Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company’s public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Inspired by COVID-19 isolation: Evolving educational techniques in dermatology residency programs

Steven A. Svoboda, BS\textsuperscript{a,}\textsuperscript{*,} Anna Swigert, BS\textsuperscript{b}, Colton B. Nielson, MD\textsuperscript{c}, Kiran Motaparthi, MD\textsuperscript{c}

\textsuperscript{a} Virginia Tech Carilion School of Medicine, Roanoke, Virginia, USA
\textsuperscript{b} Department of Dermatology, Tulane University School of Medicine, New Orleans, Louisiana, USA
\textsuperscript{c} Department of Dermatology, University of Florida College of Medicine, Gainesville, Florida, USA

Abstract The coronavirus disease 2019 (COVID-19) global pandemic has required dermatology residency programs to convert their learning environment largely to a virtual setting. The impromptu reliance on online lectures, videoconference didactics, and other digital educational resources during this time is welcomed by today’s millennial generation of medical trainees and coincides with their learning preferences. Although hands-on direct patient care experiences are currently limited due to reservation of in-office visits for urgent care only, resident participation in teledermatology has permitted them to continue gaining valuable clinical training and may allow for enhanced evaluation of their performance in the future. Given the shown benefits of telemedicine and student preferences for online learning, incorporating these virtual technologies into the curriculum will be essential to advancing dermatology residency education.

© 2020 Elsevier Inc. All rights reserved.

Introduction

The current coronavirus disease 2019 (COVID-19) global pandemic has disrupted graduate medical education and may forever alter the way physicians are trained. Residency programs have rapidly reorganized their learning environments to comply with social distancing measures and ensure the safety of residents and patients.\textsuperscript{1,2} The reservation of in-person patient encounters for urgent care and procedures and widespread implementation of teledermicine has shifted residency training largely to a virtual setting. For dermatology residents, the American Board of Dermatology has stated that completion of independent structured academic activity during COVID-19-mandated quarantine will count toward clinical education. Online learning strategies and virtual technologies are being used in novel ways to support dermatology residency education during this challenging and uncertain time. Although inspired and propelled by the COVID-19-imposed isolation, these innovative learning techniques may be here to stay.

Current learning strategies

Traditional instructional methods such as faculty-led, in-person lectures are anything but the norm in the world of medical education today. Over the past decade, medical schools and residencies have reduced their reliance on traditional didactics in favor of online video lectures and more interactive flipped classroom and case-based teaching formats.\textsuperscript{3,4} Medical students and residents of the millennial generation have a strong preference for these self-directed and...
team-based learning modalities, which appear to be as effective as conventional methods.\textsuperscript{3-6} One-third or fewer of medical students actually attend class in-person when given the option of watching the recorded lecture online.\textsuperscript{7} A major purported benefit of these online lectures is improved learning efficiency.\textsuperscript{3,7} By being able to watch a lecture at a preferred speed, rewind, and rewatch lectures, students can spend more time focusing on the concepts to which they need more individual exposure. In addition, this approach provides more flexibility and convenience as online lectures can be viewed virtually any time or any place.\textsuperscript{3,7}

Undoubtedly, a large and indispensable portion of resident learning takes place in the clinic, working directly with patients under the guidance of an attending physician. Clinical instruction allows residents to receive immediate feedback from their supervising physician regarding their medical decision making and patient interaction skills, fostering professional development.\textsuperscript{8} For dermatology trainees, clinical exposure is especially paramount given the highly visual nature of the field. Surgical skills are also honed in the clinic as residents have the opportunity to perform procedures ranging from excisional biopsies to complex graft and flap reconstructions;\textsuperscript{9} nevertheless, simulation also plays a key role in the teaching and acquisition of surgical skills for dermatology residents. In fact, almost 70% of the 42 surveyed dermatology residency programs reported using simulation models for surgical training.\textsuperscript{9}

### Learning strategies inspired by COVID-19

In response to the isolation precautions and social distancing imposed by COVID-19, residency programs rapidly converted their learning environment to virtual domains. Remote videoconferencing using digital communication platforms such as Zoom, WebEx, and Microsoft Teams has largely replaced in-person didactics—traditional lectures and flipped classroom formats alike.\textsuperscript{10,11} Even surgical skill simulation workshops, which typically take place in a small group setting, can be moved to virtual settings.\textsuperscript{11} For those programs already using online recorded lectures, educational modules, or video simulations, the transition to a virtual learning environment is more straightforward.\textsuperscript{11} Educators have also taken advantage of social media and other online resources to actively engage students from afar and promote asynchronous learning; for example, residencies use podcasts, Twitter “tweetorials,”\textsuperscript{12} and private Facebook groups to present clinical scenarios with associated board-style questions.\textsuperscript{10,11}

Given the aforementioned potential benefits of online video learning and the preferences of today’s learners, residency programs may be well-served to create a digital repository of lectures and educational materials organized with a learning management system such as Canvas, MediaSite, or BlackBoard.\textsuperscript{3,10,11}

The University of Florida is currently creating online introductory lectures for residents to review before rotations in specialty clinics, such as autoimmune blistering disorders, autoimmune connective tissue diseases, and pediatric dermatology. The goal is to provide streamlined and standardized online resources to prepare residents for clinical instruction. This may increase confidence and performance in clinic, especially for learners without previous experience. Syncing these online didactics with clinical instruction, including teledermatology, is likely to facilitate greater learning consolidation.\textsuperscript{11,12} Moreover, foundation lectures may help prevent both resident and faculty burnout and promote more sophisticated clinical questions by reducing knowledge gaps and establishing clear learning objectives.\textsuperscript{13} In turn, faculty may focus on specific clinical scenarios and tailor clinical instruction toward residual knowledge gaps.

With many academic dermatology departments adopting telemedicine and reserving in-office visits for urgent care and procedures, direct patient care has been reduced for residents. To minimize the education gap created by this pandemic, dermatology programs have modified telehealth clinics to allow residents to participate in meaningful clinical experiences. Similar to an in-person encounter, the resident is still able to lead the visit, but this time in a virtual room with the attending physician present for questions remotely. Afterwards, the resident can enter a private virtual room with the attending physician to discuss the diagnosis and management before the resident re-enters the virtual patient room to provide patient counseling and complete the encounter.\textsuperscript{11} Although telehealth workflows are inherently suited for one-to-one patient-to-physician encounters, they can be modified to support graduated autonomy for residents.

One of the unforeseen benefits of telemedicine in clinical instruction is that faculty can evaluate a resident’s interaction with patients and provide the resident with more specific and timely feedback without the faculty’s physical presence. Currently, dermatology residents can be evaluated through the use of clinical evaluation exercises (CEXs), which are based on direct observation of resident performance during patient encounters;\textsuperscript{14} however, the physical presence of faculty during a resident—patient encounter may create an uncomfortable environment for the resident and cause distraction for the patient. Ultimately, this may result in suboptimal resident performance and an evaluation that is not representative. Teledermatology presents a favorable, less intrusive alternative to the current in-person CEXs and may allow for more accurate assessment of nonprocedural skills.\textsuperscript{15}

As a result of this unprecedented circumstance, residents are gaining valuable experience in telemedicine. In 2016, almost 50% of the 72 surveyed dermatology residency programs reported having a telemedicine education component within their curriculum;\textsuperscript{15} however, only 9% of programs actually believed that their residents understood health policies and legalities surrounding the use of teledermatology; moreover, about one-fifth of programs reported that residents likely did not have any knowledge of telemedicine.\textsuperscript{15} Given that the efficacy and cost-effectiveness of telemedicine have now been shown in both inpatient and outpatient settings and
can increase access to high-quality dermatologic care, teledermatology should be an essential component of a residency curriculum. 16–19

Learning strategies here to stay

The COVID-19 crisis has prompted the immediate implementation of various virtual learning techniques by medical schools and residency programs. Many of these strategies were already on the horizon due to the learning preferences of millennial students. 3,7 A recent contribution describes a transitioning of all preclinical medical school lectures to an online format exclusively by 2025. 7 There are several benefits of an online learning environment for students and educators. Learning efficiency for foundation knowledge is maximized, reducing redundancy while preserving the educators’ time and resources. 7 Videoconferencing allows focused, interactive didactic sessions and addresses concerns of losing the student–teacher interaction. 7 Videoconferencing enables busy faculty tasked with increasing demands for clinical productivity to provide frequent informal feedback to millennial learners, which is often difficult to do with traditional communication methods; 3,8 furthermore, dermatology residents and faculty have both expressed interest in social media platforms as a means to facilitate educational discussions and collaboration. 5

The use of telehealth for clinical instruction and evaluation in dermatology residencies is likely here to stay. Almost 70% of dermatology programs previously indicated an interest in incorporating teledermatology into their curricula. 15,18 The majority of programs acknowledged that teledermatology may be beneficial for evaluation of clinical performance. 15 COVID-19 has highlighted the benefits of telemedicine for patients, physicians, and the health care system at large. It is possible that telemedicine will comprise a substantial proportion of patient care in the near future. 3,17,18,20 In dermatology, telehealth visits, although not viable for full-body skin examinations, may become standard for follow-up of patients with stable chronic diseases, such as psoriasis, lichen planus, and acne vulgaris. 16,17 Consequently, it will be crucial for dermatology residency programs to ensure that their learners receive appropriate teledermatology training and are comfortable navigating this technology. Although residency programs frequently map goals, objectives, and evaluations to the Accreditation Council for Graduate Medical Education Milestones and Core Competencies, progress should also assess teledermatology-specific competency. 14,15

Challenges and concerns of virtual learning and telemedicine

Despite the immense education value that online learning and telemedicine offer, challenges must also be considered. The transition from the workplace to a home environ-

ment may pose challenges in preserving boundaries between the two. 4 These virtual activities may increase social isolation with potential adverse psychologic effects. 4 Some question the efficacy of particular didactic formats—such as the flipped classroom method—when delivered through teleconferencing. Additionally, there is a fear that increased reliance on these technologies will reduce opportunities for hands-on learning; 4,11 however, in a cohort of general surgery residents, an online flipped classroom approach resulted in improved knowledge acquisition without an increase in preparation time. 11

Patient data safety and privacy are also of concern in the practice of telemedicine. Although the U.S. government has temporarily relaxed patient data confidentiality regulations for telehealth during this time, the development of Health Insurance Portability and Accountability Act–compliant texting and video chatting applications will be critical to advance telehealth services after the COVID-19 pandemic. Other potential barriers to the incorporation of telemedicine into dermatology residency training include reimbursement and lack of investment by institutions or departments. 15,18,20

Conclusions

The isolation imposed by the COVID-19 pandemic has inspired and prompted the development of innovative learning techniques that may reimagine medical education. Online learning modalities such as recorded video lectures, interactive teleconference didactics, and virtual simulations are not only effective but are often preferred by the current generation of medical students and residents. The implementation of telehealth during this time has shown its potential as an educational tool for within dermatology as well as in other specialties. Although there is no replacement for hands-on direct patient care, telemedicine clinics may soon constitute a significant portion of clinical instruction and allow for evaluation of a resident’s performance. Training residents adept in teledermatology will be vital to ensuring their competency in the post-COVID future and maintaining access to high-quality, cost-effective dermatologic care in subsequent potential outbreaks.

Disclosures

Dr. Motaparthi serves as principal investigator for research supported by Proscia, Inc. Dr. Nielson, Mr. Svoboda, and Ms. Swigert have no disclosures.

References

1. Nassar AH, Zern NK, McIntyre LK, et al. Emergency restructuring of a general surgery residency program during the coronavirus disease 2019 pandemic: The University of Washington experience. JAMA Surg. 2020;155:624–627.
2. Bashshur R, Doarn CR, Frenk JM, Kvedar JC, Wooliscroft JO. Telemedicine and the COVID-19 pandemic, lessons for the future. *Telemed J E Health*. 2020;26:571–573.

3. Svoboda SA, Swigert A, Murina A, Motaparthi K. Teaching dermatology to the millennial learner. *Clin Dermatol*. 2020; In press.

4. Rose S. Medical student education in the time of COVID-19. *JAMA*. 2020;323:2131–2132.

5. Meeks NM, McGuire AL, Carroll BT. Electronic collaboration in dermatology resident training through social networking. *Cutis*. 2017;99:253–258.

6. Pontius LN, Hooten J, Lesesky E, et al. A comparison of knowledge acquisition and perceived efficacy of a traditional vs flipped classroom-based dermatology residency curriculum. *Cutis*. 2020;105:36–39.

7. Emanuel EJ. The inevitable reimagining of medical education. *JAMA*. 2020;323:1127–1128.

8. Wang JV, O’Connor M, McGuinn K, Albornoz CA, Keller M. Feedback practices in dermatology residency programs: Building a culture for millennials. *Clin Dermatol*. 2019;37:282–283.

9. Dai J, Bordeaux JS, Miller CJ, Sobankof JF. Assessing surgical training and deliberate practice methods in dermatology residency: A survey of dermatology program directors. *Dermatol Surg*. 2016;42:977–984.

10. Rakowsky S, Flashner BM, Doolin J, et al. Five questions for residency leadership in the time of COVID-19: Reflections of chief medical residents from an internal medicine program. *Acad Med.* 2020;95:1152–1154.

11. Chick RC, Clifton GT, Peace KM, et al. Using technology to maintain the education of residents during the COVID-19 pandemic. *J Surg Educ.* 2020;77:729–732.

12. Blakely K, Bahrani B, Doiron P, Dahlke E. Early introduction of dermatology clinical skills in medical training. *J Cutan Med Surg*. 2020;24:47–54.

13. Shoimer I, Patten S, Mydlarski PR. Burnout in dermatology residents: A Canadian perspective. *Br J Dermatol*. 2018;178:270–271.

14. Turiansky GW, Loo D. The dermatology milestone project. *J Grad Med Educ*. 2014;6:67–70.

15. Wanat KA, Newman S, Finney KM, Kovarik CL, Lee I. Teledermatology education: Current use of teledermatology in US residency programs. *J Grad Med Educ*. 2016;8:286–287.

16. Keller JJ, Johnson JP, Latour E. Inpatient teledermatology: Diagnostic and therapeutic concordance among a hospitalist, dermatologist, and teledermatologist using store-and-forward teledermatology. *J Am Acad Dermatol*. 2020;82:1262–1267.

17. Wang RH, Barbieri JS, Nguyen HP, et al. Clinical effectiveness and cost-effectiveness of teledermatology: Where are we now, and what are the barriers to adoption? *J Am Acad Dermatol*. 2020;83:299–307.

18. Portnoy J, Waller M, Elliott T. Telemedicine in the era of COVID-19. *J Allergy Clin Immunol Pract*. 2020;8:1489–1491.

19. Flodgren G, Rachas A, Farmer AJ, Inzitari M, Shepperd S. Interactive telemedicine: Effects on professional practice and health care outcomes. *Cochrane Database Syst Rev*. 2015;9.

20. Hollander JE, Carr BG. Virtually perfect? Telemedicine for Covid-19. *N Engl J Med*. 2020;382:1679–1681.