowledge and awareness of oral medicine will potentially enable greater access to care, improve clinical outcomes, and positively affect public health. Novel educational formats, such as massive open online courses (MOOCs), can help to achieve these goals.

MOOCs began more than 10 years ago and provide free and easily accessible information, often via dedicated internet platforms.⁶ MOOCs are typically lecture-based offerings, using short video presentations and independent formative assessments, to allow large numbers of learners across the globe to obtain high-quality education without direct instructor feedback.⁷ Online delivery of content is considered equally effective to traditional offerings with student satisfaction and completion comparable to, and sometimes exceeding, that in traditional courses.⁸⁻¹⁰ MOOCs present an opportunity for institutions of higher education to connect with

international learners, and worldwide distribution expands access to content experts for students who would not otherwise gain these direct connections.^{9,11}

Existing MOOCs have drawn on their decentralization and wide distribution, particularly in health care fields, with MOOCs designed to introduce careers in various areas and prepare students for further study.¹² They have been considered particularly useful in prerequisite courses and continuing education and may especially benefit students without traditional to career paths of interest.^{7,13,14} MOOCs provide access to advanced knowledge with little to no financial investment and minimal time requirement. MOOCs in health care have also targeted allied providers, patients, and the public.¹⁵ MOOCs allow both providers and educators to disseminate understanding of disease conditions, treatment considerations, and theoretical knowledge to interested consumers as well as lifelong learners.^{7,16,17}

The Oral Cavity: Portal to Health and Disease (TOC) is the first MOOC in the field of oral medicine. This study aimed to (1) analyze demographic characteristics of learners participating in TOC and (2) assess worldwide interest in accessible, high-quality oral medicine education. We hypothesized that learners from many demographic groups would be interested in accessing

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Received for publication Jul 6, 2020; returned for revision Aug 4, 2020; accepted for publication Aug 30, 2020.

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2212-4403/\$-see front matter

<https://doi.org/10.1016/j.oooo.2020.08.036>

Statement of Clinical Relevance

With the spread of online learning, The Oral Cavity: Portal to Health and Disease is an example of a successful massive open online oral medicine course with global participation. Broad engagement in this course indicates the appeal of topics in oral medicine to learners from diverse backgrounds.

information regarding systemic diseases and their oral medicine considerations.

MATERIALS AND METHODS

This study aimed to review the creation, distribution, and success of TOC, the first MOOC in oral medicine, which was created by Penn Dental Medicine (PDM) in partnership with Coursera (www.coursera.org, Mountain View, CA, USA). TOC was designed by the authors (U.H., T.P.S., E.T.S.) as a review of the specialty of oral medicine and as an illustration of the many ways in which systemic and oral health overlap and affect one another. This course was designed to benefit dental, oral medicine, medical, and other professionals by providing information on patients of shared relevance to dental and medical specialists and by looking at topics from shared perspectives. Registration for TOC is continuously open, allowing students to begin the material at their convenience.

TOC is hosted on the Coursera platform and is broadly available to all learners but is listed as an intermediate course, suggesting that those learners who challenge the material have some background knowledge. This allowed the presented material to meaningfully cover the overlap of dental and general medicine. However, no specific prerequisites, skills, or background were recommended or required, allowing students to register for the course of their own volition based on an individual assessment of their ability to benefit. The intended audience of the course was listed as “physicians, dentists, health care professionals, dental students and college students contemplating careers in dentistry. However, if you are not working in any fields mentioned above, please still feel free to join us and learn the knowledge about the relationship of dentistry and medicine.” Through this messaging, in keeping with the principles of MOOCs, all learners were welcomed, and those interested in joining understood the level of material presented. Registration in the course carried no fee, and learners were able to register for a Coursera Course Certificate (US\$49) if they desired as a proof of their achievement. Course content

and assessment did not change depending on how a student registered.

The content presented in TOC was divided into 8 weeks, with the first week serving as an introduction to the course and to the interplay between medicine and dentistry. Each of the following 7 weeks concentrated on a topic of interest and featured a medical specialist with experience in the area (Table I). After a short introduction (provided by K.F., 2-3 minutes), the visiting specialist was interviewed by a dental specialist (U.H.) and were asked to introduce the topic, considerations for medical and dental treatment, and recent areas of growth in the field. These videos lasted between 13 and 30 minutes. The oral medicine considerations in this subject were then explored, again in interview format, with U.H. questioning the featured specialists (T.P.S., E.T.S.), often focusing on oral manifestations of the disease at hand and modifications to dental treatment for affected patients. These segments varied in length from 10 to 21 minutes. After each presentation (twice per week), learners were asked to complete a 5-question multiple-choice quiz, and at the completion of the week’s material there was an additional 5-11 question multiple-choice and true/false quiz assessing comprehension of the topic as a whole. In total, each week was designed to take students between 1 and 2 hours. Because each subject in weeks 2-8 was independent of the others, students were able to complete the material out of sequence, as is common in MOOC courses, although all students were encouraged to follow the order presented.

After completing each subject, learners were asked to complete a final exam that consisted of 42 multiple choice questions and included material from each week. This required students to complete all the materials presented to successfully complete the course. The quizzes after each lecture and at the end of each week, as well as the final examination, required at least 80% correct answers to pass. Students who did not complete the assignment with a sufficient score were able to take it again after a waiting period of 8 hours. The quizzes after each lecture accounted for 3% of the final grade, those

Table I. Subject reviewed during each week in TOC, physician guest speaker highlighted and specialty of guest speaker; illustrating the range of subjects covered during the course.

<i>Week</i>	<i>Subject</i>	<i>Featured Speaker</i>	<i>Speaker’s Specialty</i>
1	The Interplay Between Medicine and Dentistry		
2	Pain Management: Approaches and Challenges	Dr. Veena Graff	Pain Management
3	Diabetic Patients and Their Care	Dr. Craig Wynne	Internal Medicine
4	Endocrine Disorders: Understanding Thyroid Cancer and Osteoporosis	Dr. Caroline Kim	Endocrinology
5	Care of Cardiovascular Diseases and Infections	Dr. Frank Silvestry	Cardiology
6	Dermatologic Conditions of the Oral Cavity	Dr. Aimee Payne	Dermatology
7	Blood and Bone Marrow Cancers	Dr. David Porter	Oncology
8	Understanding Head and Neck Cancers	Dr. Jason Newman	Otorhinolaryngology

summarizing each week counted for 4%, and the final examination counted for 30% of the student's grade.

After learners completed all course material, they were automatically provided with a standard Coursera survey. This asked for a starred rating (1-5) of the course, a written review, and any additional reflection the learner chose to provide in the form of a learner story. In addition, students were able to provide feedback at any time on individual lectures, assessments, or weeks, and on the course as a whole. This is standard practice for Coursera courses given that many MOOC learners do not complete courses in their entirety.

To inspire community, a well-established benefit of participating in MOOCs, TOC provided multiple opportunities for engagement with course material, staff, and fellow learners. Discussion boards were established for this purpose focusing on each week and devoted to general discussion. Learners were also able to create new discussion boards. These forums were actively moderated, and each post received a reply by course staff (K.F.).

Data on course participation and categorical data on learner demographic characteristics were obtained from the Coursera administrative dashboard to assess which learners had searched for and enrolled in TOC until March 1, 2020. Data were gathered on demographic, geographic, and socioeconomic factors as well as on engagement by all learners to determine the variety of persons interested in course content. These data were analyzed to assess how represented groups related to Coursera norms. Course feedback including numeric ratings and reviews were also evaluated to determine participant satisfaction. All data were critically evaluated, summarized, and analyzed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA). Because participant-level data were not available, this study was exempt from Institutional Review Board approval.

RESULTS

TOC launched on September 17, 2017 and has been available for continuous enrollment since that time. Between launch and March 1, 2020, TOC garnered 18,122 visitors, of whom 4,641 enrolled in the course. Visits to the course and enrollments have maintained a continued steady proof of interest since that time (Figure 1A). Both visits to the course and enrollments peaked in November 2017 with 1142 visits and 345 new enrollments. In addition, learners enrolled in the course had consistent monthly and daily engagement, including video views, quiz completions, and discussion board posts (Figure 1B). This included as many as 42 students active per day and as many as 216 students active per month.

Learners in TOC represented a full range of ages. Learners must be 13 years or older to participate in a Coursera course independently, and learners in TOC

ranged from 13 to older than 65. Although most learners were between the ages of 25 and 34 (51.42%), TOC included more learners between 18 and 34 than Coursera averages, reflecting significant interest in learning more about the dental-medical connection among young adults (Figure 2). TOC learners were 54% female, compared with 39% over the entire Coursera platform, with 44% males and 2% representing other genders.

TOC learners represented all educational categories for which data is collected by Coursera. The plurality of learners, 32.27%, had completed a bachelor's degree before participating, which is the most common educational level among Coursera participants (Figure 3). However, TOC learners included more participants with professional degrees (23.10% vs 4.34%), doctorate degrees (5.42% vs 4.02%), and some college but no degree (12.72% vs 11.64%) than Coursera-wide averages, suggesting interest among professionals, highly educated populations, and students. The broad variety of educational levels (>5% of learners in each category) also suggests the diverse appeal of the course. Of note, since completing the course, some learners have applied to and enrolled in dental schools and specialty programs in oral medicine, including in both programs at PDM.

Employment among TOC participants also reflected the diverse range of learners who have enrolled in the course. TOC included learners from all employment categories with >5% of learners representing each. Notably, TOC included a larger percent of students who were unemployed and looking, employed part-time, self-employed full-time, unemployed and not looking, and unable to work than Coursera averages (Figure 4). Although the largest percentage of students identified as employed full-time (35.76%), the distribution of employments proved more balanced in TOC than is average in Coursera courses.

Learners also came from six continents, with high percentages of learners from North America, Europe, and Asia (25.16%, 29.71%, and 21.79%, respectively, Figure 5A). This represented a higher proportion of students from Europe and Asia compared with all Coursera courses (21.79% vs 20.05%, 29.71% vs 29.67%). TOC also included more learners from Africa (15.17% vs 5.92%) compared with Coursera averages. TOC participants lived in many countries, with the top 10 most represented countries accounting for only 55% of all participants. These 10 countries again reflect a wide geographic appeal of the course (Figure 5B). The highest percentage of learners in TOC lived in the United States (18%), which is also true across the Coursera platform (21% from the United States, Figure 5C). However, the other countries with the highest percentages of learners reflect some differences between TOC and Coursera at large, with TOC including more students from Egypt, Pakistan, Turkey, and Saudi Arabia.

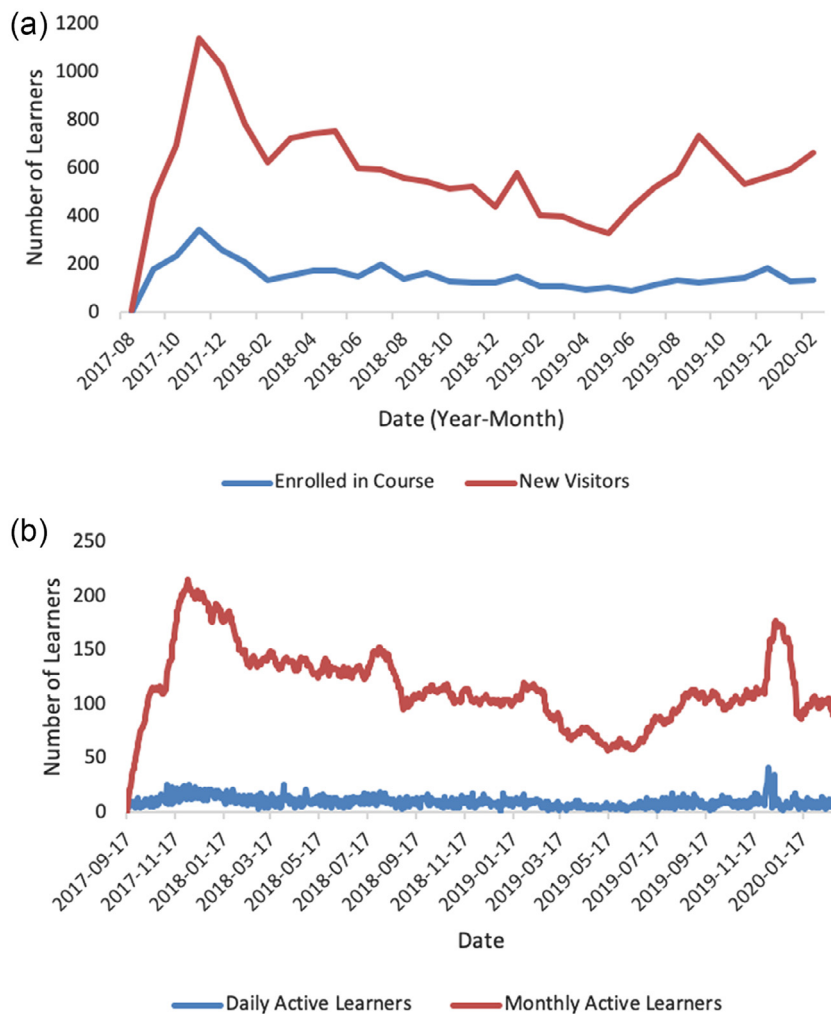


Fig. 1. Trends in (A) course visitors and enrollment and (B) enrolled learner monthly and daily engagement showing steady engagement with The Oral Cavity: Portal to Health and Disease over time.

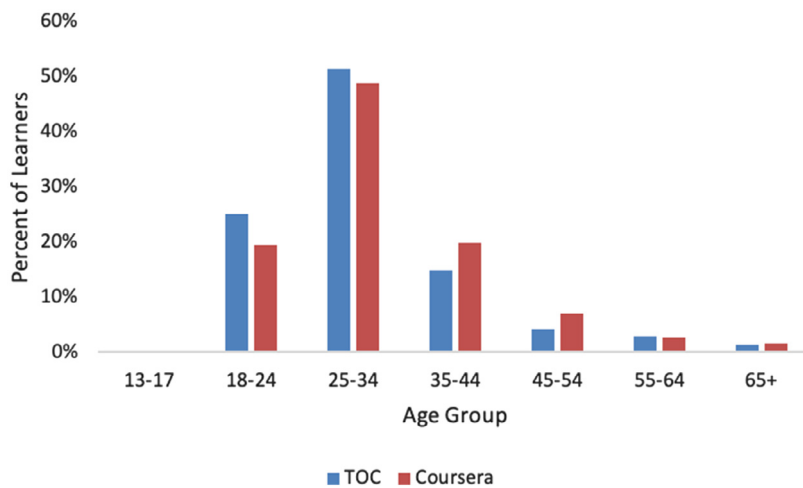


Fig. 2. Age distribution of learners in The Oral Cavity: Portal to Health and Disease (TOC) compared with Coursera averages showing particular interest in the course among younger groups.

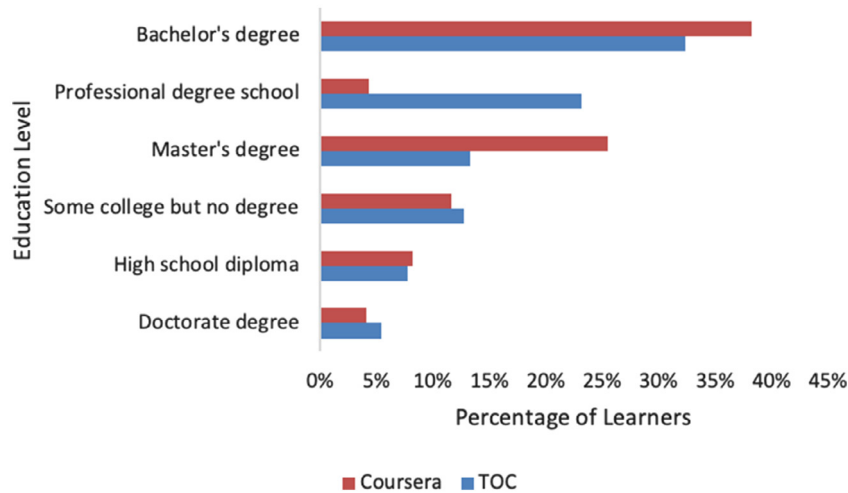


Fig. 3. Comparison of educational background between learners in The Oral Cavity: Portal to Health and Disease (TOC) and Coursera averages showing broad variety in TOC learners and particular prevalence of professional degree holders.

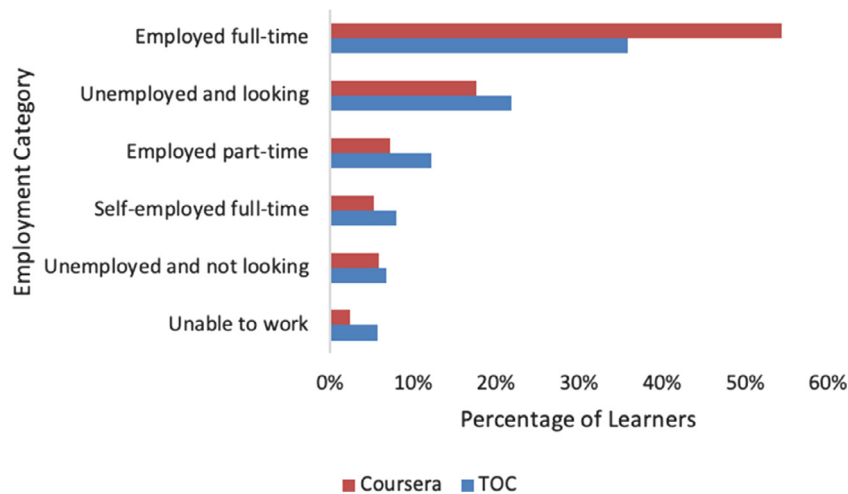


Fig. 4. Employment status of learners in The Oral Cavity: Portal to Health and Disease (TOC), compared with Coursera averages, showing interest in the course among all categories of learners.

According to learner feedback, TOC was very well received. It gained a rating of 4.9 out of 5 stars and 95% of students giving the course a “thumbs up.” As of March 1, 2020, 38 learners had left reviews, many of which were very positive. These included accounts from ranging from newly practicing dentists (“[a]s a fresh graduate from dental school and just getting into a dental practice, I think this course has helped me a lot as a healthcare professional because we need to teach the community that the oral cavity is indeed the portal to overall health and it is crucial to go for regular dental check-ups”) to established dentists (“I’ve been practicing Dentistry for 30 years. With the increased correlation of Oral conditions with systemic disease this course was a great review”) to dental students (“[i]t is a great course for dental students who want to know how systemic diseases or conditions may affect in (sic) the

Oral Cavity”). Reviews also suggested benefit to learners in other fields, and a general interest in the topic.

Learners also engaged actively in the discussion boards provided. During the time frame of this study (September 17, 2017 to March 1, 2020), 34 discussion threads were started covering course questions, logistics, introductions, and more. Many participants introduced their backgrounds and motivations for joining this course. In addition, many commented on the information provided in each week. This often included asking for additional sources of information or asking specific questions not covered in the lectures. In addition, multiple patients enrolled in the course took advantage of the discussion boards as an opportunity to share a personal account of treatment and the benefit of appropriate communication and interprofessional cooperation. Although some threads are focused on an individual learner’s question, many have spurred discussion between learners.

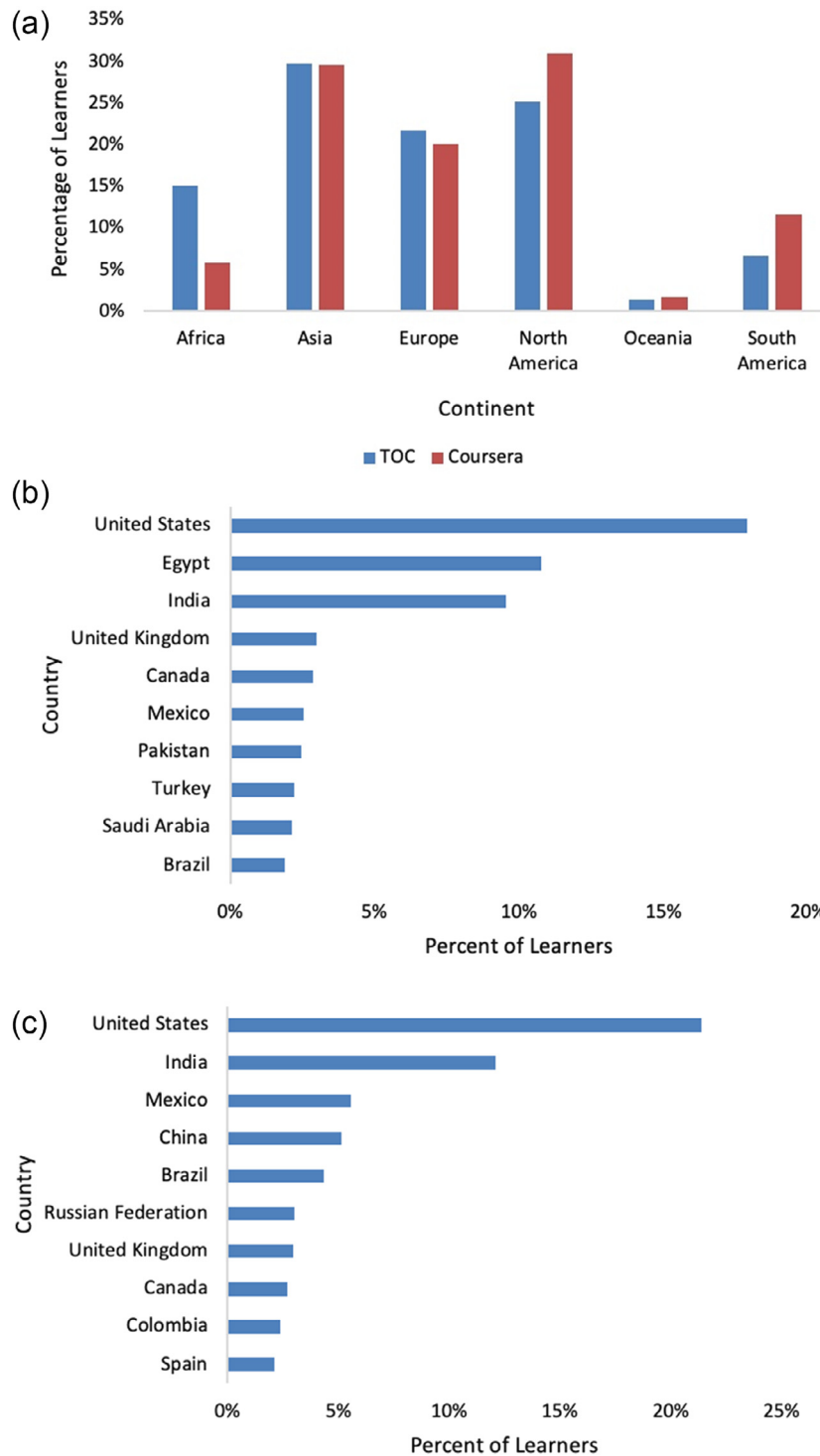


Fig. 5. Geographic distribution of learners in The Oral Cavity: Portal to Health and Disease (TOC) compared with all Coursera courses, including (A) distribution across 6 continents and (B) meaningful representation in TOC from learners in countries across the globe showing different areas of prevalence than in Coursera averages (C).

DISCUSSION

This study identified the demand for high-quality widely available oral medicine education, illustrated by the broad participation and enjoyment of TOC since its launch. TOC provided a unique MOOC in its design, bringing

medical and dental specialists together to discuss topics of interest and the particular impacts of various systemic conditions on oral health considerations. However, TOC also followed organizational structures that have proven effective in MOOCs, including focusing each week on a

different subject, using short videos that clearly illustrate the material, and examining students at regular intervals to ensure continued engagement.^{18,19} In addition, although TOC presented many topics relevant to patient care, the videos, assessments, and discussions focused on theoretical concepts rather than advising directly on patient treatment.¹⁸ The course was deemed successful in bringing together well-established principles of MOOCs with a conversational and interdisciplinary approach to presentation that engaged students in expanding their knowledge of medical and dental treatment considerations.

TOC presented a course that, although open to any interested party, recommended some medical or dental experience to fully benefit from the topic-specific instruction. In this way, its organization heeded warnings that courses must be well defined in their scope and target to fulfill their maximal teaching potential.²⁰ Others have suggested that learners with some background in the subject at hand may indeed be better positioned to benefit from MOOCs, despite the fact that existing courses range from those that require no background to those that require specific prerequisite skills or courses.^{10,15} TOC followed these suggestions by clearly describing the existing knowledge that would be most helpful for learners.⁶

TOC was very successful as an academic and social experience for participants as shown by the active participant involvement in discussion boards, building, as suggested, a community both with the course faculty and with fellow learners.⁶ TOC has also benefitted from the social aspect of MOOCs through the learner networks, in which a participant in one course is more likely to complete a second. TOC has seen this with learners from PDM's first Coursera offering, Introduction to Dental Medicine, often proceeding to complete TOC.²¹ MOOC learners can also benefit from this social connection through the formation of group discussions on and off MOOC platforms and even in person; active engagement has proven very beneficial for course engagement.^{7,22,23}

The data presented here suggest a high demand for accessible information on dentistry and specifically on oral medicine, as proven by the geographic and demographic diversity in participants. MOOCs often have high appeal to younger learners, which was seen in TOC, but as with other courses on dentistry, TOC gained participation beyond current students and those considering further study in these fields.¹⁴ TOC has included participants preparing for and completing dental and medical programs, practicing dentists and physicians, and those in allied health fields, including insurance experts and policy professionals. TOC has also often appealed to patients, including many who are anxious about undergoing treatment and looking

for an introduction to specialty care.¹⁶ Many patients in the course have been able to benefit from increased knowledge and comfort with the subject matter presented and represent the diverse appeal of this MOOC.

Although this study illustrates many benefits of MOOCs, particularly the creation and distribution of specialty-specific MOOCs and the demand for increased access to oral medicine topics, it is not without its limitations. This analysis focuses on a single MOOC from a single institution, limiting the generalizability of the findings. In addition, the analysis of learner engagement and demographic characteristics was limited to data collected by Coursera, which allowed for anonymous collection but limited the factors that could be evaluated. In addition, ratings in Coursera are anonymous, which benefits honesty but limits the available background information on those evaluating the course. Despite these limitations, our analysis suggests that there is a strong global desire for widely available information in medicine and dentistry.

The roles that MOOCs play in health care education will continue to evolve. This may include continuing to leverage the MOOC format for continuing education and prerequisite courses developed by educational institutions, which will allow a wider variety of learners the ability to master subjects at their own pace.^{12,13} MOOCs have also been found to effectively teach students how to learn in online settings, which may prove necessary for further education.¹¹ Currently MOOCs are generally not offered as an alternative to credit-bearing courses in health sciences, but further spread of this format may change the ability for these courses to benefit learners at all levels.¹² Further availability of online material does lessen the existing strain on the curricula of health science schools, and MOOCs may be found in the future to have a role in covering material as a supplement to traditional educational formats.¹⁶ In addition, further research will elucidate which subject areas are in highest demand and where these demands are insufficiently met.

CONCLUSIONS

TOC was a novel MOOC in oral medicine created by PDM and hosted on the Coursera platform. TOC reached students from 6 continents, from age 13 to older than 65, of all educational backgrounds, and of all employment statuses. The course received positive reviews, and students participated actively in course lectures and discussion boards. The outcomes of this study suggest a demand for high-quality oral medicine–related education, which can increase visibility and recognition of oral medicine.

The authors extend their gratitude to Coursera and the University of Pennsylvania for their support of all aspects of TOC creation and distribution, including to the University of Pennsylvania Office of the Provost and School of Dental Medicine for funding to support

development of the course. They extend their sincere gratitude to those colleagues who participated in the course content for their expertise and time.

PRESENTATION

This research was accepted for oral presentation at the American Academy of Oral Medicine Annual Meeting 2020 and was presented at the Penn Dental Medicine Research Day 2020.

This work was supported by the University of Pennsylvania Office of the Provost; and the University of Pennsylvania School of Dental Medicine.

DISCLOSURES

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