

Telehealth, Ultrasound, and the Physician of the Future

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ABSTRACT

Aim and objective: In this article, we explore the current practices, challenges, and opportunities to the integration of telehealth in the field of ultrasonography for the education of the physician in the care of obstetrics and gynecology patients. Telemedicine and telehealth (TM/TH) have been used in obstetrics and gynecology primarily as an adjunct service to the usual care for encounters that require a minimal physical examination.

Background: Telemedicine and telehealth are commonly interchangeable terms referring to the provision of clinical services at a distance. Before the coronavirus disease-2019 (COVID-19) pandemic, the United States (US) was seeing modest but significant growth in the use of TM/TH. The COVID-19 pandemic appears to have accelerated the implementation of TM/TH.

Review results: Teleradiology, in particular, the use of asynchronous (i.e., store-and-forward) technology, is also used for maternal–fetal medicine consultations. Other TM/TH modalities such as fetal echocardiography, remote fetal monitoring, and remote patient monitoring (RPM) are slowly becoming more popular. Despite the ample benefits of TM/TH, undergraduate and graduate medical training on TM/TH and point-of-care ultrasound (POCUS) skills have been historically deficient. Multiple challenges remain for the expansion of TM/TH services including regulatory, reimbursement, and licensing policy. For the incorporation of ultrasound in TM/TH visits, a greater infrastructure is needed. Considerations for this infrastructure include rural broadband internet access and modernization of the information technology infrastructure capable of exchanging ultrasound images electronically in a secure and HIPPA-compliant interface.

Conclusion: There is ample reason to remain optimistic about the future of TM/TH in the field of ultrasonography and clinical care for obstetrics and gynecology patients. To take advantage of these opportunities, it is imperative that the current challenges to the expansion of TM/TH, including the gaps in the medical education system, be addressed systematically.

Clinical and Educational significance: Advances in POCUS, intelligent navigation, and teleoperated ultrasound technology provide a prospect of opportunities to advance TM/TH care while expanding educational opportunities. The most recent expansion of TM/TH after the COVID-19 pandemic is likely to launch TM/TH into a new level of market penetration, making the need for undergraduate and graduate medical education on TM/TH skills ever more relevant.

Keywords: Graduate medical education, Obstetrics and gynecology, POCUS, Telehealth, Telemedicine, Ultrasound, Undergraduate medical education, Women's health.

Donald School Journal of Ultrasound in Obstetrics and Gynecology (2021): 10.5005/jp-journals-10009-1827

INTRODUCTION

Telemedicine and telehealth (TM/TH) are commonly interchangeable terms referring to the provision of clinical services at a distance. In effect, a great variety of telecommunication systems and devices are used for the provision of these clinical services, and therefore, TM/TH is a broad term that encompasses not only audio and video conferencing, but also the transmission of clinical multimedia (i.e., audio, video, still images, and text) through synchronous (i.e., transmitting in real-time, or through a live feed) or asynchronous (i.e., collecting multimedia and transmitting it at a future time, otherwise known as store-and-forward).

Additionally, advances in sensor and communication technology have made possible remote patient monitoring (RPM). This model of care relies on the use of monitors located at home or remote locations, which collect the patient's bioinformatics data (i.e., vital signs, patient images, fetal heart rate, urine protein, etc.) according to the goals of care. This information is then transmitted to a care team that can analyze and take appropriate action. Smartphone technology, mobile devices, and their ubiquitous presence have added an additional level of optimization to the various modalities of TM/TH, in many cases integrating the collection of data, telecommunication, and analysis into a single device.

Before the coronavirus disease-2019 (COVID-19) pandemic, the United States (US) was seeing modest but significant growth

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How to cite this article: De la Mora D. Telehealth, Ultrasound, and the Physician of the Future. *Donald School J Ultrasound Obstet Gynecol* 2021;15(4):377–379.

Source of support: Nil

Conflict of interest: None

in the use of TM/TH.^{1,2} A systematic change was noticeable in many aspects of the healthcare system: public perception was slowly more accepting,³ payers were increasingly more likely to provide coverage,² the number of visits was steadily increasing year-to-year, and the number of direct-to-consumer telehealth services was growing quickly. Reimbursement reforms for RPM were being implemented; and technologies in mobile health (mHealth), wearable devices, internet-of-things (IoT), and store-and-forward asynchronous TM/TH were growing in the last decade. However, TM/TH services were still only a very small portion of the overall healthcare delivery system due, in great part, to reimbursement and

regulatory policy that provided a narrow framework of the TM/TH service delivery model. The Centers for Medicare and Medicaid Services (CMS) defined reimbursable telemedicine encounters only as those using audio–video technologies, generally requiring at least one in-person visit before telemedicine encounters could be established. Originating sites—the patient’s location—were also narrowly defined and could not include the patient’s home. Data security concerns, licensing restrictions, high cost of set-up, inadequate rural broadband internet, and administrative burden were just a few of the additional barriers to the limited use of TM/TH.

The COVID-19 pandemic appears to have accelerated the use of TM/TH across the world. In the US, this expansion was possible thanks to the multiple emergency waivers from CMS and from the Office of the Inspector General (OIG). In particular, a waiver allowing the patient’s home to function as the originating site has brought mHealth to the forefront of clinical care. This rapid expansion has also highlighted the need, among other things, for telehealth medical education in undergraduate and residency programs across all the different fields of medicine.

In this article, we explore the current practices, challenges, and opportunities to the integration of telehealth in the field of ultrasonography for the education of the physician in the care of obstetrics and gynecology patients.

CURRENT USE

Telemedicine and telehealth have been used in obstetrics and gynecology primarily as an adjunct service to the usual care. Certain medical services which generally do not require hands-on physical examination such as medication counseling, genetic counseling, mental health, preconception planning, and family planning are just a few of the great candidates for the synchronous audio–video/audio-only TM/TH delivery model.⁴ Teleradiology, primarily the asynchronous (i.e., store-and-forward) interpretation of ultrasonography images, has also been used in obstetrics for decades. Maternal–fetal medicine (MFM) consultation with ultrasound interpretation is commonly used across the US and it increases access to highly specialized care in rural areas. In this use case, a pregnant patient, located at the originating site, has a detailed fetal ultrasound performed by a trained sonographer, these images are then transmitted in real-time or asynchronously to the MFM physician who reviews them and then has a video conference with the patient.⁵ Similarly, fetal echocardiography and fetal heart rate monitoring *via* TM/TH has also been reported in the literature.⁶ Furthermore, RPM services have become more prevalent, not only because of the COVID-19 pandemic but also because of regulatory and reimbursement reform. For pregnant patients with chronic conditions, the use of connected home devices that automatically communicate with their interdisciplinary care team allows for a more tailored response in care and early detection of chronic disease exacerbation.

Despite the ample benefits of TM/TH, education and training on TM/TH skills have been historically deficient. It is estimated that in 2015 only a quarter of undergraduate medical schools included TM/TH clerkships.⁷ A recent study suggests that growth in TM/TH education plateaued during the academic year 2017/2018 to about 60% of the US medical schools offering required or elective courses in TM/TH.⁸ There are concerning trends in graduate medical education as well. TM/TH skills are considered a milestone in only one specialty (Child and Adolescent Psychiatry) out of the 104 American College of Graduate Medical

Education (ACGME) specialty milestones mentioned in the 2018 Milestones National Report.⁸

CHALLENGES

The growth of the TM/TH service line faces multiple challenges. Perhaps the most important is the concern for the future of the regulatory and reimbursement waivers enacted during the COVID-19 pandemic. Without a permanent extension of these waivers, access to TM/TH services would become restricted to designated origination sites, potentially removing the patient’s home as a point-of-care and practically eliminating the most important aspect of this service, accessibility. Reimbursement reform and the extension of payments for audio-only visits are also extremely important for the continued provision of TM/TH services.

Despite the ability of the communication networks to connect across political and geographic limitations, state licensing regulations continue to challenge the provision of TM/TH services across state lines. Individual states have offered waivers to these requirements during their emergency declarations; however, it is unlikely that these waivers will remain in effect after the COVID-19 pandemic has been addressed.

There are also infrastructure challenges that further limit the ability to provide quality and efficient healthcare services evenly across the US. For example, inadequate access to broadband internet in rural communities. This is of great importance to the integration of ultrasonography in the TM/TH delivery model, since it requires the synchronous transmission of high-definition images, along with audio–video consultation. The bandwidth requirements are lower for the asynchronous delivery of images; however, in the latter model, there is a great need for modernizing the workflows away from the use of physical forms of digital information storage (i.e., compact disks or USB) into an information technology infrastructure capable of exchanging these images electronically in a secure and HIPPA-compliant interface.

Integrating TM/TH skills into the undergraduate and graduate medical education system requires a level of expertise that is still growing. The COVID-19 pandemic and the pivotal role of TM/TH have certainly increased the interest in incorporating this topic in required courses. Residents and fellows are increasingly more exposed to the practice of TM/TH as a natural effect of the exponential increase of TM/TH visits across the country. Nonetheless, more formal inclusion, mentorship, and evaluation methods are needed for the development of graduate programs and experiential learning opportunities.

OPPORTUNITIES

There is ample reason to remain optimistic about the future of TM/TH in the field of ultrasonography and clinical care for obstetrics and gynecology patients. For one, the point-of-care ultrasound (POCUS) technology is advancing rapidly, making it more accurate, interconnected, affordable, and mobile, all of which are important characteristics of any TM/TH tool. Intelligent navigation technology assisting in the production of 3D/4D ultrasound renderings has the promise of decreasing operator dependency⁹ and has the prospect of guiding the patient into self-service ultrasonography. It is not a stretch to contemplate a future where households own a POCUS device that can provide 2D/3D/4D images for their TM/TH physician on demand.



Teleoperated ultrasound consists of a robotic arm present at the originating site, which is operated by a trained ultrasonographer from a distant site. During the encounter, audio, video, and force sensors provide feedback to the operator.¹⁰ Systems such as TERESA¹¹ and MELODY (AdEchoTech) are being used for obstetrics and gynecology applications with high reliability and interobserver agreement.

Innovative models such as OB Nest, a reduced visit prenatal care model supplemented with RPM, have also shown great potential by demonstrating higher patient satisfaction and lower prenatal stress.¹² Studies on home/patient-operated fetal heart rate monitoring suggest that this model of care is feasible, accessible, and patient centered.¹³ Furthermore, remote fetal heart rate monitoring could decrease the cost of care by decreasing the need for hospitalizing patients who require frequent fetal heart rate monitoring but who are otherwise at low risk.

Ultrasound curricular content in medical schools is highly variable,¹⁴ and there are understandable concerns about the incorporation of POCUS into the educational system. Without rigorous clinical evidence on the risks and benefits of the substitution or enhancement of the physical examination with this technology,¹⁵ one should remain cautious to not introduce a technology too quickly. However, handheld ultrasound systems connected to commercially available mobile devices represent a great advantage for training on the interpretation of ultrasound images because they are more affordable, require smaller storage spaces, and imaging transmission can be easily arranged through the same mobile device. Integration of POCUS devices into the existing ultrasound learning curricula for the obstetrics and gynecology resident/fellow may also lead to greater confidence during TM/TH encounters.¹⁶

The growing number of TM/TH visits may translate into an increased number of educational opportunities at rural sites away from the academic centers. Medical students, residents, and fellows could benefit from clerkships, either virtual or in-person, to rural areas and originating sites thus potentially expanding the class size of these educational programs.

Standardized certification programs can serve as an initial platform to develop expertise in the medical educational system. Recently, the American Board of Telehealth has published a well-rounded certification program for the education on the fundamental concepts and skills in TM/TH.

CONCLUSION

Over the last decade, and particularly after the COVID-19 pandemic, the number of TM/TH visits has grown exponentially. A large proportion of providers and patients have engaged for the first time on a TM/TH encounter. This momentum is likely to launch TM/TH into a new level of market penetration, making the need for undergraduate and graduate medical education on TM/TH skills ever more relevant. Technological advances in POCUS, intelligent navigation, and teleoperated ultrasound make ultrasonography an ideal imaging modality for the obstetric and gynecological TM/TH applications of the future. Although more evidence on the risks and benefits of RPM is needed, there is no question

that mobile technology and interconnected sensor technology provide a vast universe of opportunities in our quest for the triple aim in healthcare—lower cost, better outcomes, and a more patient-centered healthcare experience. To take advantage of these opportunities, it is imperative that the current challenges to the expansion of TM/TH, including the gaps in the medical education system, be addressed systematically.

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