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Core competencies in ophthalmology

The promise of telemedicine

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ABSTRACT

We have developed an extraordinary capability to capture and transmit digital ocular imaging, enabling remote interpretation of every aspect of the eye. The issues regarding telemedicine were primarily technical and procedural when this journal first reviewed the topic in 1999. Fourteen years later, telemedicine presents strikingly different challenges—legal, ethical, and professional. Some "tele-ophthalmology" applications have now become a reliable part of daily practice. Although it offers improved health care at lower cost to more people, telemedicine could also radically transform the traditional doctor–patient interaction.

"Never before in history has innovation offered promise of so much to so many in so short a time." Bill Gates

"Technology is a queer thing. It brings you great gifts with one hand, and it stabs you in the back with the other." C.P. Snow

In 1999 this journal published "Telemedicine and Ophthalmology," a comprehensive review of what was then an emerging technology.[25] The author, H.K. Li, touched briefly upon the ways in which this new tool might profoundly alter the professional landscape and explored the history of information technology in medicine, the practical aspects of setting up ophthalmic telemedicine centers, and the quality and reliability of image transmission.

Telemedicine could alter the time-honored face-to-face doctor–patient encounter, passed along through generations of mentors. Increased Internet speed, widely available connectivity, and the digital capabilities of ophthalmic instruments solved many of the technological problems. Today's 4G wireless networks provide virtually "lossless image transmission."[23] In short, we can image almost every aspect of the organ to which we devote our professional lives and can send that picture anywhere, anytime. The telemedicine questions facing us 14 years later are largely legal, ethical, and professional.

Such change is well underway in other specialties, but this technology presents special advantages and heightened perils to ophthalmology. Telemedicine, representing the high-speed interconnection between people and data, promises great

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benefits to our patients. The challenge will be to integrate telemedicine into our professional lives in a sensible and judicious manner.

1. Definitions

See Appendix A.

2. Our unique moment in time

Physicians in every era rightly envision themselves working at an exceptional moment, the forefront of fast-moving progress, but today we do stand at a unique crossroads. Two convergent trends will thrust telemedicine into our professional lives in a rapid and compelling manner.

First, the necessary technology is already available and becomes less expensive every day. Video-equipped computers, high-resolution cell phone cameras, and fast broadband Internet service are all in place. Our office imaging devices readily connect to the Internet and, as we know, we are never more than an instant away from being summoned electronically.

Second, as our society moves toward 20% of Gross Domestic Product spent on health care, cost control becomes a top priority. Expansion of health services under the Affordable Care Act will strain the existing pool of physicians. With 20 million additional enrollees in Medicaid alone, the newly insured will find much of their care giving by ancillary personnel such as nurse practitioners and physician assistants.[10,38] These clinicians will need telemedicine's speedy, low-cost access to consultation. Commercial insurers and Medicare also push for cost reductions. Some proposed uses of ophthalmic telemedicine might seem radically nontraditional, but could be viewed by insurers as irresistibly cost efficient.

3. Cost effectiveness

The cost benefits of telemedicine have been studied in detail. Telemedicine has proven less expensive than conventional in-person examinations for small clinical care facilities, the falling expense of equipment more than compensating for increased cost of skilled technicians.[24] Screening for diabetic retinopathy in a community health center was 35% less costly using telemedicine rather than direct observation, including the expense for a second in-person exam to confirm the need for treatment.[26] Rural underdeveloped areas show cost efficiencies from diabetic telemedicine screening, but the expense of maintaining remote imaging facilities may make annual testing in such circumstances economically impractical.[36]

4. Other specialties

Telemedicine has become pervasive. Remote patient monitoring is well established. Cardiac pacemakers can be monitored—including battery life and lead placement.[7] Blood glucose data can be automatically forwarded over the phone or the Internet. Neurologists find improved outcomes from tissue plasminogen activator treatment for stroke when telemedicine replaces patient transfer.[35] In her 1999 *Survey* article, Dr. Li raised concerns about image resolution and color fidelity. Many of these problems have been solved. Telepathology and teledermatology utilize remote imaging of the gross specimen, whole slide, and selected microscopic fields with high resolution and exquisite control of color fidelity that replicates direct viewing.[51] In developing countries and those with large rural populations, telemedicine improves communication, medical education, patient monitoring, and medication management.[6]

Trans-Atlantic laparoscopic cholecystectomy with surgeons in New York and the patient in France demonstrated the potential reach of this technology.[28] Plans are underway to implement robotic surgery in extreme rural areas, Antarctic bases, and on the International Space Station.

5. The doctor will connect with you now

As clinicians, we want to know how telemedicine might affect the face-to-face patient encounter. Concern has been expressed that telemedicine could be disorienting for patients, who might find themselves "objectified."[33] There is little in the literature demonstrating such an effect. Rather, many patients seem open to electronic encounters. The younger generation, accustomed to Skype teleconferencing and smartphone photo/video interaction, is likely to be comfortable with such interactions.

Work done by many organizations, including the Mayo Clinic and the American Academy of Family Practice, "supports enhanced-access physician–patient interactions, including virtual/electronic visits."[1,B] We might suppose that telemedicine would be less successful for more intimate and protracted problems; when used for psychiatric evaluation, however, videoconferencing compared favorably with face-to-face encounters.[4,29]

For a monthly fee individuals can enroll in a program offering rapid telephone access to board-certified specialists at any time, with immediate e-prescribing when indicated.[C] One telemedicine company merges its online treatment system with an employer's health insurance, suggesting that 20% premium reductions will be realized from timely, low-cost interventions.[D] WellPoint has announced it will join other insurers offering "virtual visits" via phone or Internet.[E] The move toward Accountable Care Organizations is predicated in part on the use of the latest telemedicine modalities, including virtual examinations.[52]

6. Ophthalmic telemedicine

6.1. *Retina*

Treatment of retinal disorders relies on observation, photography, and digital imaging, so this subspecialty in a natural fit for telemedicine. One area of considerable promise is the diagnosis of retinopathy of prematurity (ROP). The literature