Medical Science Educator (2023) 33:21–25
https://doi.org/10.1007/s40670-023-01726-x

SHORT COMMUNICATION

Development of an Online SARS-CoV-2/COVID-19 Elective Course for Fourth-Year Medical Students

Houriya Ayoubieh[1] · Cynthia Perry[1] · Jorge Cervantes[1] · Curt Pfarr[1] · Jessica Chacon[1]

Accepted: 9 January 2023 / Published online: 21 January 2023

Abstract
As a result of the COVID-19 pandemic, the Paul L. Foster School of Medicine incorporated supplementary online learning for 4th year medical students who were unable to participate in clinical activities due to clinical site restrictions to reduce SARS-CoV-2 transmission. An online elective was developed aimed to increase student knowledge of COVID-19: "COVID-19: Utilizing basic sciences to implement what you need to know as a physician." This course required students to further their understanding of SARS-CoV-2 and COVID-19 through directed self-study to identify and summarize the latest scientific literature followed by presenting an online seminar to peers and faculty.

Keywords Undergraduate medical education · COVID-19 · SARS-CoV-2 · Online learning · Elective

Background

In March 2020, the American Association of Medical Colleges (AAMC) instructed medical schools to suspend student clerkships and direct patient care activities except where local critical workforce was needed [1] As a result, medical students at the Texas Tech University Health Science Center El Paso Paul L. Foster School of Medicine (TTUHSC El Paso PLFSOM) were not allowed to report to campus and virtual curricular alternatives were rapidly implemented. To help 4th year medical students increase their scientific knowledge of the novel coronavirus, corresponding pathology, and clinical management, we developed an online 2-week elective course, "COVID-19: Utilizing basic sciences to implement what you need to know as a physician."

The goal of this 2-week elective course was to provide a foundational overview of the COVID-19 pandemic and the SARS-CoV-2 virus, including clinical context, basic molecular biology and virology, technology for detecting the virus, therapeutic approaches, and clinical management. Students were provided with priming learning materials and tasked with reviewing the literature and selecting resources to be able to answer clinical and basic science questions related to COVID-19. This elective course used a discussion board that was available to the students via the learning management system CANVAS (Canvas LMS, Salt Lake City, UT), which facilitated interaction between students and the faculty. WebEx (WebEx by Cisco, San Jose, CA), video conferencing was used to allow students to present their work live and obtain feedback from enrolled peers and supervising faculty.

The final grade was based on a "grand rounds" style student presentation to faculty and student peers taking the elective. A grand round format employing expert-led lectures with an emphasis on the latest evidence was used [2]. The decision to incorporate this format was to help students develop their skills at preparing slides and presenting to a faculty audience, which is useful for future formal presentations during their post-graduate medical education and beyond. Student faculty and peers asked questions and provided feedback to the student presenters during their grand round presentations.

The objectives for the course elective were as follows:

1. Provide a foundational overview of the COVID-19 pandemic and the SARS-CoV-2 virus, including clinical context, basic molecular biology and virology, technology for detecting the virus, therapeutic approaches, and clinical management.
2. Challenge students to conduct independent research and propose novel approaches for prevention and/or management of COVID-19.

✉ Jessica Chacon
Jessica.Chacon@ttuhsc.edu

[1] Department of Medical Education, Paul L. Foster School of Medicine, Texas Tech University Health Sciences Center El Paso, El Paso, TX, USA

3. Offer alternative learning opportunities to prepare students for their roles as future interns, who are expected to participate in the care of patients with COVID-19.
4. Offer students the opportunity to practice a grand rounds type of presentation.
5. Offer virtual learning opportunities to complete 4th year student graduation requirements.

The goal of this effectiveness study was scholarship and quality improvement. After completing the elective, students were surveyed to examine satisfaction and perceptions of possible benefits and the impact of this online elective. Survey results identified strengths and weaknesses and helped guide course improvements.

Activity

The online course launched in May 2020 and consisted of 6 topics (Table 1): (1) Clinical features of COVID-19; (2) At risk populations for SARS-CoV-2/COVID-19; (3) Modalities for detection of SARS-CoV-2; (4) Management plan for a patient with confirmed SARS-CoV-2 infection; (5) Applying current approaches for SARS and MERS vaccine development to a COVID-19 vaccine; (6) Novel therapies: Proposing a new therapy based on a mechanistic understanding of the virus life cycle.

Five faculty members participated in designing and implementing the course. Faculty members included clinician educators and basic scientists with expertise in immunology, microbiology, biochemistry, and cell and molecular biology. Designing the syllabus and the CANVAS page and obtaining curricular approval to start the course were completed within 3 weeks. The first cohort of students participated in the elective during May 2020. On average, there were 2–3 students concurrently enrolled in the elective with a course length of 2 weeks. The elective was optional, and students enrolled at their own discretion.

The course was evaluated using a post-assessment survey via Qualtrics software (Qualtrics, Provo, UT). Students were invited to participate in the survey through email after completing the elective. The survey was open for 1 month from the day of the initial invite, with reminders sent as appropriate, and based on weekly monitoring of response rates. This study was deemed IRB-exempt by the TTUHSC El Paso IRB. Likert scales were used to measure satisfaction and agreement with elective benefits. Additionally, a focus group with the faculty was used to identify themes regarding the feedback given to students about their grand round presentations.

Results

Feedback indicated this COVID-19 elective course was well received. A total of 33 students completed the course elective and nineteen students (57.5%) completed the post-elective survey. Demographic data were collected, along with residency program interests (Fig. 1).

Of the students who completed the elective and the survey, 100% found the course useful (strongly agreed: 53%; agreed 47%) for learning about SARS-CoV-2/COVID-19 and felt more knowledgeable about COVID-19 clinical features (Fig. 2A). Further, 63% strongly agreed they were more knowledgeable about SARS-CoV-2/COVID-19 at-risk populations and modalities for detection of SARS-CoV-2 (Fig. 2). Students felt more knowledgeable about a management plan for a patient with a confirmed SARS-CoV-2 infection (90% of students).

Table 1 Topics and objectives for the elective discussion board and presentation

Topic	Objectives
Clinical features of COVID-19	1. Recognize the clinical manifestations associated with COVID-19, compared to other viral respiratory illnesses
At-risk populations for SARS-CoV-2/COVID-19	1. Identify risk factors for COVID-19—consider host and external factors in your answer 2. Determine SARS-CoV-2 incubation period, duration of viral shedding, and infectious period
Modalities for detection of SARS-CoV-2	1. Identify the screening procedure for COVID-19 2. Determine why the available tests are the best approach for detecting SARS-CoV-2 (consider basic science principles)
Management plan for a patient with confirmed SARS-CoV-2 infection	1. Explain the best management plan for a COVID-19 patient
Applying current approaches for SARS and MERS vaccine development to a COVID-19 vaccine	1. Discuss the immune response in COVID-19 2. Explain why your patient who recovered should or should not receive the SARS-CoV-2 vaccine
Novel therapies: Proposing a new therapy based on a mechanistic understanding of the virus life cycle	1. Propose a novel treatment for COVID-19 based on literature review 2. Differentiate your innovative treatment to what is currently being used/investigated

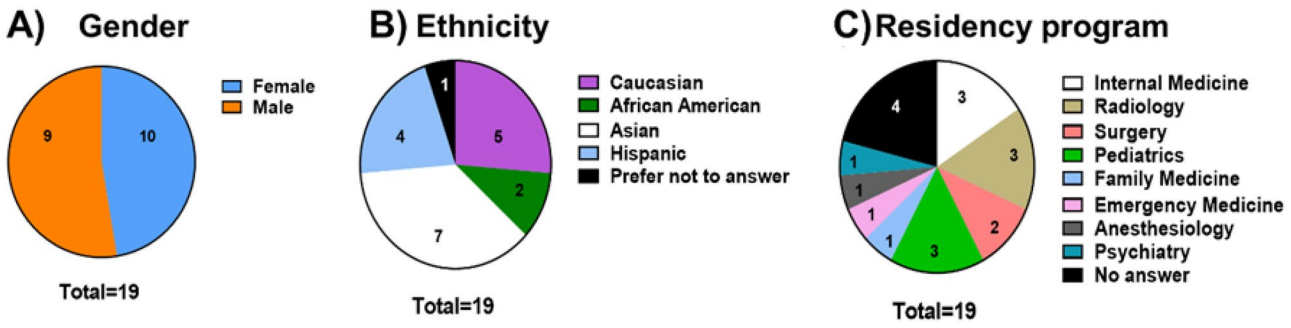

Fig. 1 Demographics of the students who completed the SARS-CoV-2/COVID-19 elective survey: (**A**) gender; (**B**) ethnicity; and (**C**) residency program the students applied to ($N = 19$)

Student responses regarding novel approaches to prevention and therapy was positive: 75% of respondents strongly agreed/agreed that the elective enabled them to critically think about developing a novel therapy for SARS-CoV-2/COVID-19, and how to approach a COVID-19 vaccine (89% of students) (Fig. 2). Ninety percent of students agreed that the amount of information covered in the elective was appropriate to address gaps in knowledge about SARS-CoV-2/COVID-19 ($N = 19$) (data not shown).

The elective was also developed to help medical students complete graduation requirements and help foster a virtual learning community and to promote connectedness for our students. Therefore, we evaluated whether students found the course to be engaging and organized. Ninety percent found the elective well organized and 80% found the course engaging (Fig. 3A and B).

The focus group with the faculty uncovered several themes: Most students needed guidance on including objectives and an outline for their talks. Students were given feedback about the need for including references with emphasis on when images or graphs were used from publications. Students were also encouraged to further research gaps in their knowledge that were identified based on the follow-up questions. Students appreciated the feedback and the opportunity to present to multiple faculty and peers.

Discussion

The rapid and extensive spread of COVID-19 has been a major concern for the healthcare profession [3]. Information about the novel virus, disease manifestations, and management strategies

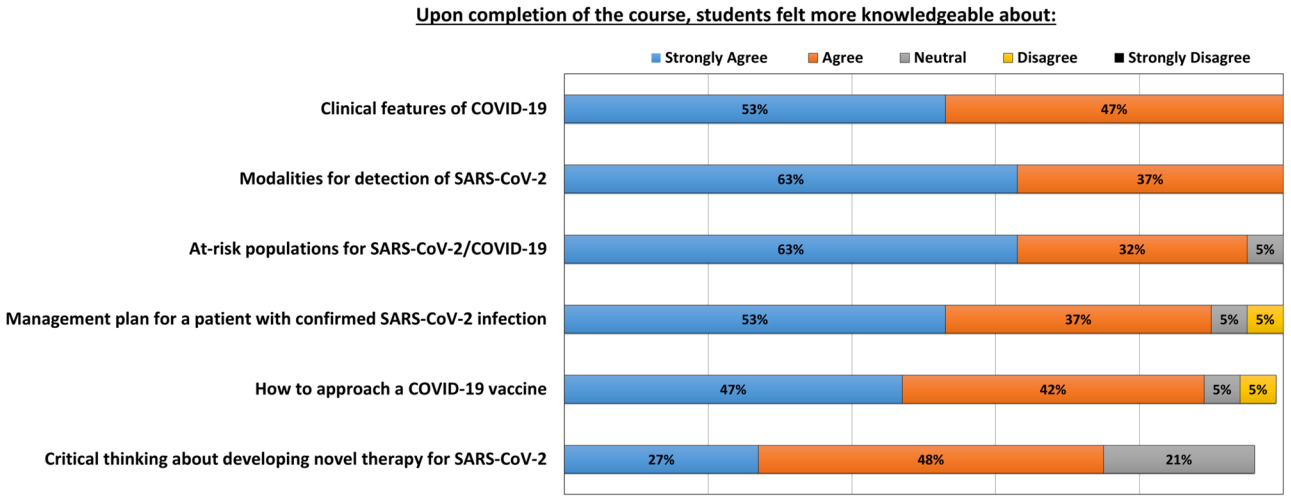

Fig. 2 Post-course COVID-19 knowledge assessment. Upon completion of the COVID-19 course, students felt more knowledgeable about: (A) clinical features of COVID-19; modalities for detection of SARS-CoV-2; and at-risk populations for SARS-CoV-2 and COVID-19. Regarding treatment and therapy, upon completion of the course, students felt more knowledgeable about: (B) management plan for a patient with a confirmed SARS-CoV-2 infection; how to approach a COVID-19 vaccine; and critical thinking about developing a novel therapy for SARS-CoV-2/COVID-19

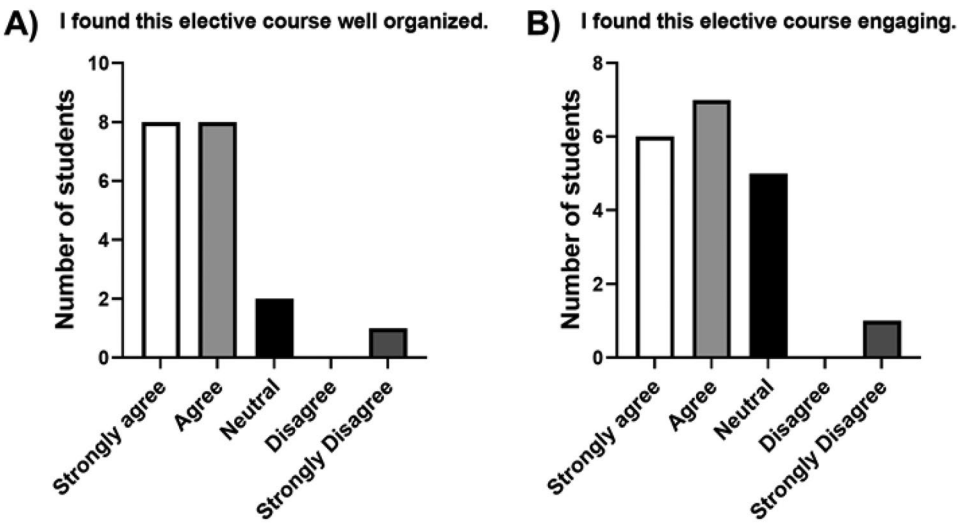

Fig. 3 Course organization and engagement evaluation. (**A**) 84% found the elective well organized and (**B**) 69% found the course engaging ($N = 19$)

have been in constant flux. This elective was designed to enable students to further their knowledge of COVID-19 through directed self-study prompts that required students to research the latest scientific literature. Students were required to submit their assignments through the CANVAS educational platform and received feedback from the faculty based on their analysis of the literature and their final grand rounds presentations. Other studies have assessed the knowledge, awareness, and attitudes of medical and pharmacy students towards COVID-19 and found that more educational efforts with periodic educational interventions were still needed regarding the pandemic [4, 5].

Major disruptions in the medical education curriculum due to pandemics and other disasters are infrequent; as a result, healthcare institutions that train medical students are typically unprepared to accommodate these disruptions [6, 7]. Medical students have previously shown interest in volunteering in cases of disasters and epidemics [8, 9]. Emerging literature has shown that students had a positive attitude towards volunteering during the COVID-19 pandemic [10–12]. Restrictions during the COVID-19 pandemic limited the ability of fourth-year medical students to participate in hands-on clinical activities, particularly involving patients with COVID-19 disease which could impact their confidence in managing those patients when they transition to postgraduate education. In this study, quickly developing a virtual elective, to encourage review of the most up-to-date literature about the topics causing the disruption in education, was effective in enhancing student knowledge and their preparedness to manage patients with COVID-19 disease.

Limitations

It is unknown if students who participated in the elective felt more competent taking care of patients with COVID-19 disease once clinical restrictions were lifted or when they started their internships Although data about the feedback regarding the grand round presentations were not formally shared, students appreciated the constructive feedback received. Additional research and focus groups are needed to analyze student perceptions about and the utility of incorporating the grand round format for assessment. Another limitation of our study is that 42.5% students' view or attitudes who did not response to their survey are unknown.

Conclusion

Virtual electives that tackle the basic science and clinical issues about a topic that is disrupting medical education can be quickly implemented and may be an effective substitute when clinical activities are restricted. Although the COVID-19 pandemic is gradually fading, the development and the experience obtained from developing this online elective were of value for the faculty and students.

Author Contribution All authors discussed the results and contributed to the final manuscript.

Availability of Data and Material NA.

Code Availability NA.

Declarations

Conflict of Interest The authors declare no competing interests.

References

1. Guidance on medical students' participation in direct in-person patient contact activities. https://www.aamc.org/system/files/2020-08/meded-August-14-Guidance-on-Medical-Students-on-Clinical-Rotations.pdf. Accessed 2 Dec 2022.

2. Hebert RS, Wright SM. Re-examining the value of medical grand rounds. Academic Medicine. 2003;78(12). https://doi.org/10.1097/00001888-200312000-00013.
3. Modi PD, Nair G, Uppe A, Modi J, Tuppekar B, Gharpure AS, Langade D. COVID-19 awareness among healthcare students and professionals in Mumbai metropolitan region: a questionnaire-based survey. Cureus. 2020;12(4). https://doi.org/10.7759/cureus.7514.
4. Hamza MS, Badary OA, Elmazar MM. Cross-sectional study on awareness and knowledge of COVID-19 among senior pharmacy students. J Community Health. 2021;46(1):139–46. https://doi.org/10.1007/s10900-020-00859-z.
5. Ikhlaq A, Hunniya B-E, Bashir I, Ijaz F. Awareness and attitude of undergraduate medical students towards 2019-novel corona virus. Pak J Med Sci. 2020;36(COVID19-S4):S32. https://doi.org/10.12669/pjms.36.COVID19-S4.2636.
6. Castro MR, Calthorpe LM, Fogh SE, McAllister S, Johnson CL, Isaacs ED, Ishizaki A, Kozas A, Lo D, Rennke S. Lessons from learners: adapting medical student education during and post COVID-19. Acad Med. 2021;96(12):1671. https://doi.org/10.1097/acm.0000000000004148.
7. Newman B, Gallion C. Hurricane Harvey: firsthand perspectives for disaster preparedness in graduate medical education. Acad Med. 2019;94(9):1267–9. https://doi.org/10.1097/acm.0000000000002696.
8. Gouda P, Kirk A, Sweeney A-M, O'Donovan D. Attitudes of medical students toward volunteering in emergency situations. Disaster Med Public Health Prep. 2020;14(3):308–11. https://doi.org/10.1017/dmp.2019.81.
9. Huapaya JA, Maquera-Afaray J, García PJ, Cárcamo C, Cieza JA. Conocimientos, prácticas y actitudes hacia el voluntariado ante una influenza pandémica: estudio transversal con estudiantes de medicina en Perú. Medwave. 2015;15(04). https://doi.org/10.5867/medwave.2015.04.6136.
10. Domaradzki J. 'Who Else If Not We'. Medical students' perception and experiences with volunteering during the COVID-19 crisis in Poznan, Poland. IJERPH. 2022;19(4):2314. https://doi.org/10.3390/ijerph19042314,-Free%20PMC%20article.
11. Lazarus G, Findyartini A, Putera AM, Gamalliel N, Nugraha D, Adli I, Phowira J, Azzahra L, Ariffandi B, Widyahening IS. Willingness to volunteer and readiness to practice of undergraduate medical students during the COVID-19 pandemic: a cross-sectional survey in Indonesia. BMC Med Educ. 2021;21(1):1–12. https://doi.org/10.1186/s12909-021-02576-0.
12. Lincango-Naranjo E, Espinoza-Suarez N, Solis-Pazmino P, Vinueza-Moreano P, Rodriguez-Villafuerte S, Lincango-Naranjo J, Barberis-Barcia G, Ruiz-Sosa C, Rojas-Velasco G, Gravholt D. Paradigms about the COVID-19 pandemic: knowledge, attitudes and practices from medical students. BMC Med Educ. 2021;21(1):1–10. https://doi.org/10.1186/s12909-021-02559-1.