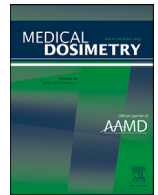




ELSEVIER

Medical Dosimetry

journal homepage: www.meddos.org

Medical dosimetry virtual clinical education: Mentors' perspectives

Jamie Baker, PhD, MEd, CMD¹, Mahsa Dehghanpour, EdD, MS, CMD

Medical Dosimetry Program, The University of Texas MD Anderson Cancer Center, School of Health Professions, Houston, TX 77030, USA

ARTICLE INFO

Article history:

Received 18 November 2022

Revised 10 January 2023

Accepted 23 January 2023

Available online xxx

Keywords:

Clinical education

Medical dosimetry

Students

Virtual

COVID-19

ABSTRACT

The COVID-19 pandemic affected the United States in early 2020, and many universities began offering their curriculum remotely. The majority of medical dosimetry programs started to offer both didactic and clinical education in a virtual setting. With COVID-19 social distancing and patient protective measures, many clinical medical dosimetrists also began to work in a remote or hybrid setting. Medical dosimetry students interact and learn from their clinical mentors in this remote clinical environment. The purpose of this study was to investigate the perspective of medical dosimetry mentors concerning the effectiveness of virtual clinical education for medical dosimetry students as a result of COVID-19. The Medical Dosimetry Mentor Perspective on Virtual Clinical Education (MedDos_VCE) survey measured medical dosimetry mentors' perceptions of the students' virtual clinical experience during the COVID-19 pandemic. The subject of the study was medical dosimetry mentors who participated in a remote clinic due to the COVID-19 pandemic since March 2020. The MedDos_VCE questionnaire measured (1) the mentors' assessment of instructional quality in remote clinical education; (2) opportunities for and quality of interaction between students and medical dosimetry mentors; and (3) suggestions for success from medical dosimetry mentors for students and other mentors who are participating in virtual clinical education. The majority of the clinical mentors were satisfied with the quality of virtual clinical education and students' learning outcomes. They felt that students experienced a good mix of patients, problems, and clinical experience and engaged in the day-to-day activities of a medical dosimetrist. Challenges exist and mentors offered practical suggestions for success for students and mentors in the virtual clinical environment.

© 2023 American Association of Medical Dosimetrists. Published by Elsevier Inc. All rights reserved.

The COVID-19 pandemic impacted the United States in early 2020, and many universities transitioned their curriculum to an online format. Medical dosimetry students complete clinical rotations and directly observe and interact with patients in the radiation oncology clinic. Health professions colleges had the additional burden of finding creative solutions to continue clinical rotations for enrolled students while clinics had closed their doors to outside visitors and paused patient observations. With COVID-19 social distancing and patient protective measures, many clinical medical dosimetrists also began to work in a remote or hybrid setting. As COVID-19 moves from a pandemic to an endemic status, many medical dosimetrists remain in a hybrid or fully remote work environment. While some medical dosimetry students have returned to face-to-face clinics to continue their education, other medical dosimetry students interact and learn from their clinical mentors in a remote clinical environment. The purpose of this study was

to investigate the perspective of medical dosimetry mentors concerning the effectiveness of virtual clinical education for medical dosimetry students as a result of COVID-19.

The Medical Dosimetry Mentor Perspective on Virtual Clinical Education survey (MedDos_VCE) measured medical dosimetry mentors' perceptions of the students' virtual clinical experience during the COVID-19 pandemic (see [Appendix 1](#)). The subject of the study was medical dosimetry mentors who participated in a remote clinic due to the COVID-19 pandemic since March 2020. The MedDos_VCE questionnaire measured (1) the mentors' assessment of instructional quality in remote clinical education; (2) opportunities for and quality of interaction between students and medical dosimetry mentors; and (3) suggestions for success from medical dosimetry mentors for students and other mentors who are participating in virtual clinical education.

Literature Review and Research Questions

In 2020, COVID-19 affected allied health universities with a decrease in the number of face-to-face lectures, increased use of telehealth appointments, protective social distancing measures, tem-

¹ Reprint request to: Jamie Baker, PhD, MEd, CMD, Medical Dosimetry Program, The University of Texas MD Anderson Cancer Center, School of Health Professions, 1515 Holcombe Blvd, Unit 2, Houston, TX 77030.

E-mail address: jabaker@mdanderson.org (J. Baker).

porary and permanent reductions in teaching staff, and travel limitations.¹ To continue the clinical education of health professions students, many universities implemented remote clinical rotations and increased their use of technology. When students were allowed to continue in-person clinical rotations, some health centers greatly reduced the number of allowable students on site at one time. Brack *et al.*¹ stated concern over the limited number of clinical placements affecting the needed supply of future allied health labor. Travel restrictions limited the placement of allied health students in distance clinics, and students working in a remote clinical setting needed strict guidance on maintaining patient confidentiality and professionalism when working from home.¹ The increased use of technology in virtual clinical settings created additional obstacles for student learning. The study participants of Brack *et al.*¹ adapted quickly to the new technology, but an initial learning curve of learners and clinical instructors impeded student success early in the pandemic. Information technology staffing and infrastructure also struggled to meet the new demand for instant access and enhanced virtual communication that was needed in a virtual clinic.

The medical training of physicians and other allied health professionals saw an increase in the use of new communication and technology platforms due to COVID-19.² Video conferencing allowed clinicians-in-training to connect with patients and instructors in a safe and socially distanced manner. Social media has gained prominence as another method of valid communication between trainees and instructors in a virtual clinic.² In-person supervised training at the patient bedside was not an option in the early days of the pandemic, and many students new to the medical field were forced to delay their clinical rotations until faculty could find novel ways to teach the necessary fundamentals.² Accrediting bodies have granted flexibility to program directors and health professions programs to administer assessments and structure their educational programs in a manner that allows students to continue supervised training.

When clinical rotations were not possible due to COVID-19, the use of virtual simulation increased to provide health professions students with the basic skills and hands on experience needed to become competent practitioners.³ Palancia Esposito and Sullivan designed a series of virtual clinical simulation modules for nursing students during the pandemic.³ Nursing students completed the virtual clinical modules and spoke positively of their understanding of the subject matter, development of teamwork and collaboration with peers, and the feeling of community building fostered within student teams.³

Additional information is needed concerning the response of medical dosimetry higher education programs in providing virtual clinical opportunities during the COVID-19 pandemic. Surveying impacted medical dosimetry mentors and assessing their perceptions about the effectiveness of online clinical education during COVID-19 could lead to better educational practices and resulting improvements in student learning outcomes.

Research questions included (1) What are the perceptions of the medical dosimetry mentors concerning the opportunities for and quality of clinical education during virtual clinical education? (2) What are medical dosimetry mentors' suggestions for success for students and mentors who are participating in virtual clinical education?

Methodology

Medical dosimetry mentor perspective on virtual clinical education

This study used a descriptive survey research design to identify mentors' perceptions of the effectiveness of virtual medical dosimetry clinical education in response to COVID-19 and to ex-

plore potential strategies to improve the virtual clinical education. The original survey instrument contained 4 demographic, 13 Likert-scale or multiple-choice questions, and 3 open-ended questions and was used to collect the data for this study. The survey responses were anonymous. The data was aggregated, and individual medical dosimetrists could not be tied to a specific result.

Upon IRB approval, the researchers piloted the survey instrument to receive feedback regarding any problematic areas or suggestions for improvement. The pilot participants were acquired by sending an email to all current medical dosimetry mentors at the University of Texas MD Anderson Cancer Center (Houston location) with the link to the survey on Qualtrics. The pilot participants were instructed that their participation was voluntary and that the researchers were wanting their feedback to improve the survey instrument. To promote anonymity, the pilot survey contained an open-ended question at the end for the participants to provide their feedback and suggestions. Ideally, some of the feedback would result in additional benefits, obstacles, and strategies to include on the survey.

Study sample

Once feedback from the pilot survey was reviewed by the researchers, no further changes were warranted to the Medical Dosimetry Mentor Perspective on Virtual Clinical Education (MedDos_VCE) questionnaire. An email was sent to all JRCERT-accredited medical dosimetry program directors with a link to the final survey on Qualtrics. The researchers asked program directors to forward that email to all of their medical dosimetry mentors who had been teaching virtual clinic in the program since March 2020. The medical dosimetry program directors self-reported to the study principal investigators concerning how many mentors were sent the survey instrument. The principal investigators sent a reminder email to program directors 2 weeks after the initial email to request that they send the survey link to their medical dosimetry mentors. The survey for participants contained the purpose of the study and a link to the informed consent document.

The survey link was active for one month (June 2022–July 2022). After that time period, the survey was closed. Results were exported from Qualtrics to SPSS to run descriptive statistics. Statistical analysis of the quantitative data included a tabulation of frequency distributions of the item responses. The written responses were evaluated to identify qualitative patterns and themes. The raw data and output tables are stored on a password-protected MD Anderson computer and can only be accessed by the investigators. All data is stored behind the institutional firewall.

Data consisted of mentors' perceptions of the positive and negative aspects of virtual clinical education in response to COVID-19. The primary outcome to investigate was the mentors' perceptions of virtual clinical learning during the COVID-19 pandemic. The survey instrument measured (1) the mentors' assessment of instructional quality in remote clinical education; (2) opportunities for and quality of interaction between students and medical dosimetry mentors; and (3) suggestions for success from medical dosimetry mentors for students and other mentors who were participating in virtual clinical education.

Results

The MedDos_VCE survey questionnaire was sent to the program directors of all JRCERT-accredited medical dosimetry programs ($N=16$) and the responses were received from 6 programs (38%). The program directors sent the survey links to a total of 163 clinical mentors, 40 accessed the survey but 26 completed it. This resulted in 16% completion rate.

The majority of the respondents (94.3%) were clinical preceptors while only 5.7% were school officials. The respondents reported that since March 2020 and the introduction of COVID-19 lockdown, dosimetrists mainly worked remotely (45.7%) or worked hybrid (54.3%), which is a combination of work from home and in clinic

days. They reported that students attended their clinical education remotely (34.3%), in a hybrid format (45.7%), or face-to-face (20%).

Instructional quality

The responses of agree and strongly agree were coded as “agreed” and the responses of disagree and strongly disagree were coded as “disagreed.” The majority of respondents (82.1%) agreed that students experienced a good mix of patients, problems, and clinical experience during their hybrid or remote clinical education, while only 7.1% of respondents disagreed with this statement. The remainder of respondents were neutral (7.1%) or felt that the fully remote students miss out on experiencing clinical workflow and issues (3.6%). The majority of clinical mentors (78.6%) agreed that the medical dosimetry students were engaged in the day-to-day activities of a medical dosimetrist during hybrid or virtual clinical education, while 14.3% of respondents disagreed. The remainder of respondents (7.1%) felt that it is difficult to share the day-to-day responsibilities in a fully remote clinical education and students miss a lot of small details and interactions. Sixty-six point seven percent of respondents agreed that the medical dosimetry students completed a sufficient amount of direct patient observations (simulation and treatment) during a hybrid or virtual clinical education, 18.5% disagreed and the remainder of participants were either neutral (7.4%), or were not involved with this process and felt that the patient contact is limited in a fully remote environment (7.4%). Seventy-eight point six percent of clinical mentors agreed that the medical dosimetry students’ learning during a hybrid or virtual clinical education was effective, 14.3% were neutral and 3.6% disagreed. Three point six percent of respondents felt that although the hybrid model is okay but face-to-face model is more effective.

Students-mentors interactions

When asked about the strategies clinical mentors utilize to review students’ cases in a virtual environment, the most common method was on-screen using share screen feature (47.3%), followed by phone conversation (18.2%), email (18.2%), and computer chat function (16.3%). To proctor students’ competencies, clinical mentors use on-screen proctoring such as Skype, Zoom, and MS Teams (73.3%); require students to come to the clinic to complete competencies (16.7%); or use a combination of the above methods (6.6%). Three point three percent of respondents stated that students’ complete competencies independently with no proctoring. When asked about the effectiveness of providing feedback in a virtual clinical environment, 88.5% of clinical mentors felt that the feedback was effective while 11.5% of respondents felt neutral.

In regards to the frequency of communication with students, the majority of clinical mentors indicated more than 3 times a day (46.2%), 26.9% stated 2 to 3 times a day, 3.8% stated once per day and 23.1% stated as needed. The majority of clinical mentors (76.9%) felt responsive, and 3.9% did not feel responsive to the students’ questions during hybrid or virtual clinical education. The remainder of respondents (19.2%) was neutral about it. Eighty-five point six percent of clinical mentors felt that students were responsive to their questions, while 15.4% were neutral.

When inquired about the components of a clinical education that cannot be provided in a hybrid or virtual clinical environment, the responses included: patient treatment and simulation observations (31.9%), interaction between radiation oncology team members (27.7%), quality assurance procedures (17%), and presenting a case to a physician (10.6%). About 12.8% of respondents stated different items such as the experience of sitting with the other dosimetrists and hearing the questions and discussions that come up as they work, day-to-day experience of working in the clinic, the ability to ask and engage in spontaneous interactions, and communicating challenges and problem solving. When asked about the tools clinical mentors wished to have for providing a better hybrid or virtual clinical education for the medical dosimetry students, they indicated communication platforms such as Zoom (17.9%), webcam (15.4%), microphone and speaker (10.3%), and dual monitors (20.5%). Thirty-five point nine percent of mentors stated that they had everything they needed.

The survey asked respondents about the potential value in continuing to educate medical dosimetry students in a hybrid or virtual clinical education format. The responses included, no value (2%), prepares students for their future working format (35.4%), can be utilized to educate future medical dosimetry workforce amidst the COVID-19 pandemic (27.1%), and it is a wise if the only option for schools is hybrid or virtual clinical education (25%). Ten point four percent of respondents offered other responses, which included more access between students and mentors, flexibility in time and work for the preceptors increasing their job satisfaction, support of a diverse workforce, most optimal method of teaching dosimetric concepts, easier communication via screenshare, changing the definition of “clinical” as meeting someone’s need, and fully remote education option for students results in missing out on essential discussions and not getting a full picture of the multidisciplinary approach in radiation oncology.

Suggestions for success

The survey inquired mentors to offer suggestions for a successful virtual clinical education to their peers. Three themes were resulted from the review of comments that included establishing an effective communication, engaging students,

and providing timely feedback. Other suggestions included flexibility with schedule, daily check in with students to discuss expectation, multiple meetings with students throughout the day, encouraging questions, teaching a variety of cases, lightening up schedule during students’ clinical day, adding students to email conversations about virtual plan reviews and other clinical tasks, making available test cases in the slow clinic time, providing students with treatment planning instructional videos, and replicating an in-person experience for students.

When clinical mentors were asked to offer suggestions for success to the medical dosimetry students, the top 3 responses included, being proactive, reducing distractions during virtual clinics, and communicating effectively and frequently with mentors. Other suggestions included flexibility, patience, being available, practicing the disciplines of a classroom while being virtual, planning ahead and asking questions, staying on task, practicing self-control during a period of less oversight, asking mentors to teach a variety of cases, practicing and getting as much exposure to plans as possible, learning different communication platforms, learning from multiple dosimetrists, learning more than the assigned competencies, and taking notes during the instruction.

Advantages and disadvantages

The survey asked respondents about the potential advantages and disadvantages of virtual clinical education. Seven themes were drawn from the written responses on advantages, which include (1) greater flexibility on time and location resulting in improved job satisfaction, (2) preparing students for their future remote work format, (3) better communication, (4) ease of access and reaching a larger number of students, (5) willingness of new clinical sites to engage with students, (6) less commute and cost associated with it would allow for more study time, and (7) the ability to record screen share instruction would allow students to review the material multiple times. The themes drawn from reviewing the written comments on disadvantages include: (1) unforeseen problems with computer, network, and security breaches, (2) missing the interactions with other radiation oncology team members affecting team building, (3) limited patient contact, which reduces relating to the patients and solving on the fly clinical issues, (4) abusing time and becoming distracted while being remote, (5) inability to see the clinical aspects of treatments such as the machine limitations and setup devices, (6) getting the input from a variety of clinical dosimetrists (6) and feeling unsupported.

Discussion

The vast majority of the clinical mentors were satisfied with the quality of virtual clinical education and students’ learning outcome. They felt that students experienced a good mix of patients, problems, and clinical experience and engaged in the day-to-day activities of a medical dosimetrist. Most of the mentors were satisfied with the amount of time students spent on direct patient observations including simulation and treatment. One suggestion from this study is for the school officials to incorporate patient simulation and treatment observations as a required part of the curriculum and ask the clinical mentors to facilitate these observations. On observation days, the medical dosimetry students are expected to be in the clinic to complete their observations.

Clinical mentors used a variety of methods to review students’ treatment planning cases and to proctor their competencies. The majority of clinical mentors use on-screen proctoring while a small percentage of clinical mentors required students to come to the clinic to complete competencies or use a combination of these techniques. The results of this study indicated that there were very few clinical mentors who did not proctor students’ competencies. Although the on-screen and face-to-face proctoring methods are both effective, allowing students to perform competencies with no supervision is not accepted. The school officials should discuss the requirements for proctoring competencies with clinical mentors and ensure that students are adequately supervised during the performance of a competency. This ensures the integrity of the students’ competency performance.

Clinical mentors utilized various instructional techniques and communication strategies to interact with and provide feedback to the students. The majority of the clinical mentors felt responsive to the students’ questions and indicated that students were also responsive to their questions and communicates well during a hybrid or virtual clinical education. They also felt that the feedback they provide to students was effective.

Table 1

The perception of medical dosimetry clinical mentors about the instructional quality

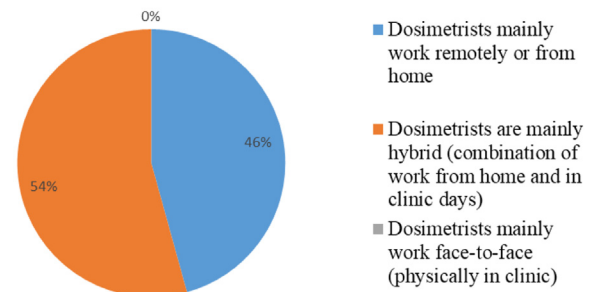
Perception of medical dosimetry clinical mentors	Agree	Neutral	Disagree
The medical dosimetry students have experienced a good mix of patients, problems, and clinical experiences during hybrid or virtual clinical education.	82.1%	7.1%	7.1%
The medical dosimetry students are engaged in the day-to-day activities of a medical dosimetrist during hybrid or virtual clinical education.	78.6%	0	14.3%
The medical dosimetry students completed a sufficient amount of direct patient observations (simulation and treatment) during hybrid or virtual clinical education.	66.7%	7.4%	18.5%
The medical dosimetry students' learning during a hybrid or virtual clinical education was effective	78.6%	14.3%	3.6%

Clinical mentors identified various components of clinical education that cannot be provided in a hybrid or virtual clinical environment including patient treatment and simulation observations, interaction with the radiation oncology team members, quality assurance procedures, presenting a case to a physician, sitting with the dosimetrists and hearing their work-related discussions, day-to-day experience of working in the clinic, and the ability to engage in spontaneous interactions regarding challenges and solutions. This study recommends clinical mentors to schedule in-person clinical observations for students and engage them in discussions, department meetings, email communications, and in-services remotely.

Virtual clinical education has become a dominant format at the beginning of the COVID-19 pandemic and is becoming a more common option for clinics that have adopted the remote or hybrid work format. The administrators should ensure that clinical mentors have resources available for remote clinical education including a computer, remote access, webcam, speaker, microphone, and access to communication platforms. The majority of clinical mentors see value in providing a virtual clinical education as it prepares students for their future remote work format, and it may be the only option for some clinical sites. Some clinical mentors find advantages in a virtual clinical education format compared to the traditional face-to-face training including improved access, flexibility, increasing job satisfaction, support of a diverse workforce, better strategy for teaching dosimetric concepts, and easier communication. There were very few clinical mentors who felt a fully remote education option for student's results in missing out on essential discussions and not getting a full picture of the multidisciplinary approach in radiation oncology.

Since the virtual clinical education is a novel teaching format, efforts should be made to improve the quality of it. Clinical mentors suggested several techniques to their peers for providing an effective virtual clinical education. They stated that frequent and effective communication with students to discuss expectation and provide feedback; engaging students in daily activities and replicating an in-person experience; teaching a variety of cases and providing test cases for practice on slow days; including students on email communications about plan reviews and clinical tasks; and providing instructional videos are great instructional techniques. They also suggested their peers to lighten up their schedule during students' clinical day so they can be more accessible to students. Clinical mentors suggested strategies to students for a successful learning. They advised students to be proactive and ask questions; reduce distractions; stay on tasks; practice adequately; communicate effectively; practice the disciplines of a classroom while being virtual; be patient and flexible while planning ahead for question; be available and ask mentors to teach a variety of cases; learn different communication platforms to be able to learn from multiple dosimetrists; and take notes during the instruction. These are effective advice that the program officials should incorporate to their clinical orientation for their students and mentors for an optimal clinical learning experience.

Since March 2020, what has been the primary structure of your medical dosimetry clinic for dosimetrists

**Fig. 1.** The primary structure of the medical dosimetry clinics since March 2020.

The virtual clinical education offers many advantages. The respondents indicated the greater flexibility on time and location resulting in improved clinical mentors' job satisfaction; preparing students for their future remote work format; improved communication and easier access to a larger number of students; possibility of more clinical sites being engaged in students' clinical education; saving money and time due to less commute offering students more study time; and the ability to record instruction allowing students to review the material multiple times as advantages of virtual clinical education.

The respondents specified several disadvantages for a virtual clinical education. The unforeseen problem with computers and network as well as security breaches were indicated. This can be solved by investing on a laptop or computer for the remote clinical mentors and students, advising them on WiFi and effective ways to remotely access the treatment planning and the dataset, and utilizing the clinical sites' IT department on concerns about security breaches and connection issues. Some clinical mentors stated that remote students miss the interactions with other radiation oncology team members, which affect team building opportunities. To improve team building and ensuring that students are aware of a variety of discussions in the clinic, the clinical sites are encouraged to include students in all department meetings, in-services, chart rounds and email communications concerning clinical updates and virtual plan reviews. Clinical mentors should schedule in-person or virtual activities, so students and mentors have opportunities to build trust and professional relationship.

Limited patient contact and relating to the patients as well as exposure to solving on the fly clinical issues were among disadvantages stated by clinical mentors. They are also concerned about the ability of students to see the clinical aspects of treatments such as the machine limitations and setup devices. This study recommends clinical mentors to schedule in-person days so students can observe simulation, treatment, quality assurance checks and learn about machine limitations, setup devices, and patient interaction. The face-to-face schedule can be communicated with the students ahead of time, so they plan for the in-person days accordingly.

What potential value do you see in continuing to educate medical dosimetry students in a hybrid or virtual clinical education format?

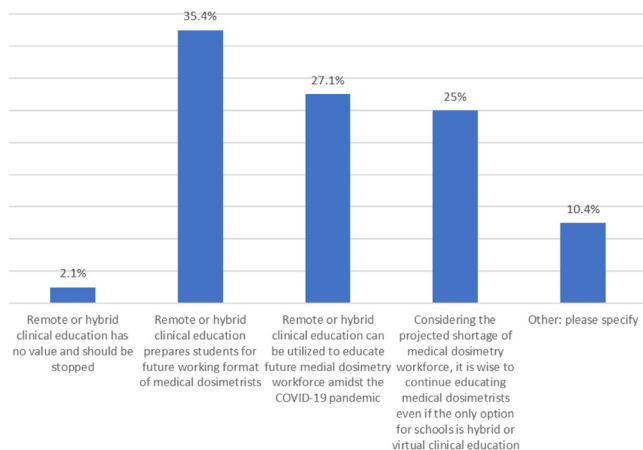


Fig. 2. The perception of clinical mentors on potential values of virtual/hybrid clinical education.

Some clinical mentors were concerned about students feeling unsupported, abusing time and becoming distracted while being remote. This issue can be improved by discussing the clinical expectations during the orientation, frequent communication with students so they feel connected and supported, requesting students to keep a daily log of their activities, and sending unannounced requests for quick meetings. The students should be encouraged to designate a quiet area at home for remote clinical education and to treat remote education like an in-person education. For example, a student with a child should arrange child care to attend the virtual clinic just like they do to attend the in-person clinic. Another disadvantage of virtual clinical education may be the lack of input from a variety of clinical dosimetrists. This can be improved by the clinical preceptor arranging for several board-certified medical dosimetrists to work with the students. Students will learn different techniques and perspectives when working with a diverse team of medical dosimetrists. Medical dosimetrists should be trained on the use of communication platforms and features such as share screen and chat, so that they can participate in students' education.

Limitations

The limitation of this study is the small sample size. Only 6 out of 16 JRCERT-accredited medical dosimetry programs participated in this study. Among these 6 programs, the survey was sent to a total of 163 clinical mentors, but only 26 clinical mentors completed this study. This study could obtain a richer data and provide a more thorough recommendations if more clinical mentors participated in this study.

Conclusions

This study suggests that the virtual clinical education is a viable option for training the future workforce of medical dosimetrists. This is a novel and innovative format of teaching that is becoming more prevalent as more and more medical dosimetrists adopt the remote work format. The remote clinical education is not without challenges and imitations. Medical dosimetry educators should investigate to find ways to improve the quality of virtual clinical education and share their findings with their peers so everyone can benefit from it. The recommendations put forth by this study can

be implemented by many clinics to improve their clinical education delivery.

Appendix 1

Medical Dosimetry Mentor Perspective on Virtual Clinical Education Survey (MedDos_VCE)

- Name of the medical dosimetry school you are associated with:
 - Bellevue College
 - Grand Valley State University
 - John Patrick University of Health and Applied Sciences
 - Loma Linda University
 - Pitt Community College
 - Southern Illinois University Carbondale
 - Suffolk University
 - SUNY at Stony Brook University
 - The Cleveland Clinic Foundation
 - The University of Texas MD Anderson Cancer Center
 - Thomas Jefferson University
 - University of California, Irvine Medical Center
 - University of Maryland Medical Center
 - University of North Carolina Hospitals
 - University of Texas Health Science Center at San Antonio
 - University of Wisconsin-LaCrosse
 - Your role within the medical dosimetry educational program:
 - Clinical instructor/preceptor/mentor
 - School official (program director, clinical coordinator, teaching staff, etc.)
 - Other: please specify
 - Since March 2020 (introduction of COVID lock downs), what has been the primary structure of your medical dosimetry clinic for dosimetrists:
 - Dosimetrists mainly work remotely or from home
 - Dosimetrists are mainly hybrid (combination of work from home and in clinic days)
 - Dosimetrists mainly work face-to-face (physically in clinic)
 - Other: please specify
 - Since March 2020 (introduction of COVID lock downs), what has been the primary structure of your medical dosimetry clinical environment for students:
 - Students mainly attend clinical education remotely or from home (virtual clinical education)
 - Students mainly attend hybrid clinical education (combination of virtual and face-to-face clinic)
 - Students mainly attend clinical education face-to-face (physically in clinic most days)
- ***Survey will terminate if "c. Students mainly attend clinical education face to face" is chosen*****
- The medical dosimetry students have experienced a good mix of patients, problems, and clinical experiences during hybrid or virtual clinical education.
 - Strongly Agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree

Box for OPTIONAL comments if they choose D or SD.

- The medical dosimetry students are engaged in the day-to-day activities of a medical dosimetrist during hybrid or virtual clinical education.

- a. Strongly Agree
- b. Agree
- c. Neutral
- d. Disagree
- e. Strongly Disagree

Box for OPTIONAL comments if they choose D or SD.

7. The medical dosimetry students completed a sufficient amount of direct patient observations (simulation and treatment) during hybrid or virtual clinical education.
- a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree

Box for OPTIONAL comments if they choose D or SD.

8. What is your perception about the effectiveness of medical dosimetry students' learning during hybrid or virtual clinical education?
- a. Strongly effective
 - b. Effective
 - c. Neutral
 - d. Ineffective
 - e. Strongly ineffective

Box for OPTIONAL comments if they choose D or SD.

9. How do you review cases for medical dosimetry students in a hybrid or virtual clinical education?
- a. On-screen/share screen feature
 - b. Phone conversations
 - c. Computer chat functions
 - d. Email
 - e. Other: please specify
10. How do you proctor medical dosimetry students' competencies in a hybrid or virtual clinical education?
- a. On-screen proctoring (Skype, Zoom, MS Teams, etc)
 - b. Students come to clinic to complete competencies
 - c. Other: please specify
11. What is your perception about your effectiveness in providing feedback to medical dosimetry students during hybrid or virtual clinical education?
- a. Strongly effective
 - b. Effective
 - c. Neutral
 - d. Ineffective
 - e. Strongly ineffective

Box for OPTIONAL comments if they choose D or SD.

12. How often do you communicate with medical dosimetry students on a daily basis during hybrid or virtual clinical education?
- a. 1 time per day
 - b. 2-3 times per day
 - c. More than 3 times per day
 - d. Only as needed
13. How responsive do you feel you are to medical dosimetry students' questions in a hybrid or virtual clinical education?
- a. Strongly responsive
 - b. Responsive
 - c. Neutral
 - d. Not responsive
 - e. Strongly not responsive
14. How responsive do you feel your medical dosimetry students are to questions from you in a hybrid or virtual clinical education?
- a. Strongly responsive
 - b. Responsive
 - c. Neutral
 - d. Not responsive
 - e. Strongly not responsive
15. What aspects of clinical education do you feel that you cannot provide for your medical dosimetry students in hybrid or virtual clinical education?
- a. Patient treatment/simulation observations
 - b. Quality assurance procedures
 - c. Presenting a case to physician
 - d. Interaction between radiation oncology team members
 - e. Other: please specify
16. What tools do you wish you had to be able to provide a better hybrid or virtual clinical education for your medical dosimetry students?
- a. Communication platforms such as Zoom, SKYPE, etc.
 - b. Webcam
 - c. Microphone/Speaker
 - d. Dual monitors
 - e. Other: please specify
17. What potential value do you see in continuing to educate medical dosimetry students in a hybrid or virtual clinical education format?
- a. Remote or hybrid clinical education has no value and should be stopped
 - b. Remote or hybrid clinical education prepares students for future working format of medical dosimetrists
 - c. Remote or hybrid clinical education can be utilized to educate future medical dosimetry workforce amidst the COVID-19 pandemic
 - d. Considering the projected shortage of medical dosimetry workforce, it is wise to continue educating medical dosimetrists even if the only option for schools is hybrid or virtual clinical education
 - e. Other: please specify

OPEN ENDED QUESTIONS

18. What suggestions for success do you have for other mentors who are providing hybrid or virtual clinical education for medical dosimetry students?
19. What suggestions for success do you have for medical dosimetry students who are completing hybrid or virtual clinical education?
20. What do you see as potential advantages and disadvantages of educating students in a virtual or hybrid clinical education format?

References

1. Brack, P; Bramley, A; Downie, S; *et al.* Riding the waves: Lessons learnt from Victoria's COVID-19 pandemic response for maintaining effective allied health student education and clinical placements. *Aust. Health Rev* **45**:683–9; 2021 PMID: 34847339. doi:[10.1071/AH21145](https://doi.org/10.1071/AH21145).
2. Hilburg, R; Patel, N; Ambruso, S; *et al.* Medical education during the Coronavirus disease-2019 pandemic: Learning from a distance. *Adv. Chronic Kidney Dis* **27**:412–17; 2020 Epub 2020 Jun 23 PMID: 33308507; PMCID: PMC7309716. doi:[10.1053/j.ackd.2020.05.017](https://doi.org/10.1053/j.ackd.2020.05.017).
3. Palancia Esposito, C; Sullivan, K Maintaining clinical continuity through virtual simulation during the COVID-19 pandemic. *J Nurs Educ* **59**:522–5; 2020 PMID: 32865587. doi:[10.3928/01484834-20200817-09](https://doi.org/10.3928/01484834-20200817-09).